



SPECIAL SERVICES FOR PIPELINES

... when the quality matters!

INSPECTIONS AND NDT/NDE OF PIPING SYSTEMS, TUBES, TANKS, PRESSURE VESSELS AND OTHER STEEL STRUCTURES



INSPECTIONS AND NDT/NDE

OF PIPING SYSTEMS, TUBES, TANKS, PRESSURE VESSELS AND OTHER STEEL STRUCTURES

We perform **inspections and integrity assessment** of:

- **Pipes and piping systems:**
 - Oil & Gas pipelines
 - Industrial plant piping systems of all kinds
- **Storage tanks (terminals)**
- **Pressure vessels**
- **Tubes in:**
 - Industrial boilers, coolers and condensers
 - Heat exchangers, steam reformers etc.
- **Other steel structures** of all kinds



In the range of inspections, we perform:

- **Pipeline inspection** (Inline or Offline)
- Defect localisation, verification and assessment
- **Nondestructive testing** (NDT) by conventional and advanced methods (TOFD, Phased Array, Guided Waves, PECA™, PEC, EMAT, etc.)
- Analysis, identification and sorting of metal materials (PMI, OES spectral analysis)
- Inspection of pipes under supports
- **Corrosion mapping and monitoring** of pipes, pressure vessels, tanks and other steel structures
- Wall thickness measurement at high temperatures
- On-site hardness testing of steel materials and welds
- **Tubing inspection** and assessment of fired heaters, heat exchangers and condensers
- **Reliability and service life assessment** of pipes, tubes, piping systems and other steel structures

We also perform **repairs and interventions** in pipelines and piping **under pressure without shutdown** such as:

- **Repair of leaks** from pipes, welds and flanged joints
- **Repair of pipelines** damaged by corrosion, weld defects and other types of pipeline damage
- **Replacement of damaged valves** and piping components **without shutdown**
- **Connecting a new pipeline** (branch connection) and connecting a new equipment **without shutdown**



Do you have any need to be solved on your pipeline, piping system, tank or pressure vessel? Do you need any advice on selecting a suitable method for NDT/NDE inspection and integrity assessment? Do not hesitate to contact us! **We will provide you with a solution to meet your needs.**

INSPECTION OF PIPES, PIPINGS AND TUBES



Inline inspection of piggable pipelines

Internal (inline) pipeline inspection is used to inspect the condition of the pipe wall and welds using an inspection tool from the inside of the pipeline. The result of an internal inspection is a defect report with the location and identification of the

defects. The report is used to assess the pipeline condition and verify its remaining service life.

It is carried out while pipeline is in operation and the pipeline must be suitable for the passage of an inspection tool (online inspection). If it is not possible to inspect the in-service pipe, the pipe can be decommissioned and the inspection can be performed offline.



Inspection of plant piping systems

Piping in plants are mostly not suitable for the passage of a standard inspection tool used for internal online inspection of piggable pipelines.

Special mobile inspection robots or specifically adapted inspection pigs (inspection tools) are used for the purpose of such inspection.

If it is impossible to carry out an inspection from the interior for whatever reason, we will perform the inspection by advanced NDT methods from the pipe exterior. We use several advanced inspection NDT/NDE methods used at difficult-to-reach places.

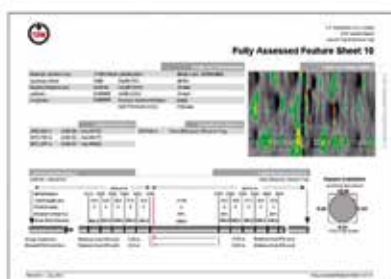
DEFECTS LOCALISATION AND VERIFICATION

Based on the defect severity specified by the inspection report from the inspection tool, the selected **defects are localized and examined by a proper NDT/NDE method.**

For a detailed inspection, in order to determine **the sizing and characteristics of a defect**, we use the quantitative NDT methods, such as: visual inspection (VT), magnetic particle or penetration test (MT, PT) and ultrasonic testing (UT, UTPA). In the case of a weld inspection, we use one of the following NDT methods: radiographic testing (RT), TOFD or Phased Array.

