

FIRST Company

(INSPECTION AND LIFTING DIVISION)

1- Conventional Inspection Services

FIRST COMPANY has been carrying our conventional inspection services in Egypt for more than 10 years and has an experienced team consisting of qualified inspectors to undertake this work. We have used the latest techniques to build on our success, enabling us to provide our clients with a safer, quicker and reliable service. Through our work we have the knowledge, expertise and experience to perform conventional NDE inspections from our offices and project network. Our conventional services include: NDE/NDT Inspections, Liquid Penetrant, Magnetic Particle, Radiographic, Ultrasonic, Visual Inspection, Electromagnetic Testing, Remote Visual Inspection and Quality Assurance.



1.1 Liquid Penetrant (LP)

FIRST COMPANY utilizes Liquid Penetrant inspection to detect surface discontinuities in both ferromagnetic and non-ferromagnetic materials. In castings and forgings, these may be cracks or leaks in new products or fatigue cracks in in-service components.

Testing is performed using visible red dyes under visible light conditions or fluorescent dyes under ultraviolet light. As the name implies, the dyes penetrate into the surface discontinuities by capillary action. After the excess material is removed from the material being tested, indications will appear. Evaluation and classification of material is based on code or customer requirements.



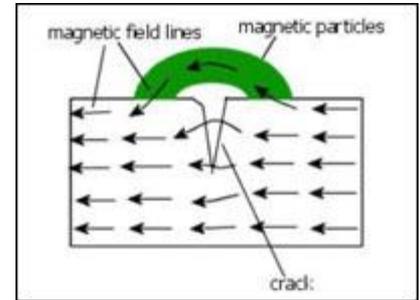
1.2 Magnetic Particle Inspection (MPI)

MPI detects surface and near-surface imperfections such as cracks, seams and laps in ferromagnetic materials, and is used to assess location, size, shape and extent of these imperfections. When the test object is magnetized, flaws perpendicular to the magnetic field direction cause flux leakage. Magnetic particles applied to the surface are held at



the location of the imperfection by flux leakage. In this magnetic particle testing technique, dry particles are dusted onto the surface of the test object as the item is magnetized.

Dry particle inspection is well suited for the inspections conducted on rough surfaces. When an electromagnetic yoke is used, the AC or half wave DC current creates a pulsating magnetic field that provides mobility to the powder.



The primary applications for dry powders are unground welds and rough as-cast surfaces.

Dry particle inspection is also used to detect shallow subsurface cracks. Dry particles with half wave DC is the best approach when inspecting for lack of root penetration in welds of thin materials.

Half wave DC with prods and dry particles is commonly used when inspecting large castings for hot tears and cracks.

1.3 Radiographic Testing (RT)

Conventional Radiography (RT) is a nondestructive examination method that uses X-ray and Gamma ray for detecting internal imperfections, for measuring wall thickness and for detection of corrosion. With RT, the material is exposed to a homogenous ray from a radioactive isotope or an X-ray tube while a negative film is positioned behind the material to be examined. After development of the film, thickness and density differences (material imperfections) will show as blackness differences. Acceptance criteria define whether or not the indication is non-acceptable (a defect) or not. FIRST COMPANY licensed technicians and equipment meet all the ROK radiography regulations.



FIRST COMPANY pipeline inspection capability benefits from decades of experience in the pipeline industry. Our procedures meet standard inspection specifications for Workmanship Acceptance Criteria or Alternative Acceptance. We ensure that welding repairs are kept to a minimum by providing welders with quick and accurate process control feedback derived from our inspection data.



1.4 Radiographic Testing (Close Proximity)

Conventional Radiography is a nondestructive examination method that uses X-ray and Gamma ray for detecting internal imperfections.



FIRST COMPANY introduced **Close Proximity Radiography** to Egypt in early 2006. Radiography provides a quality, cost effective, permanent record with high volume capabilities due to simple operation and portability. However, its use is restricted by the inherent risks associated with the use of radiation and the need to establish and manage a controlled area during the process. The associated problems are greatly reduced by the use of the “Small Controlled Area Radiography” (SCAR) system. SCAR has set the precedent for safer working in the industry.



