



SA INTERNATIONAL Ltd

ADVANCED NDT SOLUTIONS

COMPANY PROFILE

INSPECTION SERVICES PRESENTATION



SA INTERNATIONAL Ltd
ADVANCED NDT SOLUTIONS

CONTACT US



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WHO WE ARE?

SA-International is an Egypt-based, internationally operating service provider, offering a wide range of activities and serving various industries and sectors like Oil & Gas, Petrochemicals, Fertilizers, Construction and others.

As an ISO/IEC 17020: 2012 Certified Company, ISO /IEC 17020: 2012 in the field of NDT Non-Destructive Testing /Coating Inspection /Painting Inspection of Pressure Vessels / Tanks /Pipeline / Heat exchangers / Steel Structure / Electrical cables / Lifting equipment ,we guarantee our clients the highest-quality services according to the high standards we set for ourselves and constantly try to exceed.

Additionally SA-International is registered with 70+ companies in diverse sectors.

SA International was founded in 2008 and has been growing and developing steadily since then. The company's main office is located in Alexandria, Egypt and established a subsidiary in Abu Dhabi/ UAE in 2011.

By now, we have achieved to build a network of 71 agents & partners worldwide to cover especially our vendor inspection activities and to support our clients in all regions of the world.



OUR MISSION

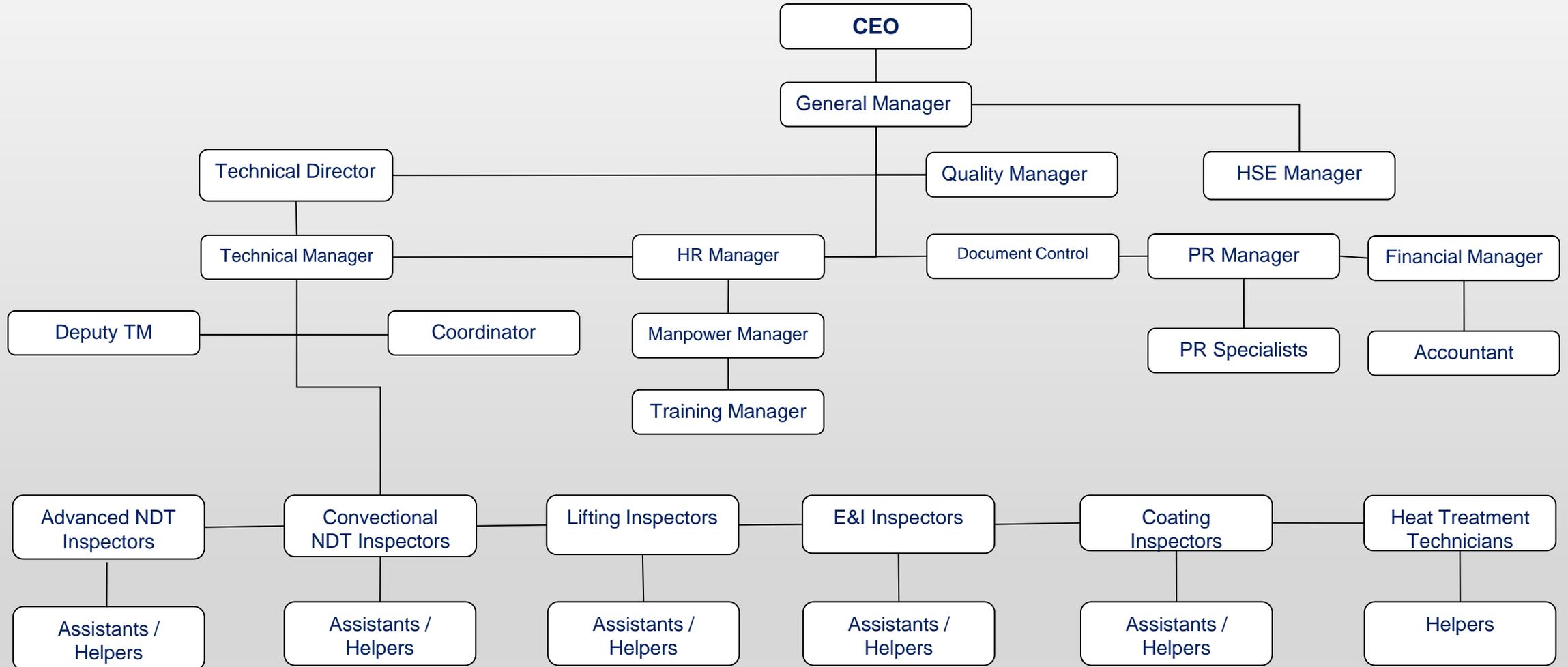
We are here to let our customers feel that their needs are taken care of by the best in the business. Our employees are experienced and trained and strive to provide excellent services with their expectation integrity, superior work ethics and professional character.

OUR VISION

We aspire to become a leading service provider for asset integrity management all over the world, now we have a subsidiary in UAE and achieved to build a network of 71 agents & partners worldwide to cover especially our vendor inspection activities and to support our clients in all regions of the world.



- Advanced NDT Technologies
- Conventional NDT Services
- Lifting Inspection Service.
- Vendor Third Party Inspection.
- Manpower Supply Consultation.
- Technical Training Courses.





Commercial Register	2580
Taxation Card	303-819-006
Egyptian General Petroleum corporation	16
Egyptian Natural Gas Holding Co.	1636
GANOPE	215
Chamber of petroleum and mining	244
Military Security Agency	3/m/36358/6899/3
Egyptian federation for construction & Building Contractors EFCBC	81790
Egyptian Nuclear & Radiological Regulatory Authority	I.X.085
Dun & Bradstreet Global Database	85-046-3902
ISO/IEC 17020:2012 by EGAC/ILAC	0321106
EN ISO 9001:2015	20001220006433
EN ISO 45001:2015	20152220006434
ISO 14001:2018	20051220006435





- BRITISH PETROLEUM (WND)
- OCEANEERING (WND)
- GULF OF SUEZ PETROLEUM COMPANY (GUPCO)
- EGYPTIAN LIQUEFIED NATURAL GAS (ELNG)
- EGYPTIAN METHANEX METHANOL COMPANY S.A.E. (EMETHANEX)
- JORDAN BROMINE COMPANY
- ANRPC - ALEXANDRIA NATIONAL REFINE & PETROCHEMICAL
- EXXONMOBIL
- PETROBEL
- QARUN PETROLEUM COMPANY
- EAST ZIET PETROLEUM COMPANY (ZIETCO)
- ALEXANDRIA MINERAL OILS COMPANY (AMOC)
- RASHPETCO
- ALEXANDRIA PETROLEUM MAINTENANCE CO.(PETROMAINT)
- CAIRO OIL REFINING COMPANY (CORC)





Refinery Plant



Oil and Gas Plant



Power Stations



Steel Factories



Industrial Gases Plants



Chemicals and Fertilizers Factories



TECHNIQUE

REFERENCE

CREW

ADVANCED TANK INSPECTION TECHNIQUES

Tanks

Pressure
Vessels

Pipelines
Piping

Heat
Exchanger

Floor mapping using magnetic flux leakage MFL

EEMUA 159 and API 653 compliance

3

Short range ultrasonic testing SRUT for annular plates

EEMUA 159, API 653 ASME V

2

Acoustic emission for bottom plates AE

EN 15856, ASME V

3

Automated ultrasonic testing AUT for shell plates

API 653, ASME Sec V

2

Rapid motion scanner RMS for shell plates

API 653 ,ASME Sec V

2

Robotic tank inspection
On-Stream Tank Inspection System OTIS

API 653

5

Recalibration, Settlement, roundness and plumpness

ISO 7507, API MPMS

2



ADVANCED PRESSURE VESSELS TECHNIQUES

Tanks

Pressure
Vessels

Pipelines
Piping

Tubing
Inspection

TECHNIQUE

REFERENCE

CREW

Corrosion under insulation CUI
(Pulsed eddy current testing PECT

API 583, ASME V

3

Acoustic emission AE

EN 15856, ASME V

3

Automated ultrasonic testing
AUT for shell plates

API 510, ASME Sec V

2

Rapid motion scanner RMS for
shell plates

API 510, ASME Sec V

2

Phased array ultrasonic testing
PAUT for welding joints inspection

AAPI510, ASME Sec V

2

Gamma scanning for towers
and columns

ASME Sec V

3



TECHNIQUE

REFERENCE

CREW

ADVANCED PIPELINES/PIPING TECHNIQUES

Tanks

Pressure
Vessels

Pipelines
Piping

Tubing
Inspection

Corrosion under insulation CUI (Pulsed eddy current testing PECT)

API 583, ASME V

3

Long range ultrasonic testing LRUT for insulated, above ground and buried pipeline.

API 570, API 578, ASME V

3

Short range ultrasonic testing SRUT for pipe support

EEMUA 159, API 653 ASME V

2

Digital and computed radiographic testing for welding, wall thickness and detecting corrosion profile.

API 583, ASME V, STM E2007

4

Phased array ultrasonic testing PAUT for welding joints inspection

AAPI510, ASME Sec V

2

Pipe blockage testing using gamma scan technique

ASME Sec V

3



ADVANCED TUBING INSPECTION TECHNIQUES

- Tanks
- Pressure Vessels
- Pipelines Piping
- Tubing Inspection**

TECHNIQUE	REFERENCE	CREW
Tubing inspection (IRIS, ECT, MFL, RFT, NFT)	ASME V	3
FTIS™ Ultrasonic intelligent pigging	API-530, API RP-573	8
Replica testing	ASTM Standards E-3, E-7, E-407, E-1351 & BS 5166	3
Acoustic Pulse Reflectometry (APR)	ASME V	2
Remote visual inspection	ASME V	2
Cleaning by Water Jetting	PUWER Regulations 1998	4



SA INTERNATIONAL Ltd
ADVANCED NDT SOLUTIONS

FLOOR MAPPING USING MAGNETIC FLUX LEAKAGE MFL



The MFL is a high speed, motorized magnetic flux leakage scanner capable of inspecting approximately 150 square meters 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.