We perform the **defect assessment** according to ASME, RSTRENG, DNV and others.

The defect assessment serves also as a base for **the design of appropriate method of the defect repair.**



NONDESTRUCTIVE TESTING (NDT/NDE)



Conventional (standard) NDT

Our mobile NDT laboratory accredited according to EN ISO 17025 performs all conventional nondestructive tests (NDT/NDE) of pipes, piping systems, tanks, pressure vessels and other steel structures as:

- Visual testing (**VT**)
- Magnetic particle testing (**MT**)
- Dye penetrant testing (**PT**)
- Ultrasonic testing (**UT, UTT**)
- Radiography testing (**RT**)

Advanced NDT methods

Screening NDT methods provide us with a quick picture of the overall conditions of the inspected material (pipes, tanks, pressure vessels etc.), when we don't know the defects yet, because they did not manifest yet or we want to identify quickly the problems areas that we need to focus on.

We use the following screening methods:

- Pulsed Eddy Current Array (**PECA™, PEC**)
- Saturated Low Frequency Eddy Current (**SLOFEC™**)
- Long Range Ultrasonic Guided Waves (**LRUT/GW** - Guided Waves)
- And other screening NDT methods



We use the **quantitative NDT methods to determine the exact defect sizing, its position, orientation, nature etc.** We perform conventional NDT methods such as VT, MT, PT, UT and RT using our mobile NDT laboratory accredited according to EN ISO/IEC 17025.

To identify and characterize the defects like manufacturing defects, fatigue cracks, stress corrosion cracking, erosion, different types of corrosion, welding defects etc., we use **advanced NDT methods**:

methods:

- **TOFD** (Time of Flight Diffraction)
- **Phased Array**
- **EMAT**
- And others



ANALYSIS, IDENTIFICATION AND SORTING OF METAL MATERIALS (OES AND PMI)

OES - Optical Emission Spectroscopy

We perform **analysis, sorting and identification of metals** (base material) using a portable optical emission spectroscopy (OES) analyser **for the purpose of verifying the correct welding procedures** (WPS).

Benefits of using the portable optical emission spectroscopy analyser for verification of steel materials prior welding:

- Accurate identification of **Carbon content**

- **Very accurate and fast identification** of the chemical composition of metal materials
- **Measuring the carbon content** and other chemicals to verify the correct welding procedure
- Chemical composition **analyses provided directly on-site** (in the workshop, in the excavation, on scaffolding ...) without the need



for any disruption on the material surface

- **On-site analysis without shutdown** or limiting the operation

PMI - Positive Material Identification

We perform a positive material identification using the portable optical emission spectroscopy analyser (OES) for **analysis, sorting and identification of metals** in order to:

- Verify the chemical composition of the metals and alloys specified in the material certificate
- Identify and properly classify the metal materials like sheets, beams, pipes, wires, screws, nuts and any other metal products and structures



Analysis, identification and verification are performed **on-site** using the portable OES analyser without the need of sampling damaging the surface of the material.

INSPECTION OF CORROSION UNDER PIPE SUPPORTS

Inspection of corrosion in inaccessible areas like under pipe supports without a need of lifting the pipe from the support.