1.5 Ultrasonic Testing

FIRST COMPANY Provides Manual (Conventional) Ultrasonic Testing and Automated Ultrasonic Testing. Both techniques transmit ultrasound through a material and receive the reflected echoes from the back wall or from any defects.

This makes it possible to locate discontinuities in a material or weld. During Manual Ultrasonic Testing the operator measures the material thickness by reading from the screen. UT uses high frequency ultrasonic waves to detect surface breaking and internal imperfections, measures material thickness and determines acceptance or rejection of a test object based on a reference code or standard. Our UT techniques provide instant results, and are sensitive to both surface and subsurface discontinuities throughout the material. UT is capable of detecting imperfections throughout the entire material thickness, and may be used with access to only one surface.



1.6 Positive Material Identification

FIRST COMPANY’s Positive Material Identification (PMI) quickly and accurately identifies the composition of more than 100 different engineering alloys onsite. FIRST COMPANY can perform PMI on virtually any size or shape of pipe, plate, weld, welding materials, machined parts or castings. Team performs both x-ray fluorescence (XRF) and Spark Emission Spectrography (SES), two methods of conducting a PMI examination.



Both methods ensure compliance with Process Safety Management (PSM) requirements.

1.7 Quality Control

NDT Service provides a comprehensive Egypt i Vendor Inspection, QA/QC and expediting service for all types of mechanical, rotating, electrical and electronic equipment as well as Oil Country Tubular Goods (OCTG).

Services include:

- Expediting
- New Build Equipment Inspection
- Surveillance
- Temporary and Portable Equipment
- Vendor Audits (Prior to PO Award)

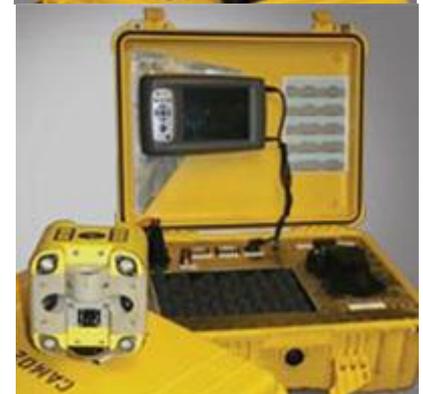
QA inspection of equipment being fabricated repaired and/or refurbished in a vendor's facility. The equipment can be for upstream application or from a client's facility for a capital project as well as maintenance repairs or replacement of original equipment. No matter what the requirements of your project are, we can provide qualified inspection personnel to assure those requirements are met. FIRST COMPANY inspectors are qualified and/or hold certifications through API, AWS, DOT, NACE, NEMA or ASNT. The inspection activities are guided by the company's Quality Manuals and ITP plans that are developed and managed by FIRST COMPANY Quality Program Management.

1.8 Remote Visual Inspection

Visual Inspection (VI) is one of the most widely used Non-Destructive Testing (NDT) methods for the detection of discontinuities before they develop into major problems. Areas where visual inspection can be utilized are; poor welding, corrosion and pitting, general condition monitoring, surface

degradation & defects and protective coating monitoring.

Visual Inspection means the inspection of equipment, structures or vessels using a combination of the following human senses; vision, hearing and touch. Visual Inspection often works in conjunction with a number of the following NDT methods; UT, EC, MT, PT or RT.



Visual Inspection can also be carried out with the aid of devices such as a magnifying glass, flash lights, borescopes, digital video borescopes and camera systems to provide Remote Visual Inspection (RVI).

FIRST COMPANY highly trained inspectors employ robotics, fiber optic cameras, borescopes and other instrumentation and recording systems to conduct RVI on equipment such as piping systems, vessels, turbines, boilers and heat exchangers. Data can be recorded onto various storage media for viewing and storage.