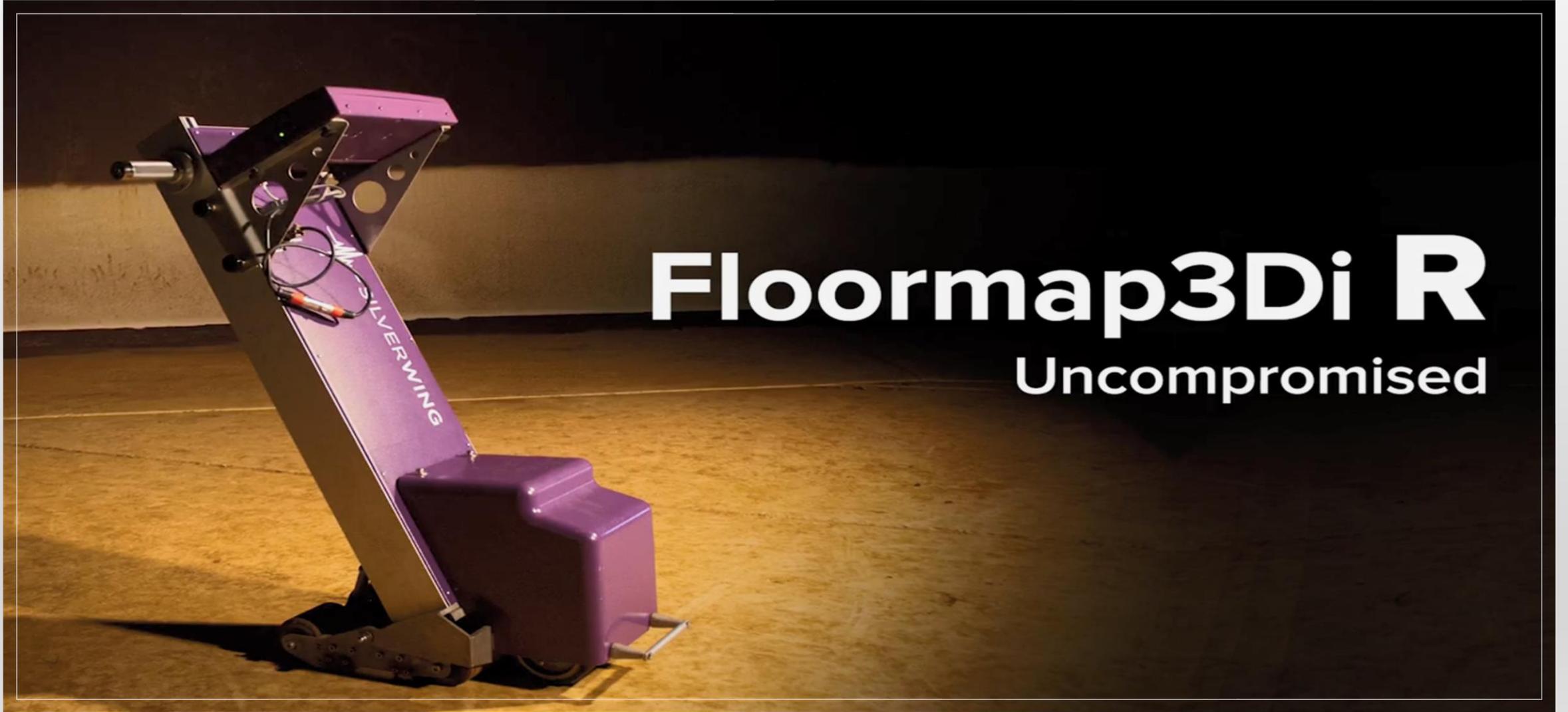
BENEFITS

- **Maximum coverage**, including critical zone
- **Multi-technology** for top and bottom defect discrimination
- **Inspect thicker plates** up to 20 mm (3/4 in) thick
- **10% reporting thresholds**, increase inspection intervals
- **High-resolution** for increased Probability of Detection
- **Flexible scanning**, one scanner with three scan modes
- **Unmatched reporting**, comprehensive and on-the-spot



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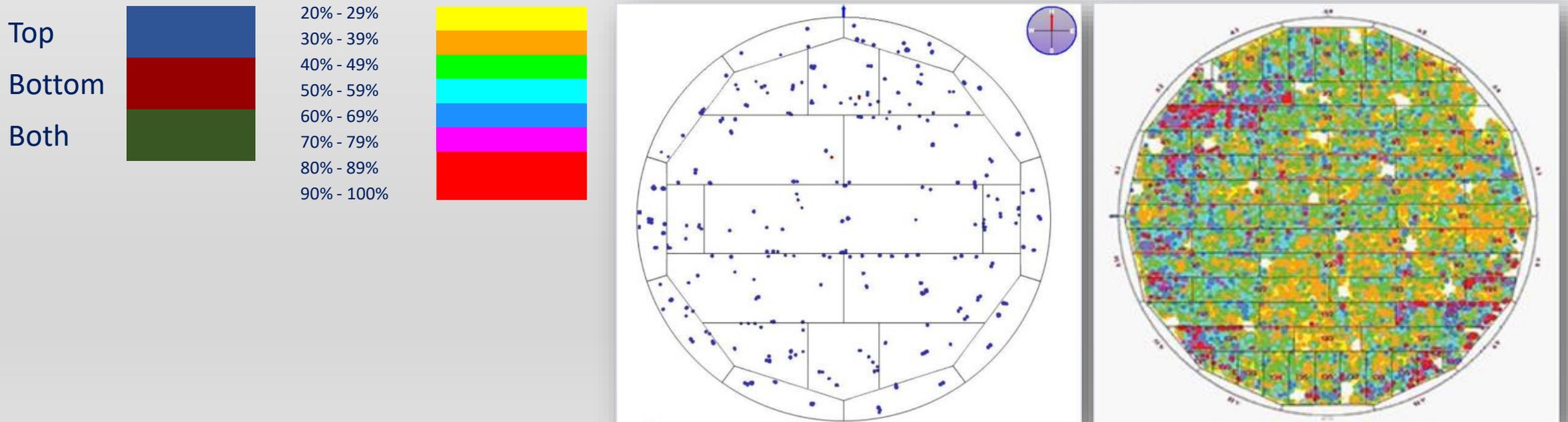
FLOOR MAPPING USING MAGNETIC FLUX LEAKAGE MFL



Floormap3Di R

Uncompromised

An onboard computer allows full data acquisition of signals detected by MFL in such a way that mapping of defect indications can then be carried out through graphical reporting software. This software allows the grouping of defects according to severity in operator-definable color-coded bands.





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SHORT RANGE ULTRASONIC TESTING SRUT



The latest Short-Range Guided Wave Ultrasonic Testing (SRGUT) is Corrosion imaging system that has been designed when the equipment in-service specifically for the Oil and gas, Refinery and Petrochemical industry.

Applicable for :

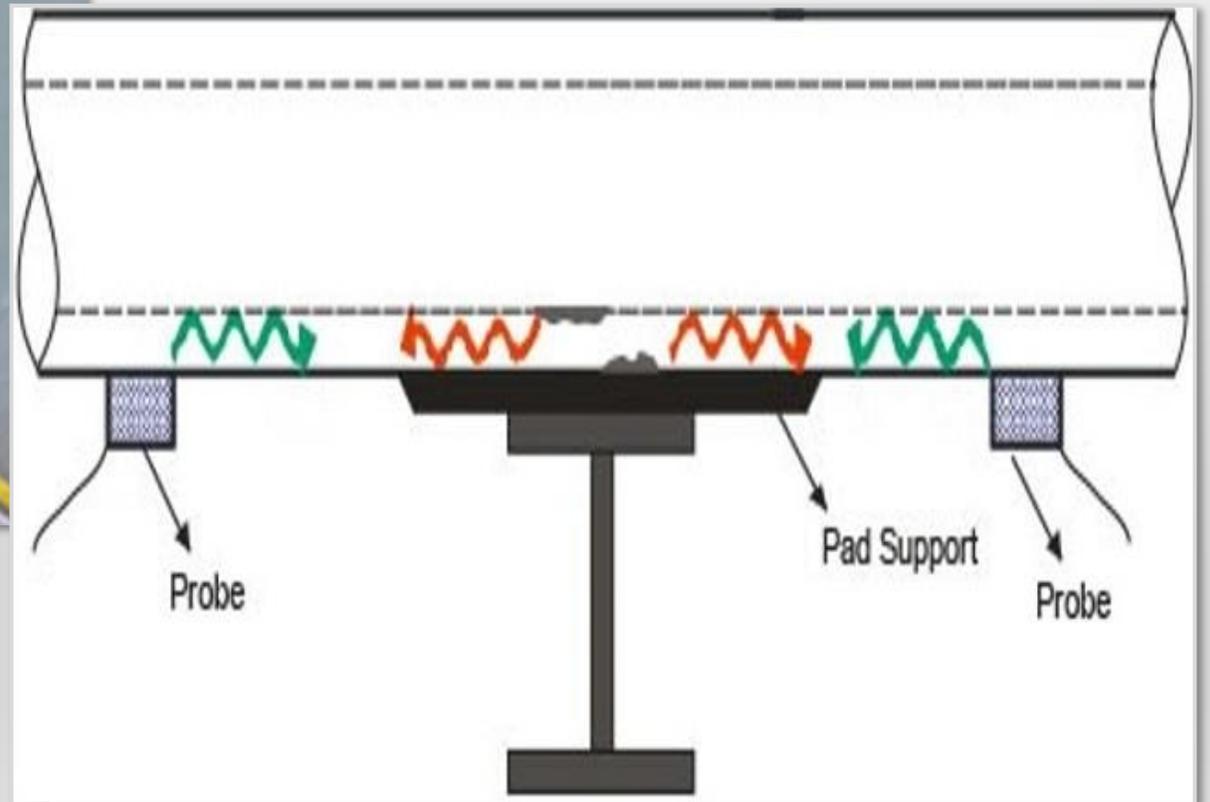
- Inspection for Annular plates for above ground storage tanks.
- Detect corrosion under supports for Pipelines or pressure vessels.
- scan up to 1m of material length without losing adequate sensitivity.
- Approximately 60mm equivalent diameter area (free from coating) is essential to contact the special probe on the material.
- SRUT is a screening technique used on wall thickness range of 6 to 25mm, this test method can locate the discontinuity location and size to an accuracy of $\pm 10\%$.