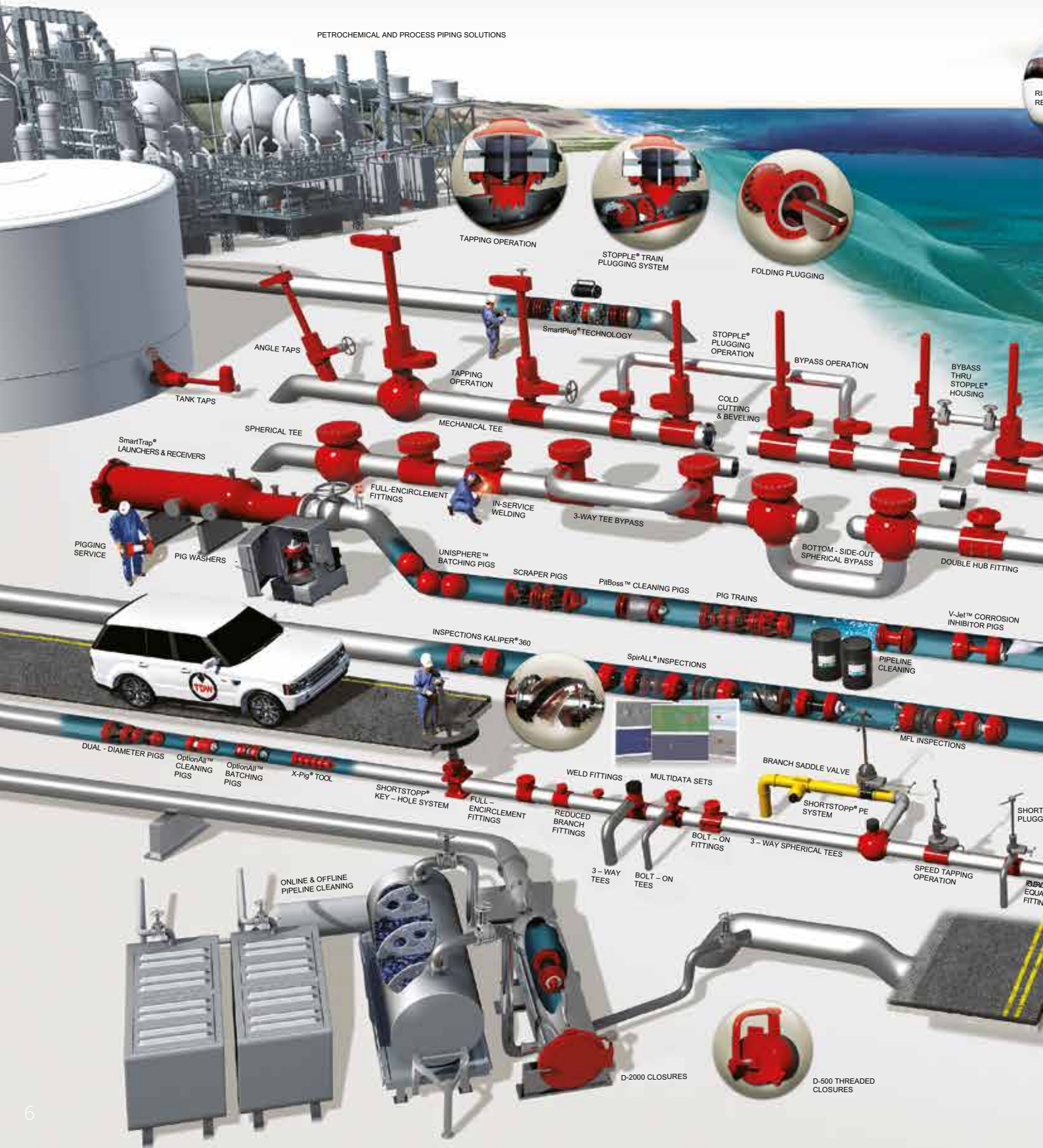
INSPECTIONS AND NDT/NDE

- Pipeline inspection (online or offline)
- Corrosion mapping and monitoring
- Advanced NDT (TOFD, Phased Array, Guided Waves, PECA™, PEC, EMAT ...)
- NDT (defectoscopy) field services by the mobile laboratory accredited according to EN ISO/IEC 17025
- Chemical analysis of metals using a mobile optical emission spectrometer (OES - PMI)

- On-site hardness testing of steel materials and welds
- Inspection and defect assessment of pipelines, tanks, pressure vessels and steel structures
- Localization and verification of defects identified by inline inspection (in-ditch verification)
- Defects assessment

REPAIRS WITHO

- Online leak sealing and repairs of pipelines, pipings and joints
- Pipeline plugging (pipeline isolation)
- Repairs of damaged pipes, valves, and welds while pipeline remains in service
- Pipeline cut-outs and replacement of piping components under pressure without shutdown