2- Lifting Inspection:

Skilled, Certified Inspector and Hi-Tech Equipment at inspection field allow FIRST Company to offer the Lifting inspection services with very high quality:

- Lifting & Handling Equipment's Inspection
- General Crane Inspection
- Mobile Crane Inspection
- Tower Crane Inspection
- Fork Lift Inspection
- Tank Inspection.

3- Advanced Inspection Services

FIRST COMPANY is at the forefront of providing Advanced Inspection Services to our clients and we have been instrumental in bringing new worldwide inspection techniques into Egypt. Through our work we have the knowledge, expertise and experience to perform advanced NDT inspections from our offices and project network. Our comprehensive service includes a variety of techniques:

- Guided Wave
- Time of Flight Diffraction (ToFD) and Phased Array (PA)
- Positive Material Identification (PMI)
- Magnetic Flux Leakage (MFL)
- ACFM
- Leak Testing
- Thermography
- Electromagnetic Testing (ET)
- RFEC
- IRIS
- Digital Radiography
- RVI and
- Endoscopy Inspections.

3.1 Internal Rotary Inspection System

FIRST COMPANY has the knowledge, expertise and experience to perform inspections using a range of systems to inspect tubes in Heat Exchangers, Air Coolers, Feed Water Heaters, Condensers and similar items. This allows tubes to be inspected periodically to detect and size discontinuities e.g. pits, erosion, cuts, grooves, and wear. Correct technique selection is critical and depends on the tube material, ferromagnetic or non-ferromagnetic and the type of discontinuities expected.



Techniques include:

- Internal Rotary Inspection System (IRIS)
- Eddy Current Testing (ET)
- Remote Field Testing (RFT)

Eddy Current Testing, and Remote Field Testing are electromagnetic techniques and tend to be used as screening tools in order to select tubes for IRIS, especially in the case of ferromagnetic materials e.g., Carbon Steels.



3.2 Long Range Guided Ultrasonic

FIRST COMPANY uses the state of the art Wavemaker (4) which generates waves propagating long distances, even beneath a layer of insulation. The ultrasound is transmitted and received from one single location. The response from the metal loss feature is a function of the depth and circumferential extent of the metal loss.

Guided Wave tools are available in fixed ring and modular ring format. The fixed ring designs are suitable for pipe diameters up to 8-inches. For larger diameters, a modular ring up to 42-inches has been adopted. Guided Wave inspections help you to limit follow-up inspection and maintenance to the areas of real interest where the piping was found to be defective.



3.3 Ultrasonic Phased Array

FIRST COMPANY uses the state of the art OmniScan MX

Mainframe with Phased Array TOFD Acquisition Modules, combined with multipurpose scanners and modulators.

Phased Array (PA) provides sharper detection capability for off-angle cracks, and is capable of displaying multiple presentations simultaneously. PA applies computer-controlled excitation to individual elements in a multi-element probe. It is an advanced pulse-echo technique that utilizes multiple miniaturized transducers and time-delays to shape the ultrasonic sound beam to a desired angle and focus. The versatility of the system permits simultaneous views of different presentations, such as sectoral views as well as A-Scan, B-Scan and C-Scan representations.

When compared with manual pulse-echo techniques, the advantages of Phased Array testing are its excellent repeatability, increased inspection speed, more accurate results. Moreover, PA allows the digital storage of all data, location and system settings, and is very much safer to operate within a working environment, compared with Non-Destructive Testing methods that use X-rays and gamma rays for detecting imperfections



3.4 Automated Ultrasonic Inspection

FIRST COMPANY has the knowledge, expertise and experience to perform Phased Array and automated ultrasonic (AUT) on both onshore and offshore operations. We use different technologies from several manufacturers to provide complete automated inspection capabilities. FIRST COMPANY's AUT capability has been used on a variety of projects and for numerous clients. Pipe sizes inspected have ranged from 5" to 48", wall thickness from 12mm to 33mm and to a variety. AUT uses conventional and specialized transducers to introduce sound in the test materials. These transducers are mounted to automated robotic crawlers, which articulate to cover large areas of the vessel or piping surface. The data collected is then displayed in color in multiple A-Scan, B-Scan, C-Scan and D-Scan images.