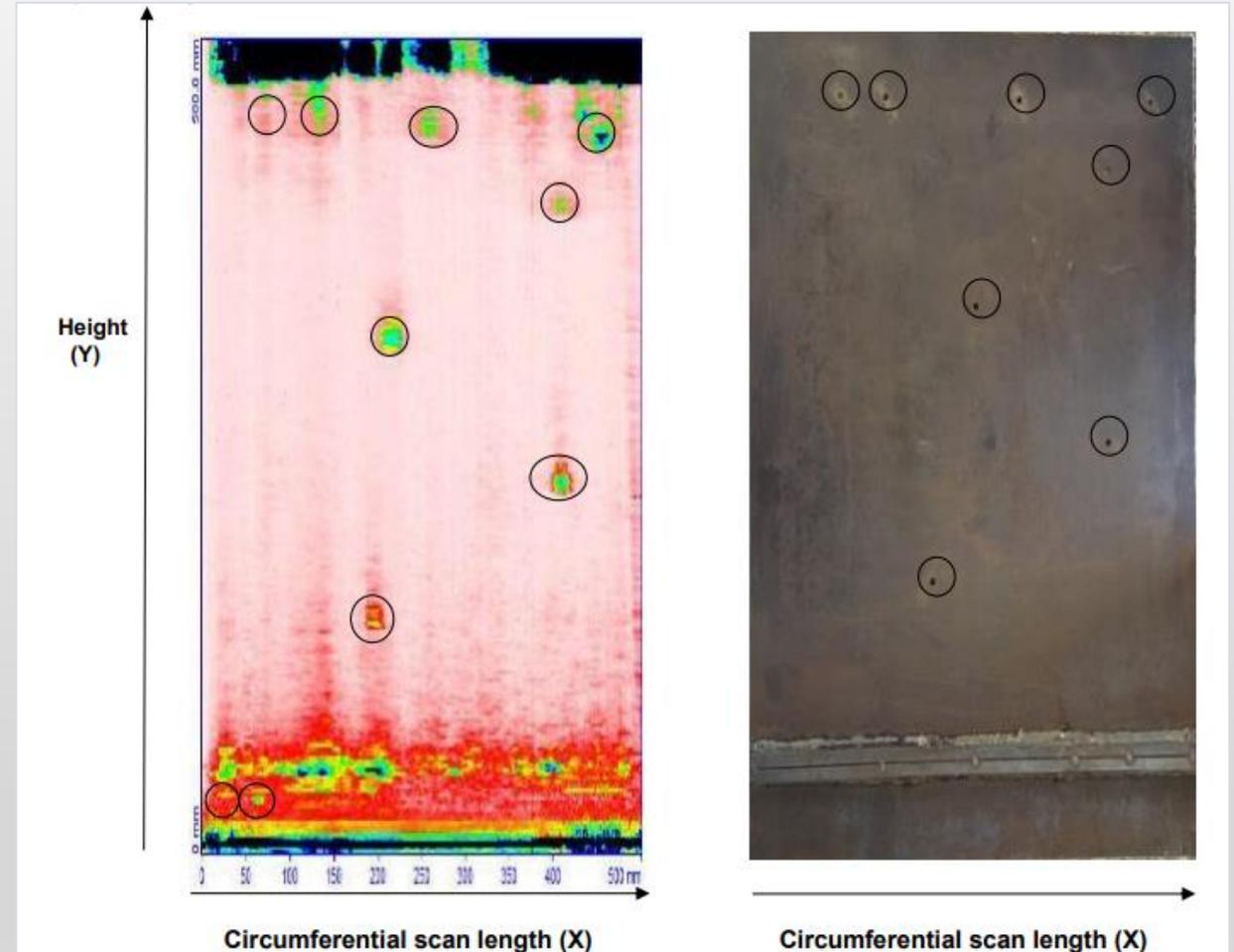
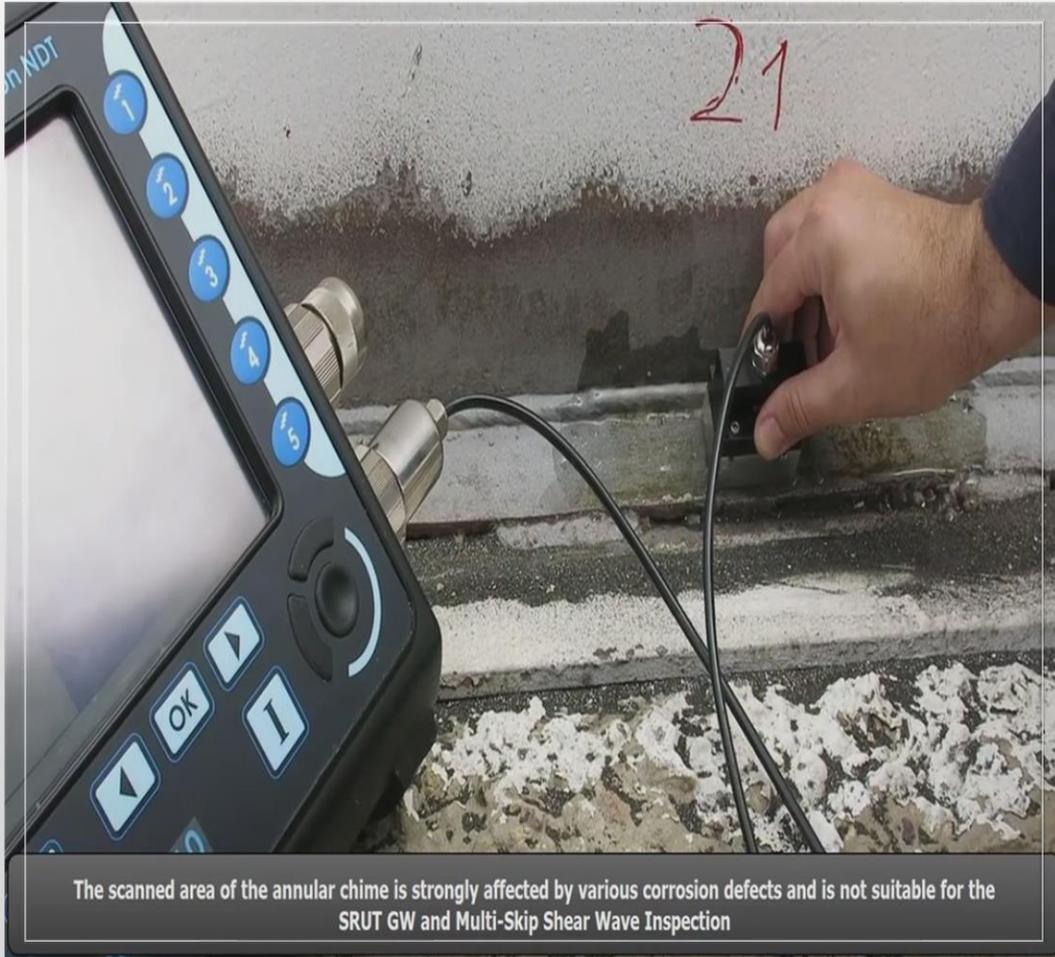
SHORT RANGE ULTRASONIC TESTING SRUT



Inspection for Annular plates for above ground storage tanks. Most ideal for rapid detection of corrosion and erosion including sizing in accessible areas for up to 2 meters length under structures.

Detect corrosion under supports for Pipelines or pressure vessels. Pipes above 200mm diameter and any flat surface







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ACOUSTIC EMISSION

Acoustic Emission (AE) method for diagnostic in-service testing of above ground vertical storage tank bottoms, Pressure vessels, spheres and pipelines, This method allows evaluation and location of active corrosion damage of bottom material and micro-leaks in the tested object.

Requires appropriate test area preparation;

- Filled to 96–100% of its maximum operating capacity.
- Minimize internal noise as much as possible by isolating the tank.
- Stabilization period minimum stabilization period is 24 h.
- The distance of a sensor to a weld or a reinforcing plate not be less than 200 mm.
- The first row of sensors shall be set at a level of approximately 1 m above the tank bottom, distance max 6 meters between sensors for vessels.
- A minimum of one hour of data acquisition under suitable conditions.
- Each test at least 2 measurement cycles.

Application ;

- Inspection of aboveground storage tank
- Inspection of vessels, columns, piping, pipelines



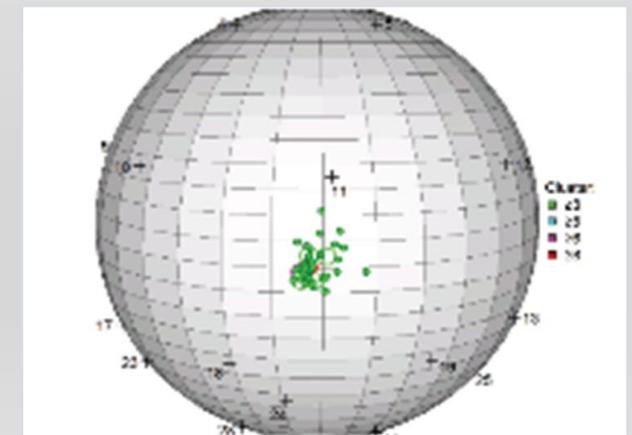
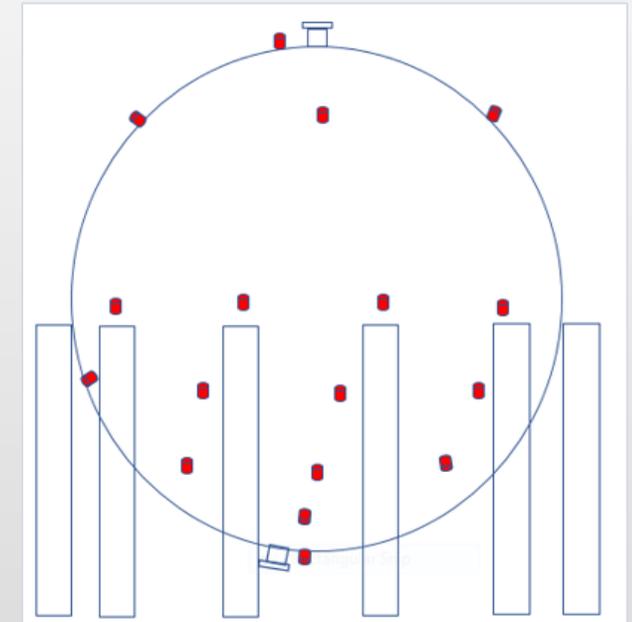
Inspection of spherical tanks
In-Service inspection

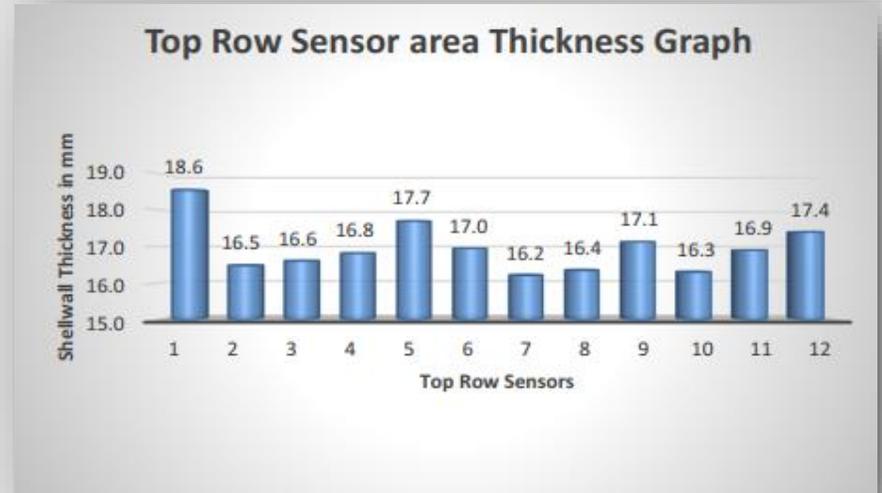
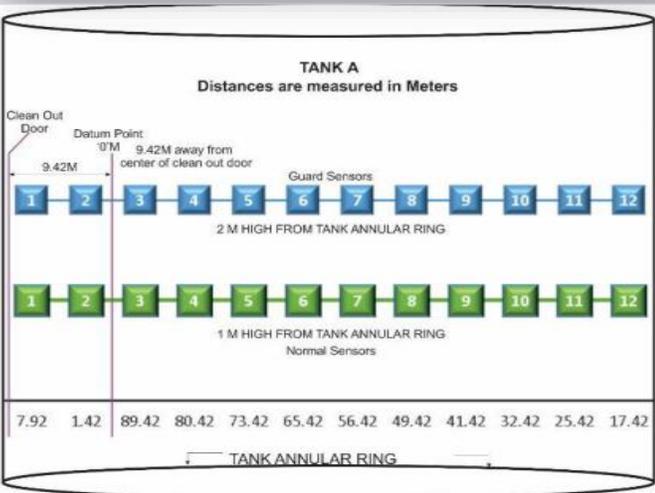
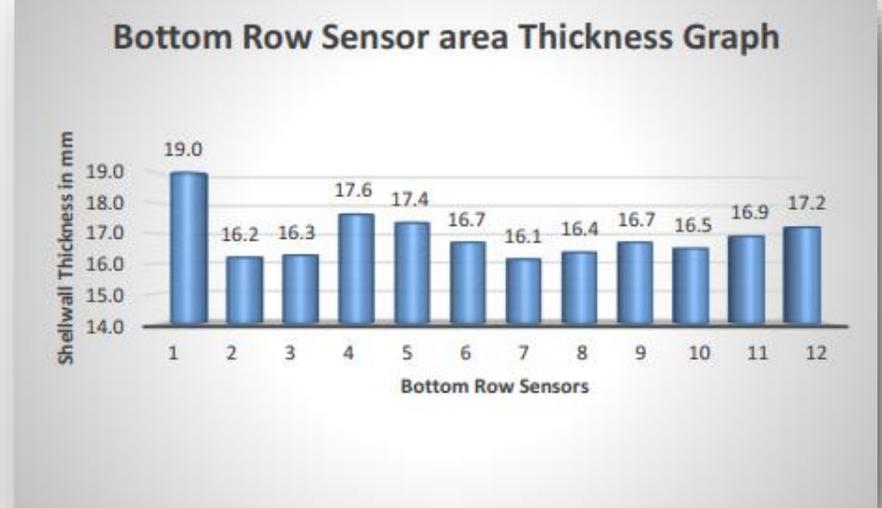
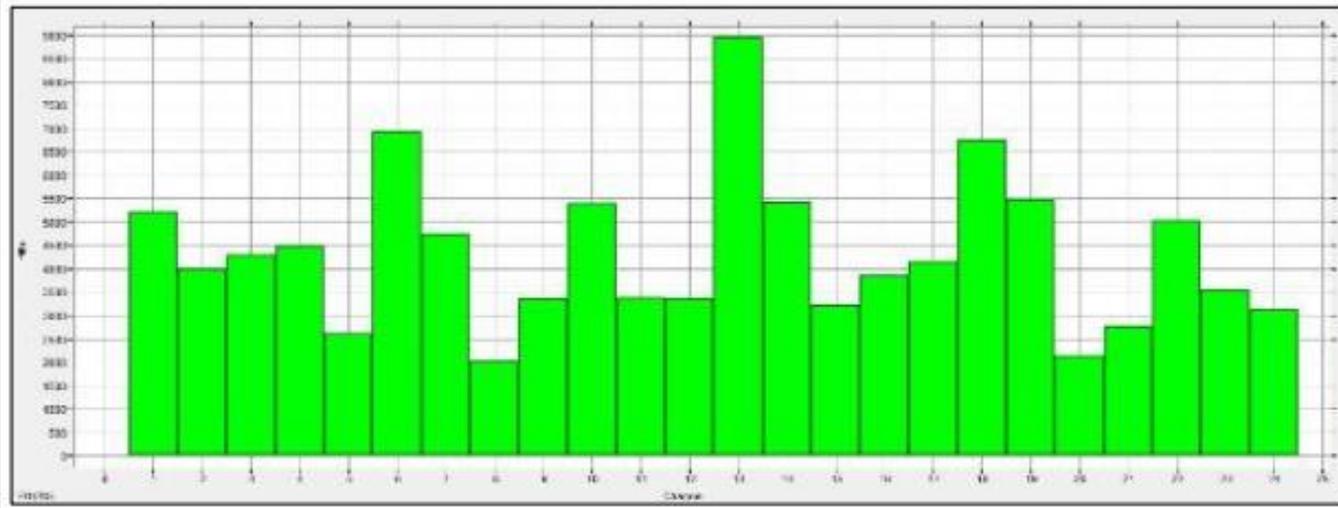
Grade for assessing tank condition on the basis of acoustic emission tests