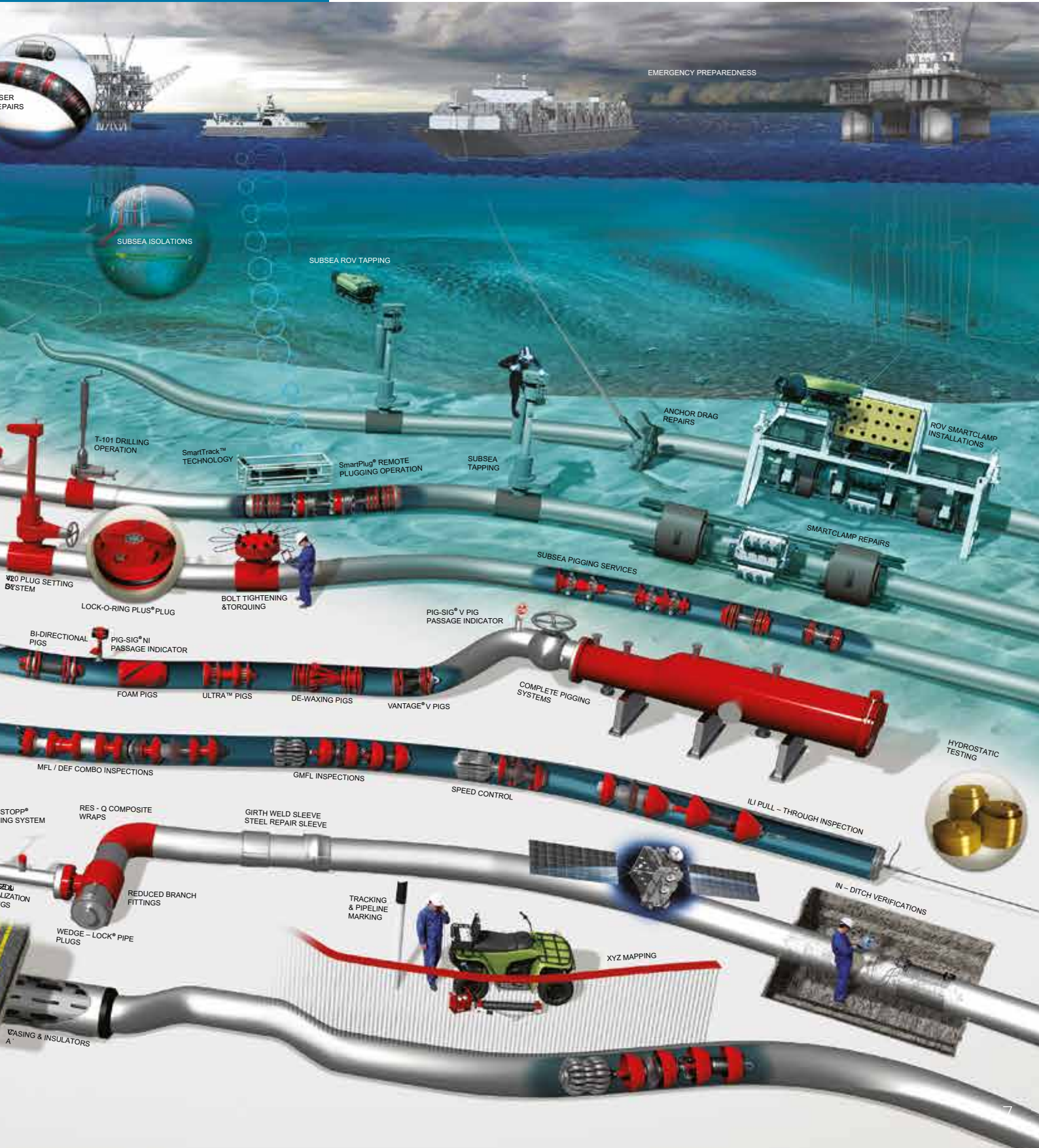


OUT SHUTDOWN

- Repairs and reconstructions of pipelines, piping systems, tanks and pressure vessels
- Making a branch connection (hot tapping and tie-ins)
- Pipeline relocations, repairs and tie-ins without pipeline shutdown by pipeline plugging and bypassing
- Composite wrap repair solutions