A-scan representation is the view in which the signal amplitude is shown as a vertical excursion from the horizontal sweep time trace. The B-scan and D-scan presentations are two-dimensional views of cross-sectional planes through the test object on different axis. This imaging is helpful in distinguishing mid-wall inclusions such as laminations and blistering, from back-wall discontinuities like erosion and corrosion.



The C-scan image is a two-dimensional plan view of the object. Indication of depth is color coded to provide the image with qualities, which resemble a topographical map viewed from the inspecting surface.

3.5 Magnetic Flux Leakage

FIRST COMPANY has the knowledge, expertise and experience to perform Magnetic Flux Leakage (MFL) on tanks.

We use the MFL 2000 which is a high speed, motorized magnetic flux leakage corrosion detection scanner capable of inspecting approximately 8000 square feet per shift. The ergonomic design, coupled with the latest magnetic technology have resulted in an easy to operate, accurate, reliable and cost effective inspection tool. The motorized scanner takes all the strain giving you more consistent results and less operator dependency.

Key Features High Speed, Cost Effective Inspection

- Easy to Use Ergonomic Design
- Automatic Defect Detection System
- Minimal Maintenance Requirement

The MFL 2000 corrosion detection floor scanner from Silverwing is a combination of magnetic technology and customer led ergonomic mechanical design. The system is designed specifically with the operator in mind and the availability of a new consistent high quality magnetic material has allowed a complete redesign of the MFL 2000. In addition the new mechanical design has overcome some of the more difficult and time consuming set-up procedures and also eliminated the vulnerable cabling, so reducing maintenance costs.

3.6 Time of Flight Diffraction

FIRST COMPANY uses the state of the art OmniScan MX 2 Mainframe with Phased Array ToFD Acquisition Modules, combined with multipurpose scanners and modulators.

With ToFD, a single line scan of a pair of angle compression wave probes held at a fixed separation can provide full volumetric coverage of both weld and heat affected zone (HAZ) and generate an immediate scale image of through wall condition with defects shown in true location and size. The wide beam used defines the test surface by generating a lateral wave and the inner surface by reflections off the material



‘backwall’. Any anomalies lying between these two surfaces are highlighted by signals diffracted and reflected off their extremities. The lateral location and length of these discontinuities is reported as a function of encoded scan position.(ToFD), which was originally developed for crack-sizing in nuclear applications, established itself as a widely used tool for flaws detection in welds. This unique ultrasonic technique has big advantages in speed, detection of defects and is the most accurate defect sizing technique in general use. One of the important advantages of using ToFD for weld inspection is the absence of radiation. Furthermore, in several validation projects ToFD has proved itself to be a technique which combines a high detection rate with a very high reliability in pre-service and in-service inspections.