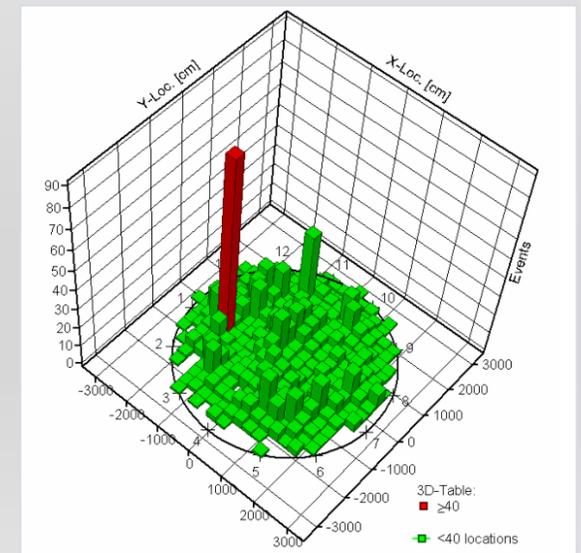
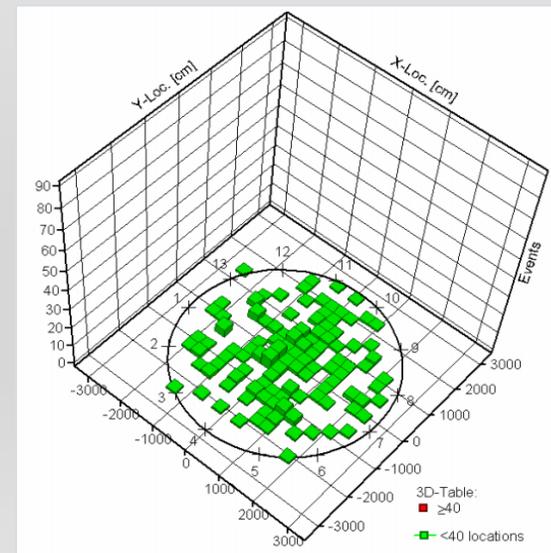
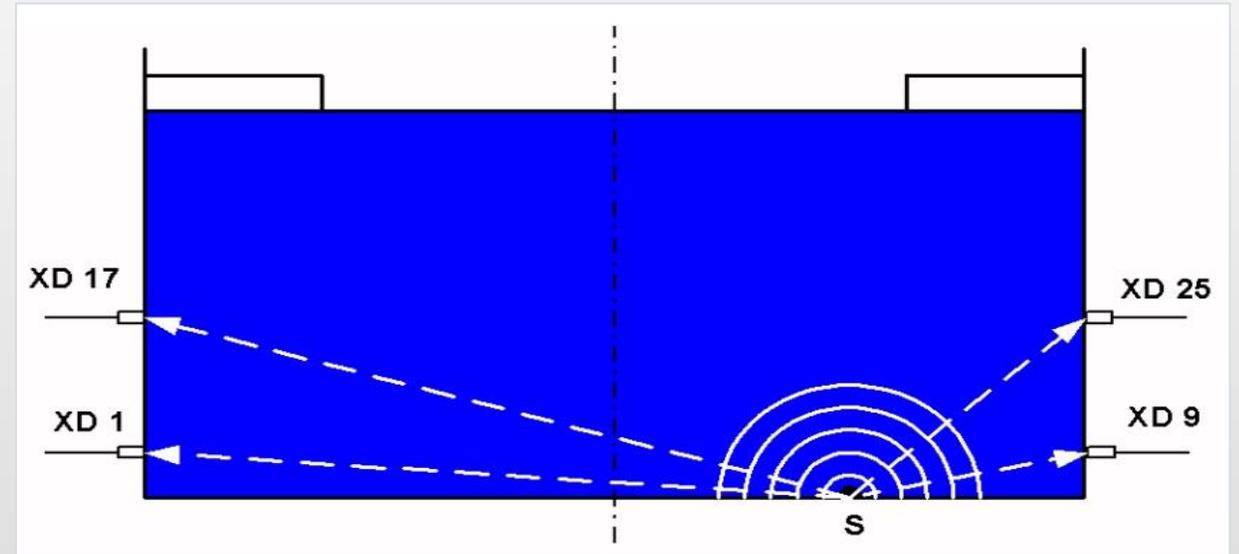
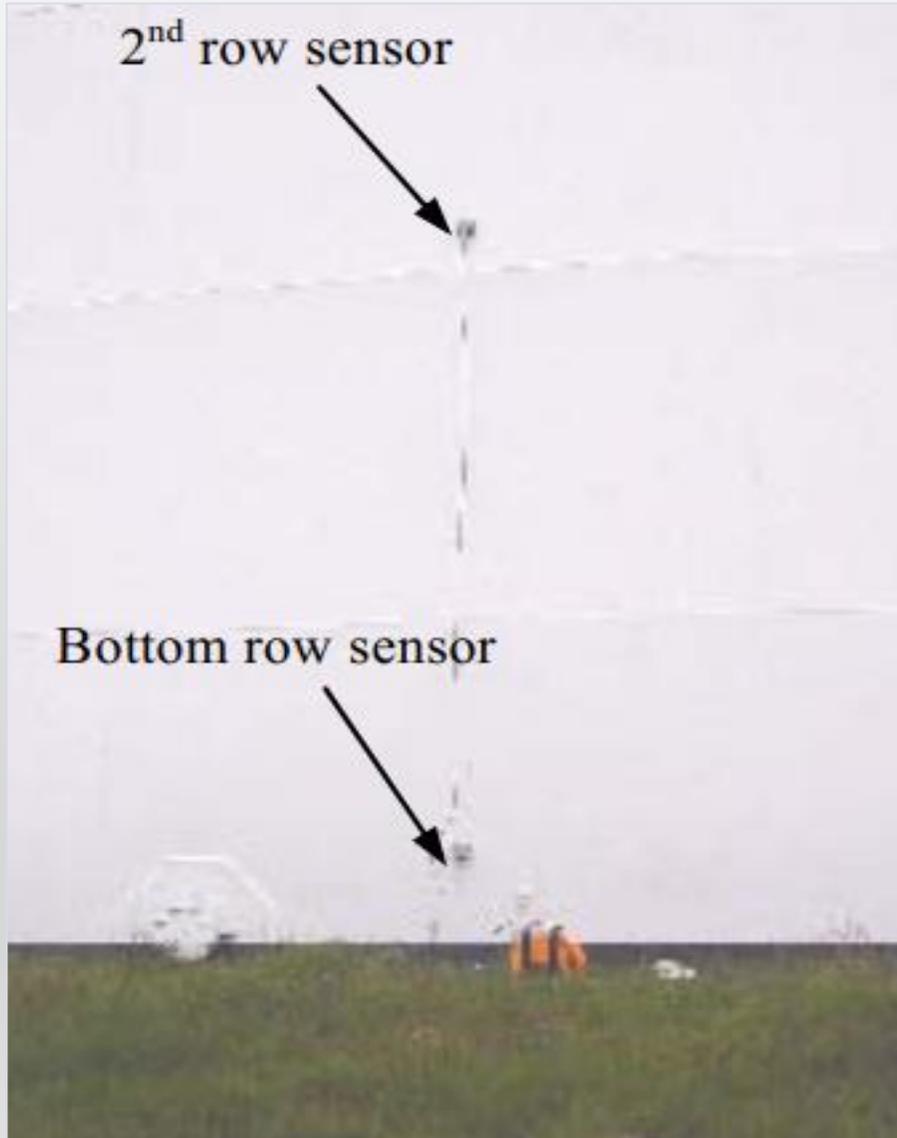
Grade	Description	Recommendation
A	Very Minor	No Maintenance in necessary
B	Minor	No Maintenance in necessary
C	Intermediate	Some Maintenance is need
D	Active	Give priority in Maintenance schedule
E	Highly Active	Give Highest priority in Maintenance Schedule.

To quantify the overall and potential leak activity, the procedure uses the following Activity Guideline:

"N" – Ash	Insignificant emissions	No Further Action
"A" -Green	Very Minor Source	No Further Action
"B"	Blue Minor Source	Visual External (possible Corrosion)
"C"	Ash Green	Further Evaluation/possible NDT
"D"	Active Source	Follow-up NDT
"E" -Red	Intense Source	Immediate Follow-up NDT