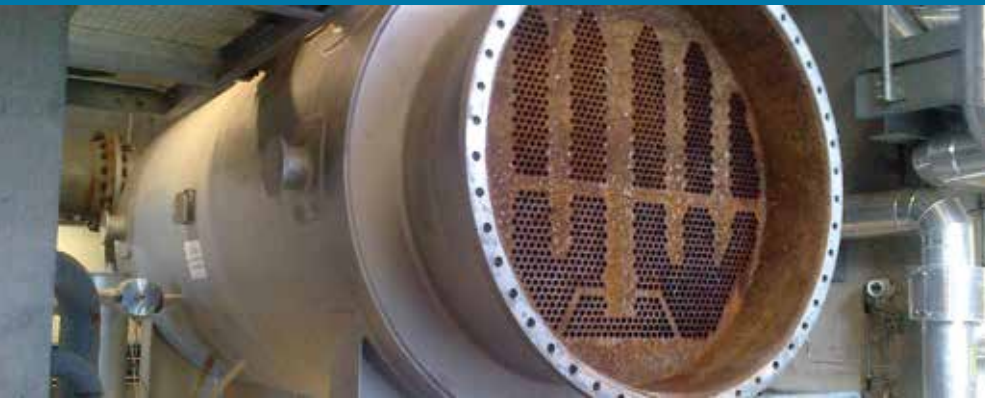
PIPELINE INTERVENTIONS AND REPAIR

- Hot tapping (pressure tapping) to pipes, tanks and pressure vessels
- Additional installation of measuring and sampling points without shutdown
- Pipeline decommissioning and decontamination before repairs or shutdowns by mobile nitrogen generators
- Stress tests and hydraulic pressure tests
- Welding on in-service pipelines
- Remaining service life and reliability assessment of pipelines, tanks, pressure vessels and other steel structures
- Extending the service life of pipelines and pipeline integrity verification
- Pipeline cleaning and drying
- Repumping of natural gas by mobile gas compressor unit
- Welding procedures development



INSPECTIONS AND NDT OF TUBES

IN INDUSTRIAL BOILERS, COOLERS AND HEAT EXCHANGERS



We perform the inspection of the industrial:

- Boilers
- Coolers
- Condensers
- Heat exchangers etc.



We use advanced NDT methods for the tubing inspection like:

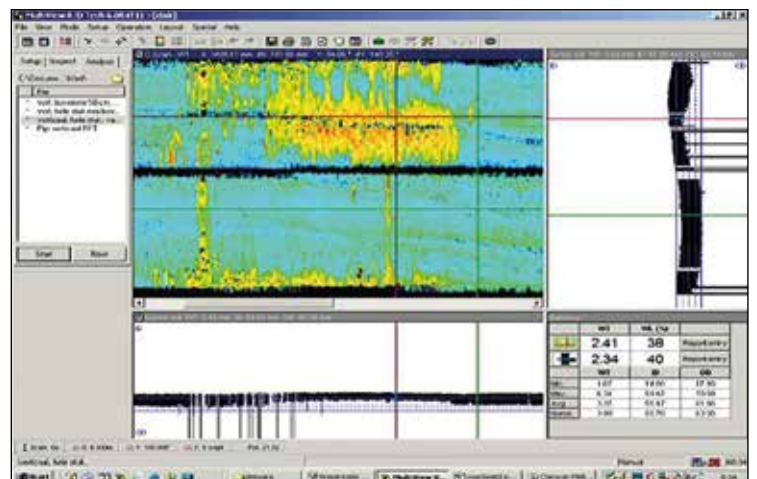
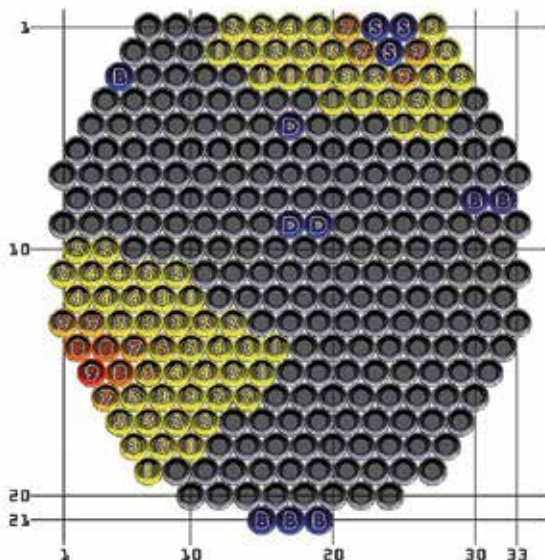
- Internal Rotational Inspection Systems (**IRIS**)
- Eddy Current (**EC**)
- Partial Saturated Eddy Current (**PSEC**)
- Remote Field Technique (**RFT**)
- Surface Eddy Current Array (**SECA**)
- Other methods for tubing inspection