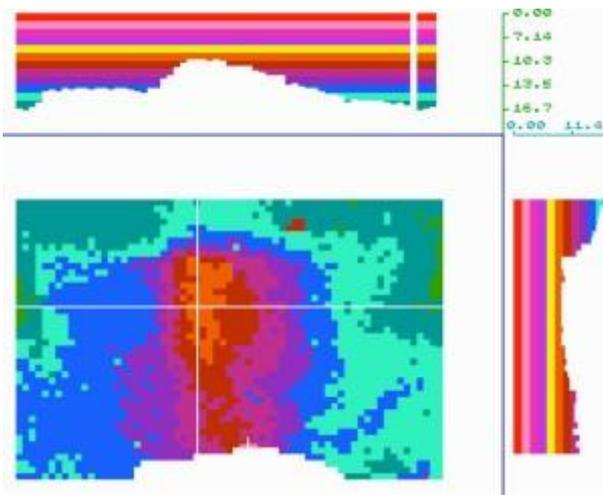
3.7 Automated Corrosion Mapping

CONDITION MONITORING

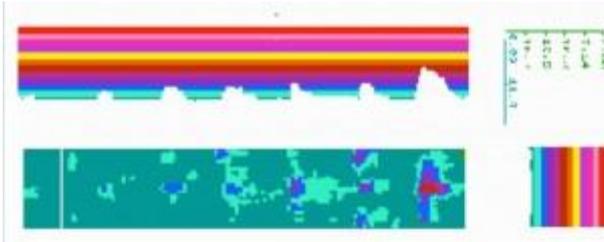
Corrosion and erosion monitoring

- Corrosion and erosion mapping utilizing Automated system and a Combination of ToFD, Phased Array and Pulse Echo
- Ultrasonic imaging
- Detection, imaging and monitoring of material degradation
- Defect sizing and propagation monitoring
- Real time Inspection

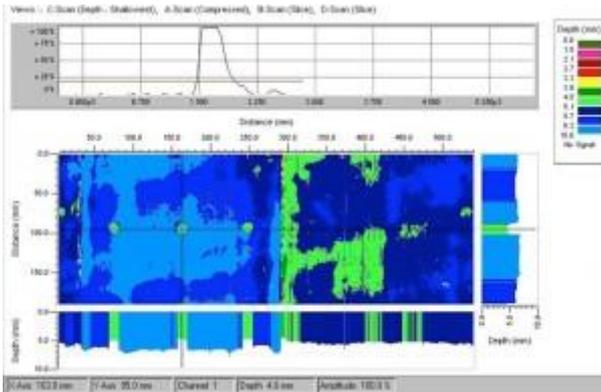
Sample Corrosion Map Petrochemical Plant Process Pressure Vessel (1)



Sample Corrosion Map Petrochemical Plant Process Pressure Vessel (2)