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ADVANCED NDT SOLUTIONS

AUTOMATED ULTRASONIC TESTING AUT



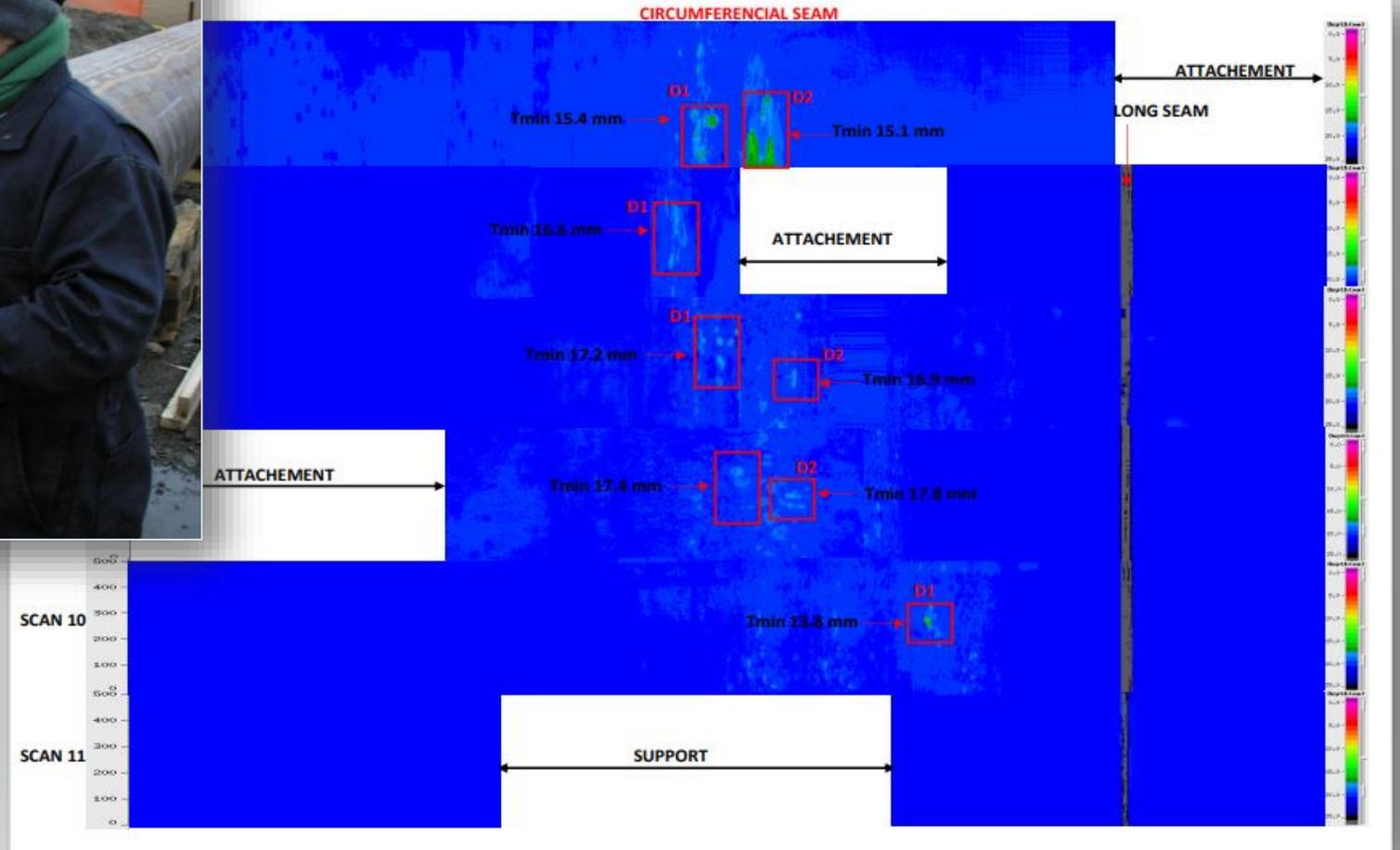
Automated corrosion mapping system is designed to provide a complete corrosion assessment and imaging solution for the detection and monitoring of corrosion.

C-scan mapping, along with cross section B-scans, provide a visual profile of the inside diameter and/or outside diameter inspection surface. The software has a number of display features, including the ability to calculate and display a remaining wall C-scan by subtracting the depth of an area of corrosion from the nominal wall thickness.

Productivity up to 20 m² per shift

Benefits of AUT inspections include:

- Optimization of inspection spend
- Reliable, repeatable, and accurate results
- No need scaffolding or lifting
- Minimal costly internal entry
- Minimal unnecessary repairs
- Reduced downtime
- Potentially reduced outage/turnaround schedules
- Online inspection data for advanced planning
- Support for RBI, FFS, and remaining life programs





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ADVANCED NDT SOLUTIONS

RAPID MOTION SCANNER RMS FOR SHELL PLATES



High Speed, Remote Access C-Scan Defect

Detection and Corrosion Mapping System

- > Remote Access Corrosion Mapping System
- > Very High Productivity 17M²/ 8Hr Shift
- > Very High Accuracy Scanning
- > Data Analysis And Reporting

The B-scan amplitude view shows the B-scan profile in both X and Y dimensions at a selected point of the C-scan. Using the B-scan amplitude view, the operator can easily identify any defects or inclusions.

SCANNING HEADS

The **RMS2-600** scanning head is designed to maximise scanning rates on large surface areas such as tank shells, pressure vessels and other structures.

The **RMS2-450** scanning head is designed for operating circumferentially on curved surfaces such as pipelines or pressure vessels from 152 mm (6 inches) up to flat plate.

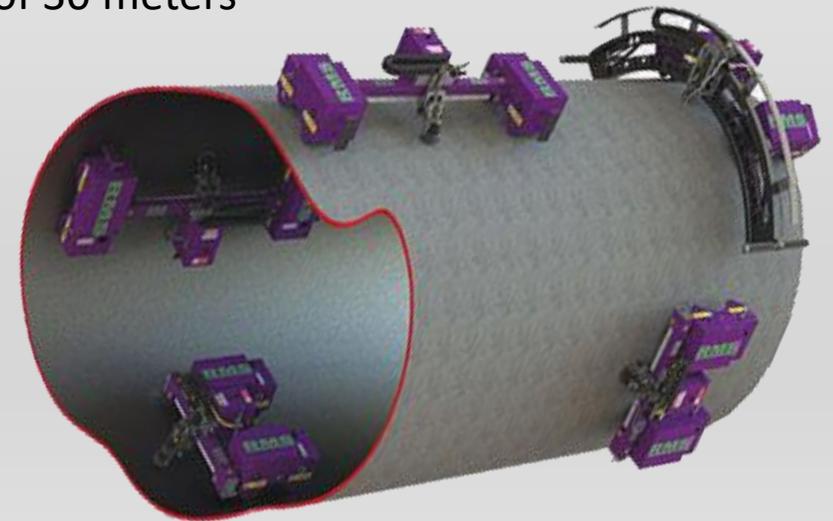
The **RMS2-300** scanning head is designed as a general purpose scanner for inspecting areas with limited access, vessel heads or other applications where smaller scan widths are required.

BENEFITS

- > Real-time A-scan and C-scan display
- > Detect top, below and far surface mechanical defects
- > Scanner controlled with either a joystick or on screen controls
- > High probability of detection with up to 0.5 mm scan grid
- > Wide range of applications up to 200°C
- > Inspect material thickness up to 280 mm
- > 3D data view for internal/external profile
- > Can be used on any ferrous item from 6" OD to flat plate
- > Up to 50 metre long x 1 m wide scan feasible in one scan session
- > Field proven durability, reliability and accuracy
- > Reduce maintenance costs by minimising use of scaffolding
- > No paint removal required

> Power requirements 100 to 240 VAC - 50-60Hz.

> Water source: the pump is capable of delivering 5.7 liters per minute at a height of 30 meters





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RAPID MOTION SCANNER RMS FOR SHELL PLATES





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ROBOTIC TANK INSPECTION

On-Stream Tank Inspection System OTIS



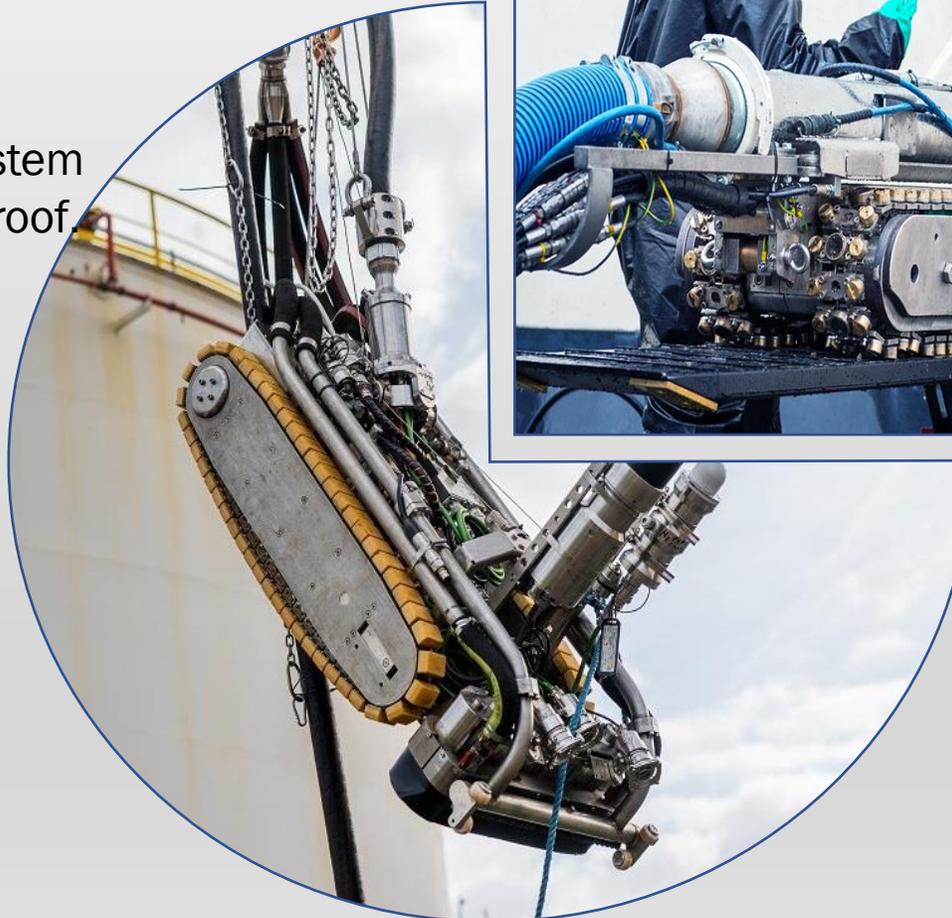
High technology tool to determine tank bottom condition without taking the tank out of service.