The most detected defects:

- Corrosion
- Erosion
- Cracks
- Material wall loss and other defects

We use the results of the inspection for **the defects assessment and the remaining service life assessment.**



INSPECTIONS AND INTEGRITY ASSESSMENT OF PIPES, TANKS AND PRESSURE VESSELS

Inspection and assessment of the technical conditions is carried out by means of an overall assessment of the previous inspections, operational conditions, repairs and maintenance (of welds, flanges and fittings) on the basis of operational records.

After initial evaluation of the overall condition of the inspected structure and the individual joints (welded and flanged joints) from the operational records, the critical points are selected on which the relevant nondestructive testing methods (NDT) are performed.



The selection of critical points is carried out based on the risk analysis using the Risk Based Inspection (RBI) methodology according to API 580 and 581, or ASME PCC-3.



If the inspected structure (pipe, tube, tank, pressure vessel etc.) allows the internal inspection, we will choose an appropriate method and **carry out the internal inspection** (online or offline).

If the internal inspection cannot be performed, then we will carry out assessment of the condition by any of the other appropriate **nondestructive testing methods (NDT) from outside**.

For the **inspection and the assessment of a structural integrity of tanks** we can use various NDT methods like SLOFEC™, PECA™, EMAT, visual inspection by drones and others.

After evaluating of all the results from NDT tests, we perform the defect assessment and calculate the remaining service life and, if necessary, we design a suitable repair method.



In the event of a breakdown, we perform the **root cause failure analysis** and design appropriate measures to extend the service life.



CORROSION INSPECTION, MAPPING AND MONITORING

For the inspection, scanning, mapping and monitoring of **corrosion on pipes, tanks, pressure vessels and other steel structures** we use an advanced NDT method using PECA™ or PEC. They are fast **NDT screening methods**, that we use for **quick inspection (scanning and mapping) of residual wall thickness of a pipelines, pressure vessels, tanks or other steel structures.**



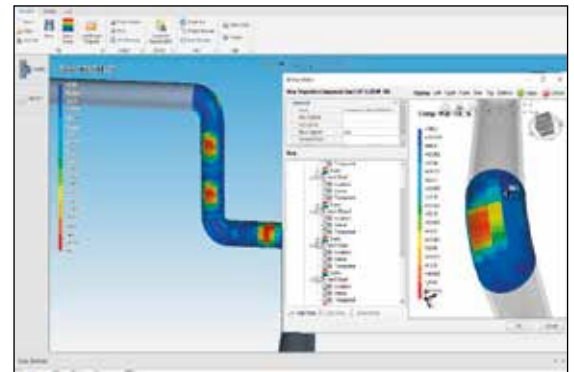
Advantages of use:

- **High inspection speed** with real-time readings, thickness measurement and reporting capabilities
- **Scanning area with 457mm working width** of the six channel array probe **in a single-pass shortens the inspection time**
- **Inspection without shutdown**
- No need of the direct contact with the surface of the inspected material
- **No surface preparation** needed
- **Measuring through thermal insulation**, fireproofing, coating, concrete, etc.

FINAL INSPECTION REPORT

The inspection results are assessed in a report that contains the remaining wall thickness values in “mm” or in “%” of the remaining wall thickness as well as the colour “map” of these values.