Sample Corrosion Map



Low and High Temperature Hydrogen Attack Detection

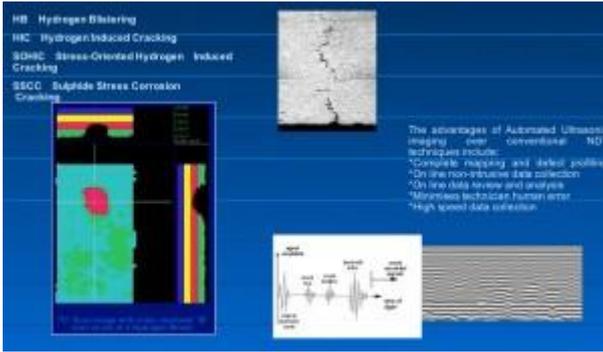
Products & Services

High Temperature Hydrogen Attack

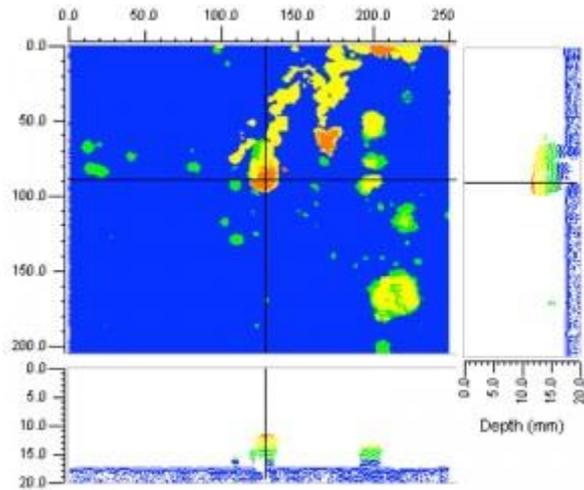
Advanced Backscatter Techniques



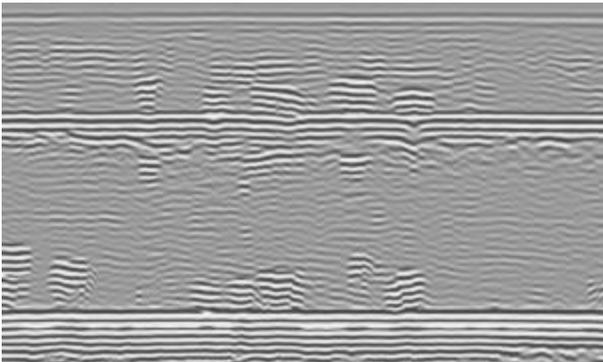
Low Temperature Hydrogen Attack



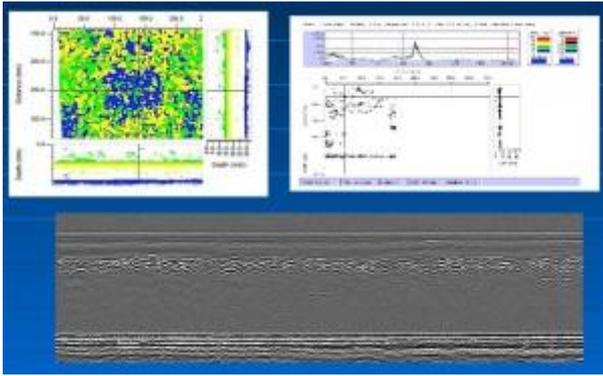
Low Temperature Hydrogen Attack



Low Temperature Hydrogen Attack On HP Separator in H2S Service



Low Temperature Hydrogen Attack



3.8 Stress Corrosion Cracking

FIRST COMPANY utilizes the Time of Flight Diffraction method for detection of Stress Corrosion Cracking.

3.9 Long Range CHIME Inspection

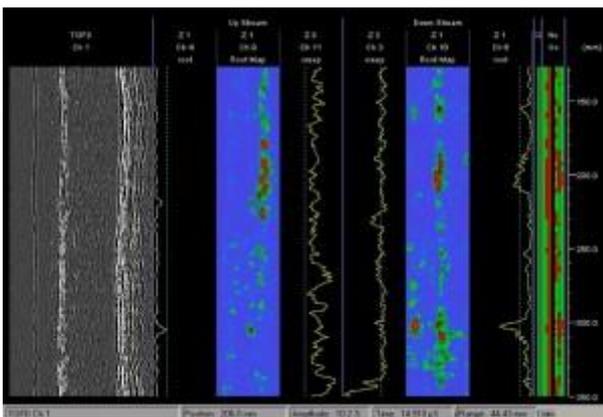
Long range ultrasonic Chime

- Under clamp/pipe support corrosion
- Corrosion under annular plate

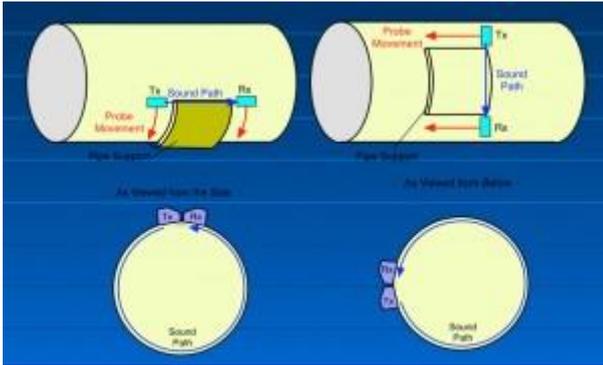
Guided wave ultrasonic

- Buried pipelines

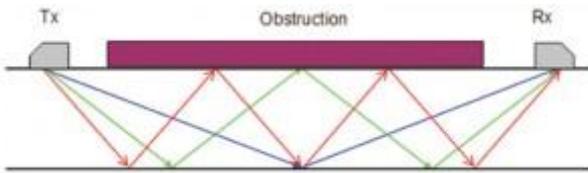
Long Range Chime



Corrosion Under Supports (CHIME)



Corrosion Under Supports (CHIME)



Key Features of the System

- Large areas can be inspected with a single pass
- Estimate of the extent of corrosion attack
- The full volume can be inspected with probes separated by up to 1 meter
- Sensitive to both internal and external surfaces
- Suitable for pipe diameters 75 mm and above
- Suitable for inaccessible locations such as clamps, saddles, tank floors and half-buried pipes.