Inspection according to API 653 standards

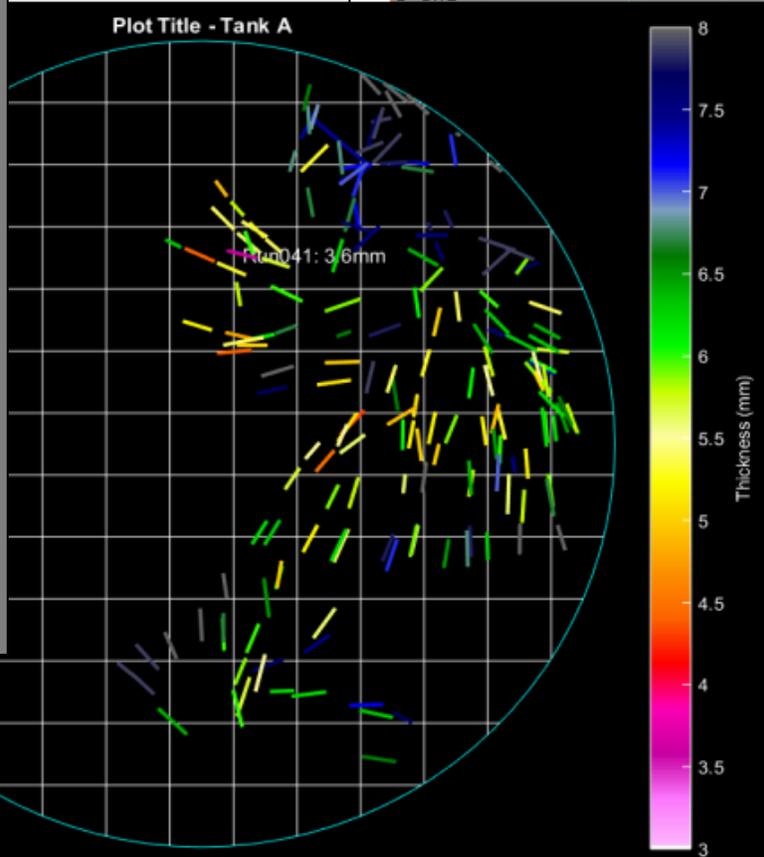
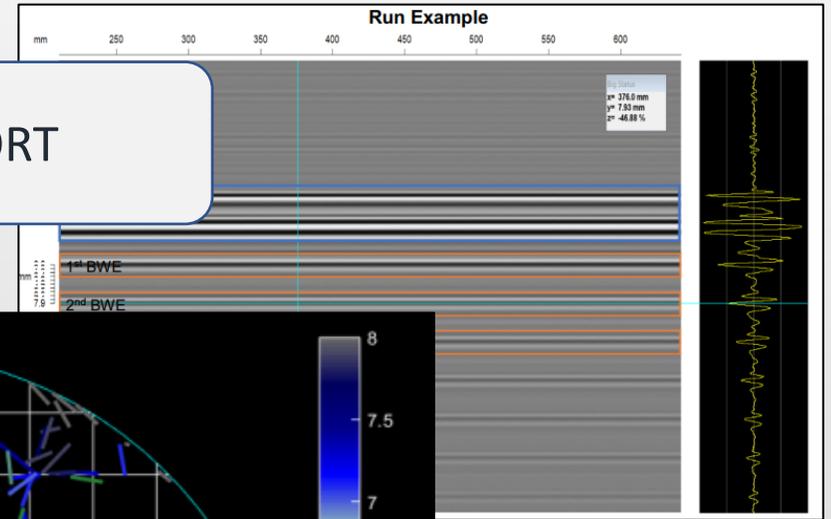
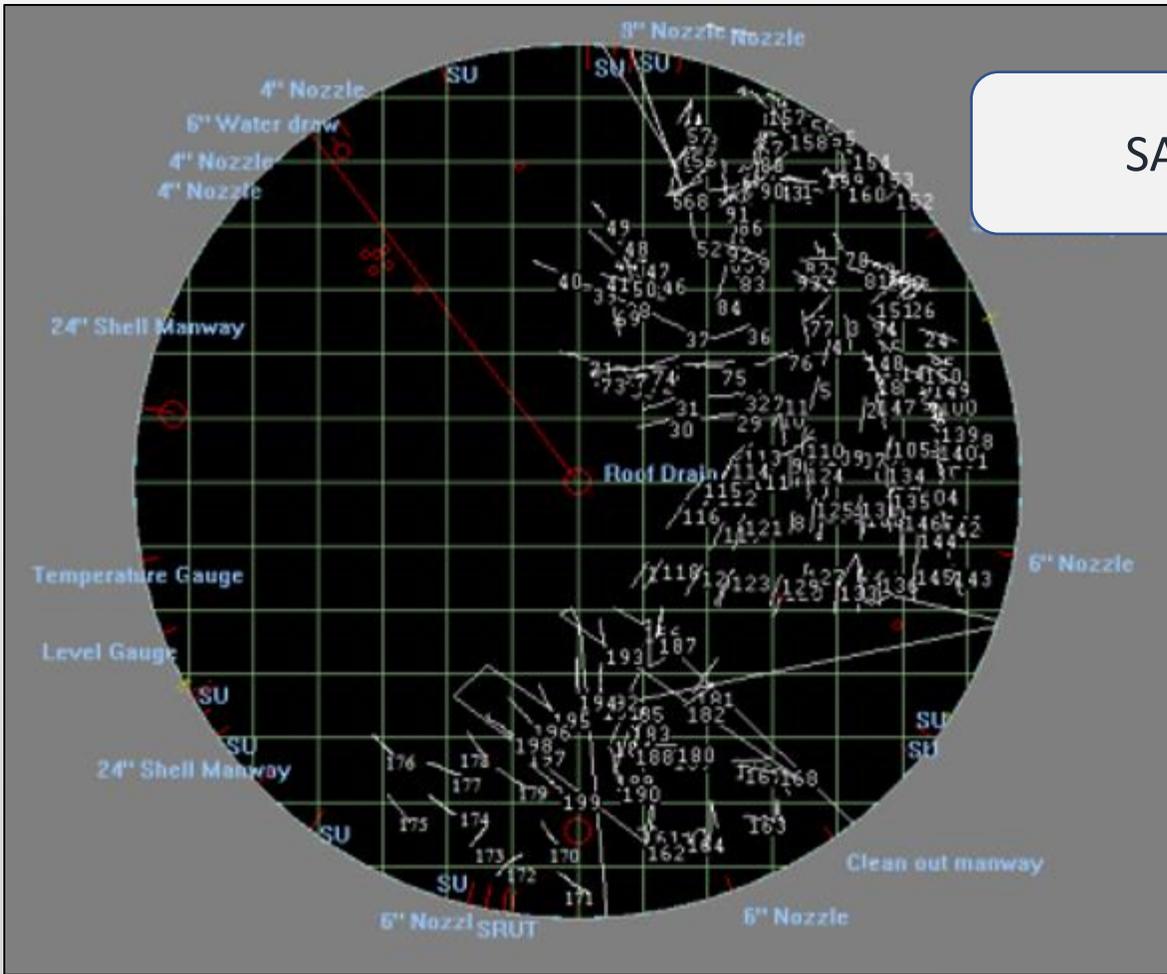
Included: Quick-Look™, a video-camera- system which is performing a visual inspection of tank roof.

BENEFITS

- No tank downtime, production loss
- No material transfer cost effective
- No alternate storage needed
- Speed
- Detailed information on bottom condition
- Reduced safety & environment risks
- Not affected by coating (incl. fiberglass)



SAMPLE OF REPORT



7.19% of the tank floor has been covered

A total of 200 Ultrasonic Runs were collected on the tank floor consisting of eight 0 Degree UT transducers at a length of 1000mm per run



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On-Stream Tank Inspection System OTIS



OTIS



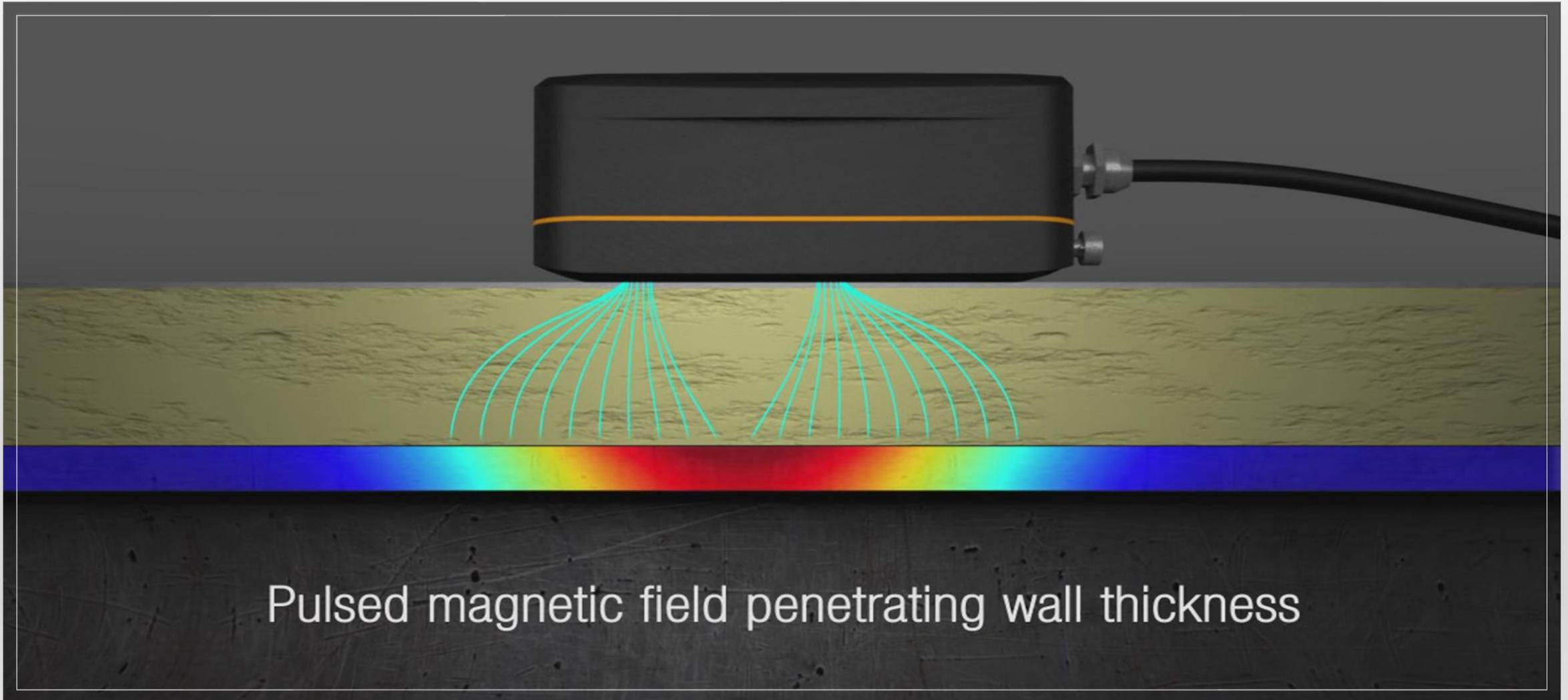
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CORROSION UNDER INSULATION CUI (PECT TECHNIQUE)

PULSED EDDY CURRENT IS USING :

- Detecting (CUI)
- An electromagnetic technique
- detect general wall loss through insulation by measuring the average wall thickness over a footprint area.
- The footprint area is approximately a disk with a diameter equal to the effective lift-off
- Not for insulated pitting, cracks or preferential weld corrosion