We use visualization software for displaying the map of material losses or residual wall thicknesses on a 3D model of the inspected object, which enables to obtain a quick overview of the potential defects.



CORROSION UNDER INSULATION (CUI) AND FIREPROOFING (CUF)



Corrosion under insulation (CUI)



Corrosion under fireproofing (CUF)

Corrosion under insulation (CUI) is one of the most difficult corrosion processes to prevent. No matter the precautions taken, water invariably seeps into the insulation and begins the corrosion from the outside begins.

Also, any corrosive product inside the pipe, tank or pressure vessel can cause internal corrosion (erosion) which is also very danger and shall be inspected and assessed (e.g. Flow Accelerated Corrosion and other corrosion defects).

There are variety of NDT methods used to inspect corrosion under insulation (CUI or CUF). We use mainly:

- Pulsed Eddy Current Array - **PECA™** or Pulsed Eddy Current - **PEC**
- Long Range Ultrasonic Guided Waves (**LRUT/GW**)
- Radiography (**X-rays**)

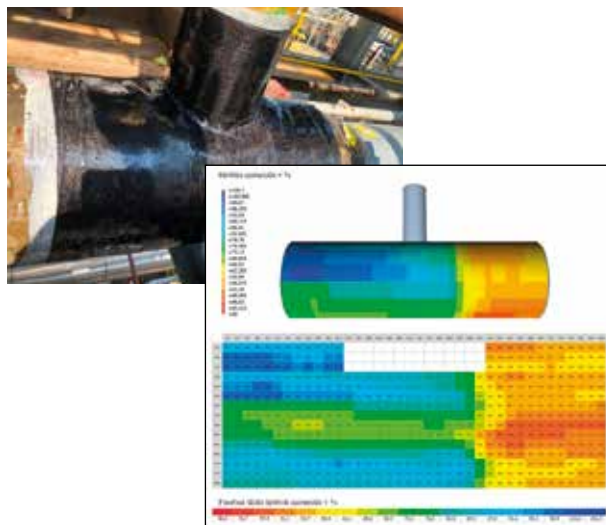
We use them as a separate method, or we combine them depending on specific inspection conditions.

CORROSION UNDER COMPOSITE WRAP REPAIR

Composite repair systems generally consist of a filler material for reshaping the pipe surface, an adhesive primer to act as a coating and bonding agent and, lastly, the composite material itself to provide strength and rigidity back to the pipe system.

Due to the internal corrosion (erosion) the original wall gets thinner continuously and it should be regularly inspected **to prevent an unexpected leak or accident**.

We perform the inspection of the corrosion under composite wrap repair using the Pulsed Eddy Current Array (**PECA™**, **PEC**) method.



CORROSION UNDER SCABS AND BLISTERS

In some cases, the external corrosion grows and then it is very difficult to inspect.

Removal of corrosion product (scabs or blisters) by blasting or grinding pressurized live process components has an associated hazard for the personnel and the environment.

It is impossible to use any ultrasonic technique without the corrosion product removal, therefore we use the Pulsed Eddy Current Array (**PECA™**, **PEC**) method to **inspect corrosion under the scabs and blisters safely**.

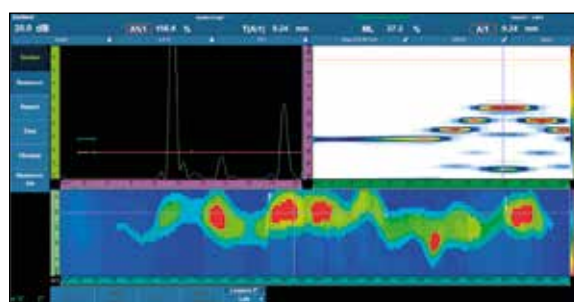


CORROSION MAPPING BY PHASED ARRAY ULTRASONIC METHOD

We use phased array ultrasonic method (PAUT) to inspect the corrosion and perform corrosion mapping. Phased array corrosion mapping is a process which maps material thickness using the ultrasound. Variations in material thickness due to corrosion is identified and graphically shown as a colour map of corrosion that provides an easy to interpret picture.