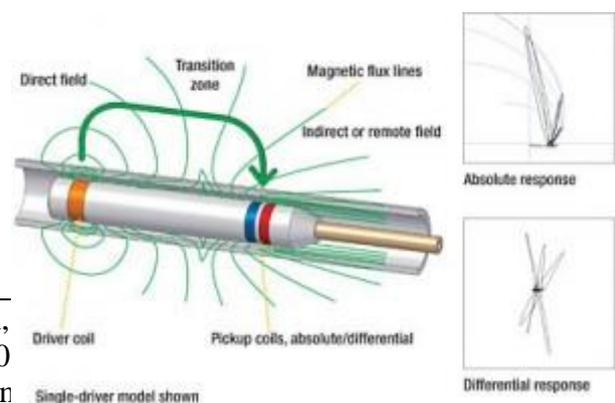
3.10 Eddy Current Testing

FIRST COMPANY, by utilizing Eddy Current techniques, can examine large areas very quickly and it does not require the use of coupling liquids.

In addition to finding cracks, EC can also be used to check metal hardness and conductivity in applications where those properties are of interest and to measure thin layers of nonconductive coatings like paint on metal parts.

Applications

- Surface Breaking Cracks
- SBC using Sliding Probes
- Metal Thinning (Corrosion)



- Heat Exchanger Tube Inspection
- Conductivity
- Heat Treat Verification
- Thickness inspection of Thin Materials
- Thickness inspection of Coatings

3.11 Boiler Inspection

FIRST COMPANY utilizes EMAT technology to perform boiler tube inspection without scale removal. Scale is used as a couplant to transfer electromagnetic signal into boiler tube for thickness detection. Utilizing this method saves time as tube cleaning is not required, therefore reducing boiler downtime.

3.12 Digital Radiography

Digital Radiography is a powerful technique that can be used in nondestructive inspection of internal features of an object to obtain two-dimensional computed tomography images needed to characterize material properties, identify defects and measure part geometry.

Multiple slices can also be assembled to create accurate three-dimensional CT that can be used for a variety of different purposes as viewing the shape of defects. FIRST COMPANY can provide site inspection utilizing method above for all your needs and requirements.



4- Pipeline Inspection Services

FIRST COMPANY provides a complete range of services for your pipeline inspection needs.

This includes:

- X RayCrawler Inspection
- Gamma Ray Inspection
- Advanced Ultrasonic Inspection (Combination of Phased Array, Time of Flight Diffraction and Shear wave Ultrasonics)
- Long Range Ultrasonic Inspection
- Advanced Corrosion Mapping
- Intelligent Pigging (Ultrasonic and MFL methods)



4.1 X-Ray Pipeline Inspection

FIRST COMPANY has the knowledge, capability and experience to provide Conventional X-Ray and Gamma Ray inspection on pipelines as well as X-Ray crawler inspection on pipes from 10" to 48" diameters.