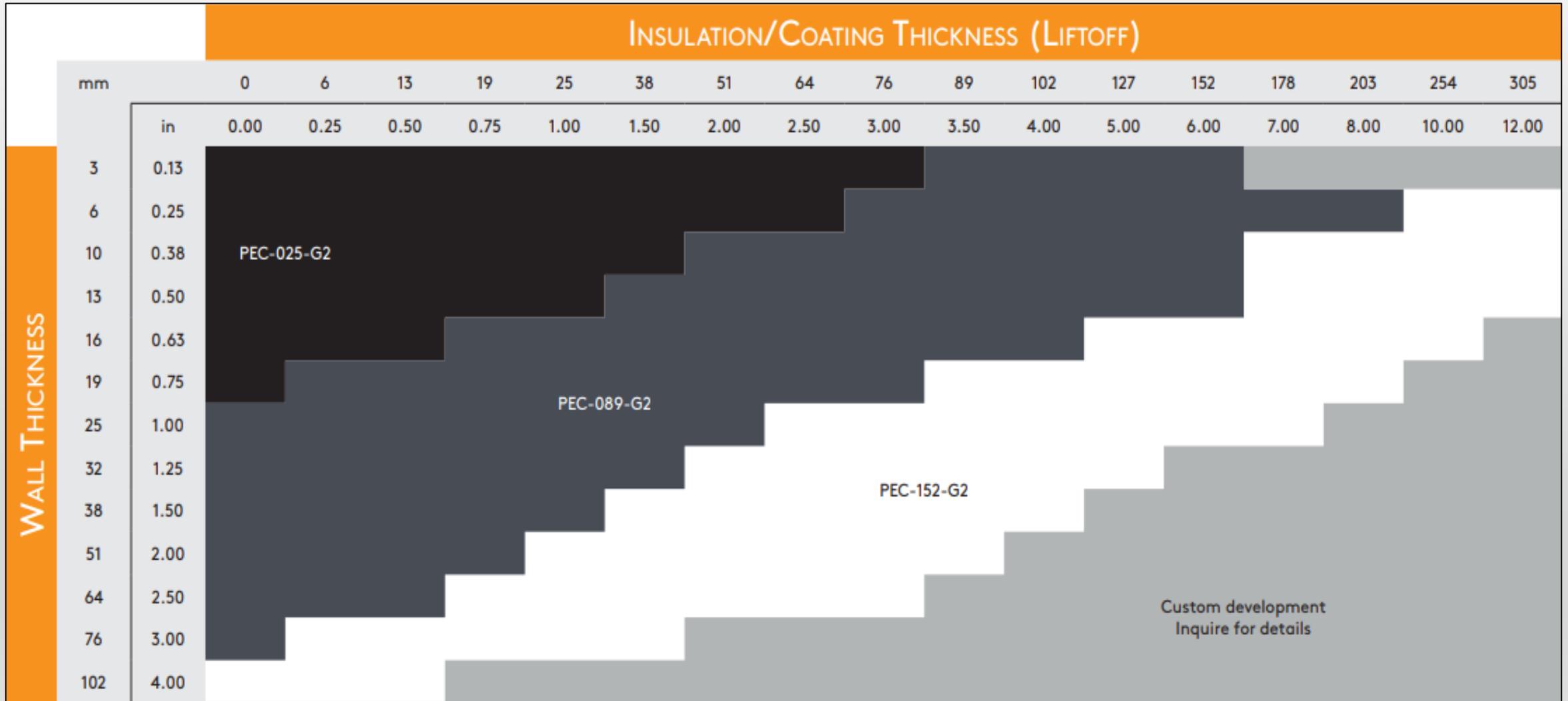


Pulsed magnetic field penetrating wall thickness



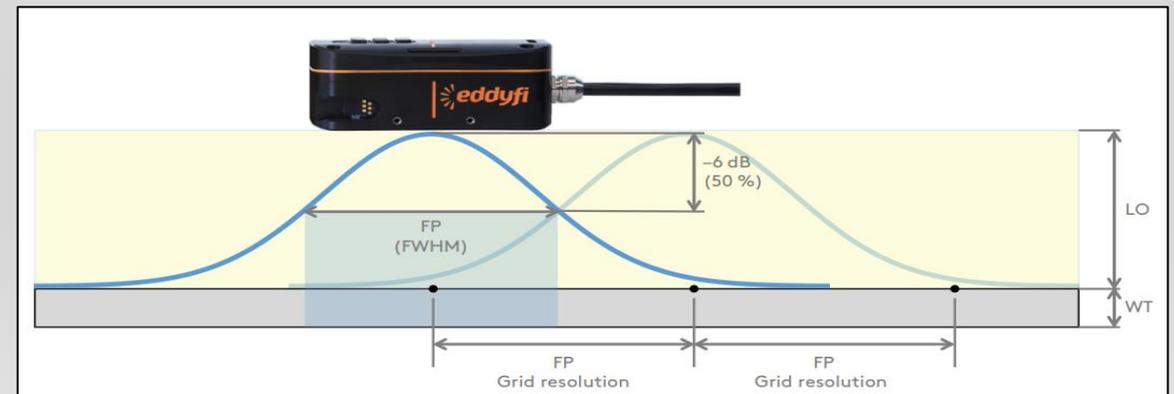
PERFORMANCE

- Nominal wall thickness Up to 100mm (4 in)
- Insulation (liftoff) 0–305mm (0–12in)
- Pipe diameter Down to 25mm (1 in)
- Testing temperatures
 - Carbon steel structures: –150 to +500 °
 - Weather jackets: maximum 70 °C
- Weather jackets
- Probe cable 5m, extendable to 100m (328 ft)

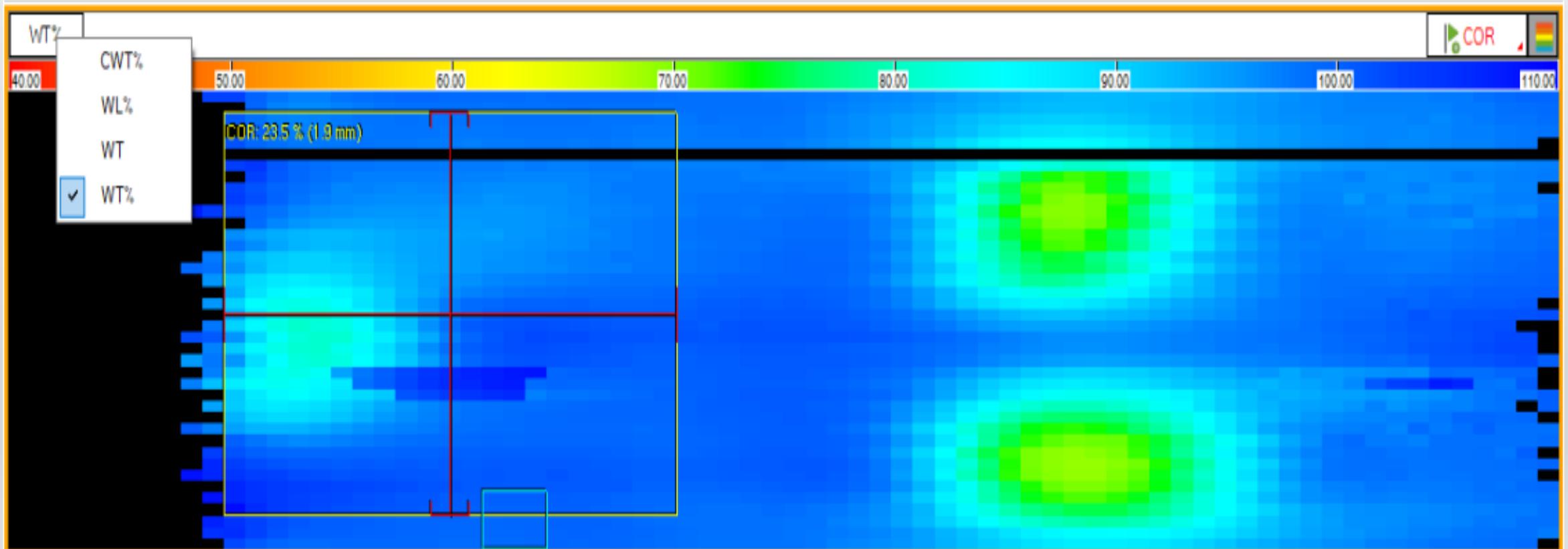


CALCULATING THE PEC PROBE FOOTPRINT

		INSULATION/COATING THICKNESS (LIFTOFF)																	
		mm	0	6	13	19	25	38	51	64	76	89	102	127	152	178	203	254	305
		in	0.00	0.25	0.50	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	5.00	6.00	7.00	8.00	10.00	12.00
FOOTPRINT	PEC-025-G2 PEC-UW-025-G2	mm	35	39	43	47	52	60	68	76	85	-	-	-	-	-	-	-	-
		in	1.38	1.54	1.70	1.87	2.03	2.36	2.68	3.00	3.35	-	-	-	-	-	-	-	-
	PEC-089-G2 PEC-SZ-89-G2 PEC-UW-089-G2	mm	62	66	70	74	79	87	95	103	112	120	128	145	161	178	194	-	-
		in	2.44	2.60	2.77	2.93	3.09	3.42	3.74	4.07	4.39	4.72	5.04	5.69	6.34	7.00	7.64	-	-
	PEC-GS-089-G2	mm	-	-	70	74	79	87	95	103	112	120	128	145	161	178	194	-	-
		in	-	-	2.77	2.93	3.09	3.42	3.74	4.07	4.39	4.72	5.04	5.69	6.34	7.00	7.64	-	-
	PEC-152-G2 PEC-UW-152-G2	mm	100	104	108	112	117	125	133	141	150	158	166	183	199	216	232	265	298
		in	3.94	4.10	4.26	4.41	4.59	4.91	5.24	5.56	5.89	6.21	6.54	7.19	7.84	8.49	9.14	10.43	11.73



- WT%: remaining wall thickness in % relative to the nominal wall thickness
- WT: remaining wall thickness in absolute units
- WL%: wall loss in % relative to the nominal wall thickness
- CWT% (Lyft Pro): compensated remaining wall thickness in % relative to the nominal wall thickness





40.0	43.7	47.4	51.1	54.7	58.4	62.1	65.8	69.5	73.2	76.8	80.5	84.2	87.9	91.6	95.3	98.9	102.6	106.3		
100.6	101.6	103.0	104.8	Non Accessible Area	Non Accessible Area	104.1	102.3	100.4	98.7	96.2	93.1	96.9	98.7							
99.3	98.8	101.4	103.7			102.7	99.9	97.4	96.1	95.6	91.0	93.8	94.8							
95.7	95.2	98.7	97.2			98.2	97.2	96.5	95.6	95.0	90.5	90.4	88.4							
99.6	93.9	94.1	96.8			93.3	98.0	96.6	95.1	94.2	90.3	87.8	84.4							
				Non Accessible Area	Non Accessible Area	97.2	96.9	96.9	95.4	95.1	90.3	88.3	84.9							
						96.9	97.9	97.0	94.7	94.1	90.3	88.6	83.0							
						95.2	98.4	97.3	96.2	93.9	89.8	88.8	81.0							
95.3	99.9	99.8	94.3			94.8	96.6	96.9	95.3	92.5	91.4	89.9	86.2							
100.0	98.2	98.6	92.6			98.5	97.1	95.9	93.3	92.7	90.5	92.2	91.4							
98.7	99.9	102.0	100.3			101.6	99.4	94.8	93.3	94.8	92.4	97.2	97.0							



SA INTERNATIONAL Ltd
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LONG RANGE ULTRASONIC TESTING LRUT



- The aim of the inspection is to test long lengths of pipe rapidly from a single test point with 100% coverage of the pipe wall and to identify areas of corrosion or erosion.
- The technique is equally sensitive to metal loss on both the outside and inside surfaces of the pipe.
- The system is entirely computer controlled, data acquisition and display/analysis being performed using a personal computer.
- Long-Range ultrasonic Non-Destructive Testing Technology was developed for detecting corrosion and metal loss in pipe work.
- Its initial application was for detecting corrosion under insulation in inspection situations where pipes are not accessible, for example where they are buried, encased in a sleeve or elevated above the ground.

BENEFITS:

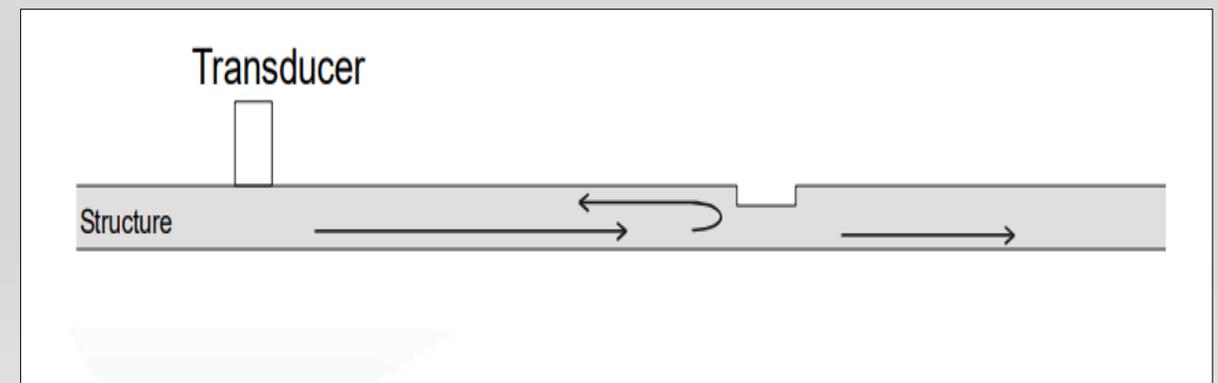
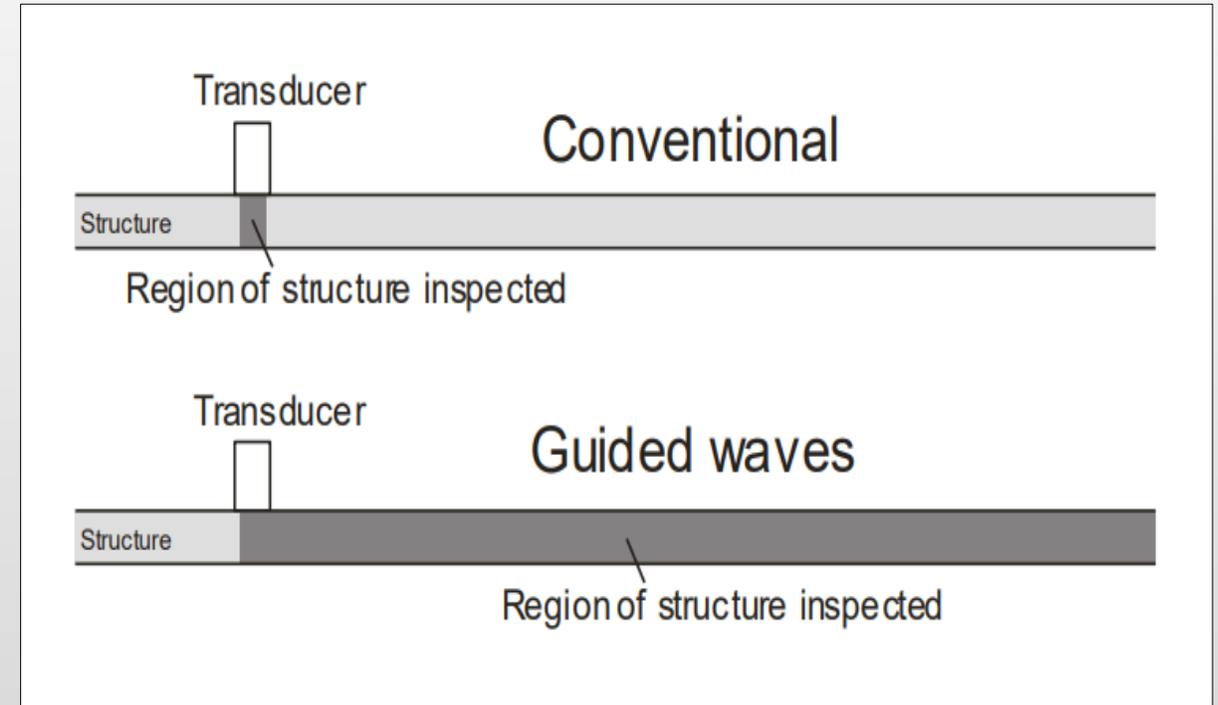
- Testing when the pipes In-service
- No need to remove insulation only under collar and no need to remove costing under collar
- Low cost screening with 100% coverage
- Focusing capability to evaluate corrosion distribution around pipe circumference
- Typical test range 60m from single location, ideal conditions can achieve 200m or more
- Testing of pipes from 2" up to 48" diameter
- Reliable detection of 9% metal loss flaws
- The guided waves travel long distances, even in submerged or insulated pipes