There is a variety of PAUT probes, manual scanners or robotic scanners available to be used for the extensive inspection or inspection on difficult-to-reach areas.

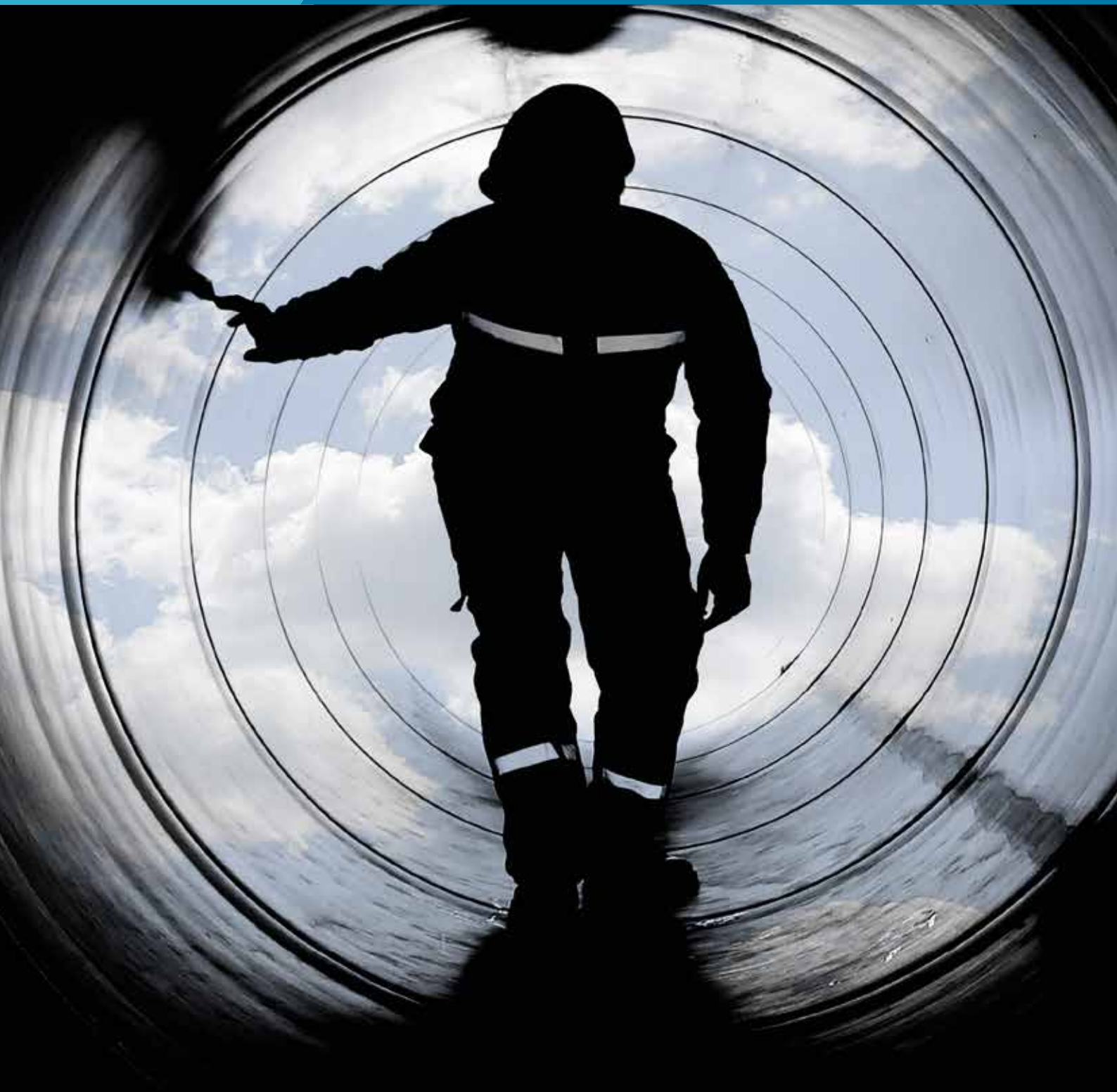




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SAFETY • QUALITY • RELIABILITY



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