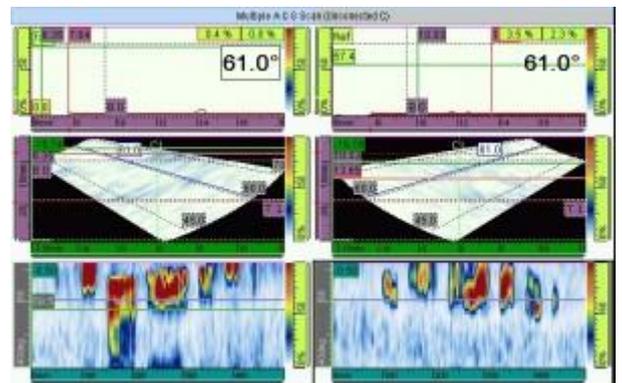


4.2 Automated Pipeline Inspection

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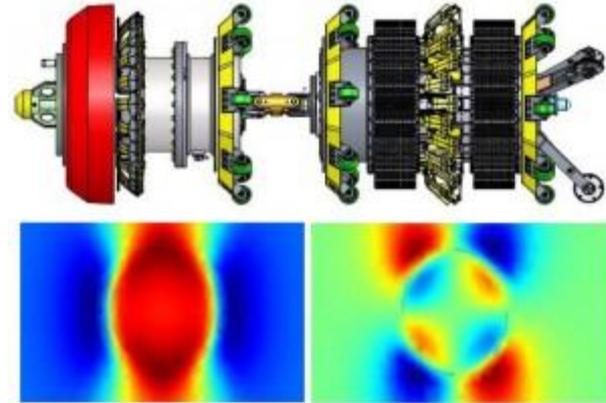
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from the inspecting surface.

4.3 Intelligent Pigging

FIRST COMPANY provides inspection utilizing intelligent pigging ILI and MFL for corrosion detection and cracking. The ILI system can also be used for riser inspections, with or without production outage. Large diameter piping from 4" up to 64" metallic and non-metallic pipelines can be inspected. This method of inspection is fast and extremely accurate with immediate inspection results. MFL can be used with or without liquid in the pipeline and offer a higher inspection speed and hence greater range. These MFL tools are based on the latest standards of electronics, data processing and measuring principles. This has led to a unique set of features such as: Real tri-axial measurement of the flux leakage vector, resulting in accurate assessment of metal loss. Flexible tools with high tolerance for various pipeline diameters, wall thicknesses and bend radii.



5. Heat Treatment Services

FIRST COMPANY and our alliance partner Denholm Zholdas are the largest provider of Heat Treatment services in Egypt having over (8000) KVA of available heat treatment power sources and High Velocity Fuel Fired Heat Treatment Services. We have a range of high velocity burner's diesel oil for the in-situ heat treatment of large fabrications, Welding Preheats, Post weld heat treatments, Hydrogen bake-outs, Temporary Furnaces, Dry-outs, Equipment sales/rentals and Equipment calibration and service



5.1 Electrical Resistance

The traditional low-voltage Electrical Resistance method of heat treatment uses ceramic blankets stepped down to 80 volts to provide a quick and convenient approach to many jobs, particularly preheat and Post-weld Heat Treatment (PWHT).



5.2 Welding Preheat



Advanced automated systems control and document welding preheat to reduce thermal stress in two primary ways. First, it drives off moisture that would release hydrogen that could penetrate the steel and cause porosity and subsequent cracking. Second, it reduces heat loss to the surrounding metal, minimizing the rate of weld hardening and allowing hydrogen that is present to escape.

5.3 Post-weld Heat Treatment

Carefully controlled PWHT is a crucial step in maximizing the life of your process equipment. PWHT tempers the metal and reduces tensile stresses, minimizing the risk of brittle fracture, stress, corrosion cracking and metal fatigue. This is especially important for equipment used in harsh service environments.

5.4 Combustion Heat Treatment

FIRST COMPANY has burners that will deliver an astonishing 100 million BTUs. In addition to multiple safety interlocks and redundancies, these systems feature a turndown ratio of 100:1, which allows FIRST COMPANY to vary heat output from candle intensity to full blast in increments as small as 1°F/hour.

Output from 20HP blowers varies from 500 CFH to 168,000 CFH to ensure that heat is distributed evenly regardless of a vessel's geometry. FIRST COMPANY Combustion Heat Treating method may be used in a variety of applications including Post-weld Heat Treatment, Refractory Dry Out and Process Startup. Post-weld Heat Treatment: Carefully controlled post-weld heat treatment.



Refractory Dry Out: The secret to long refractory life is a professional Dry out using FIRST COMPANY's high-velocity combustion systems to ensure that every inch of your refractory is heated under control as tight as one degree per hour.

Process Startup: It is well known that process heaters are designed for a small range of temperatures. FIRST COMPANY's high-velocity combustion systems feature exceptional turndown ratios (100:1), so they can be programmed to increase from candle-heat to process heat in tightly controlled increments. It is the best way to minimize thermal stress and ensure long run-times in cyclone boilers, CFBs, steel mills, glass plants and other process applications.