- At every change in cross section there is a reflection of the guided waves
- Amplitude depends on cross sectional area change

Changes In Cross-Sectional Area:

- Method is equally sensitive to defects internally or externally positioned.
- Method is sensitive to increase or decrease in cross section, thus detecting welds and flanges
- Reflections from welds and flanges are used as reference points for defect sizing
- Amplitude of reflection is scaled with distance.





PIPE TYPES

- Seamless
- Longitudinally and spiral welded

PIPE MATERIALS

- Ferritic, stainless steel and other materials

PIPE SITUATIONS

- Buried
- Air-to soil interface
- Air-to water interface
- Elevated on racks
- Sleeved in road crossings
- Wall, bund or berm penetrations

FLAWS FOUND

- External corrosion
- Corrosion under insulation (CUI)
- Internal corrosion or erosion
- Environmental cracking

PIPE COATINGS

- Foam or mineral wool
- PVC, epoxy, coal tar epoxy
- Paint
- Bitumastic wrapping

PIPE DUTIES

- Transmission and distribution lines
- Refinery and chemical plants
- Offshore risers
- Jetty lines
- Tank farm link lines
- Power plant service pipes
- Storage sphere support legs
- Headers

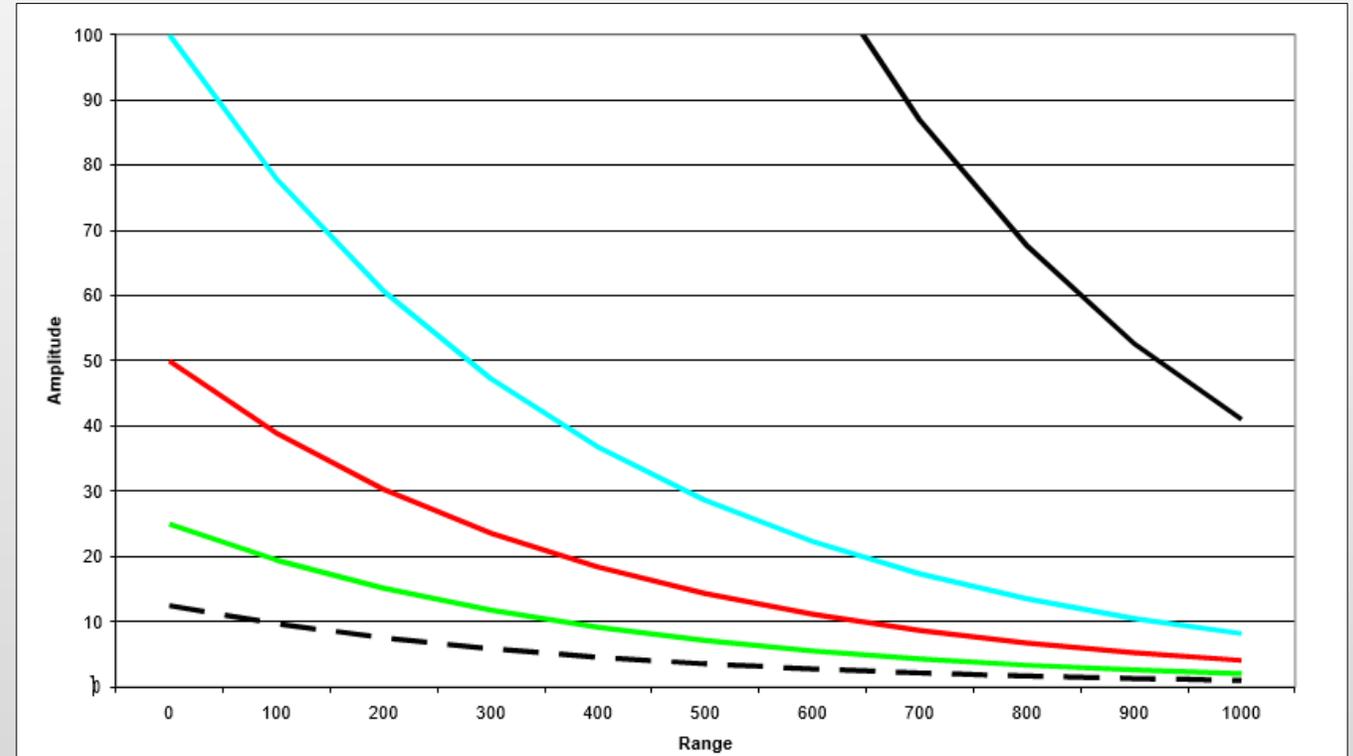
EVALUATION METHOD

Representation of the DAC curves

Category 1 responses are those which are lower than the green -26dB line.

Category 2 responses are those above the -26dB line, but are lower than the red line at -20dB.

Category 3 responses exceed the red -20dB line.



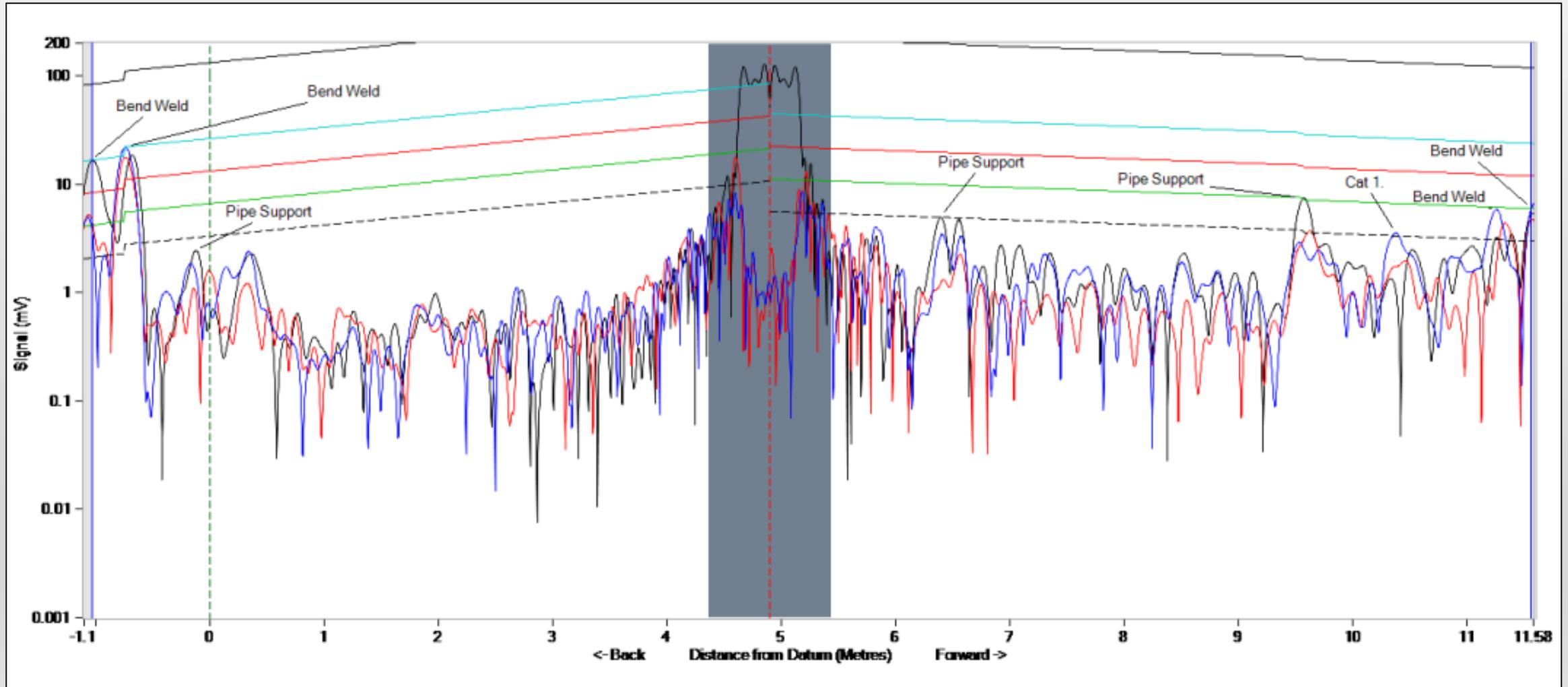
- Weld line,
- -14dB Category 3 line
- -20dB Category 2 line
- - - - - -26dB Noise line
- -32dB 100% reflector, 0dB



EVALUATION METHOD

Amplitude	Directionality	Score	Follow up priority
3	3	9	High
3	2	6	High
3	1	3	High
3	0	0	Weld
2	3	6	High
2	2	4	High
2	1	2	Medium
1	3	3	High
1	2	2	Medium
1	1	1	Low

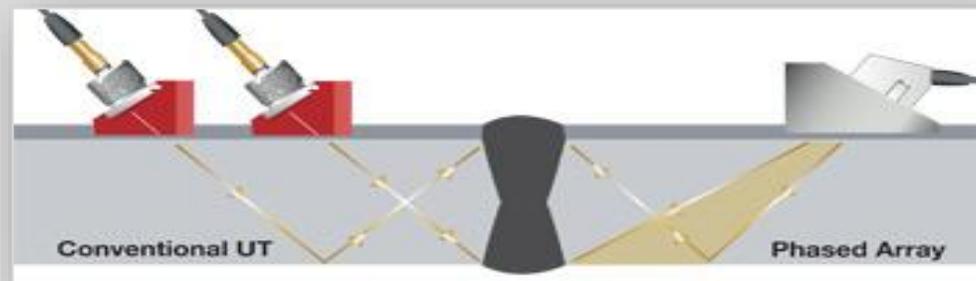
EVALUATION METHOD





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PHASED ARRAY ULTRASONIC TESTING PAUT FOR WELDING JOINTS

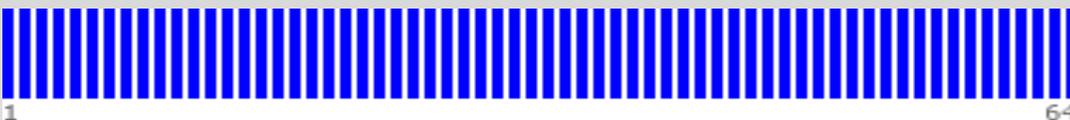
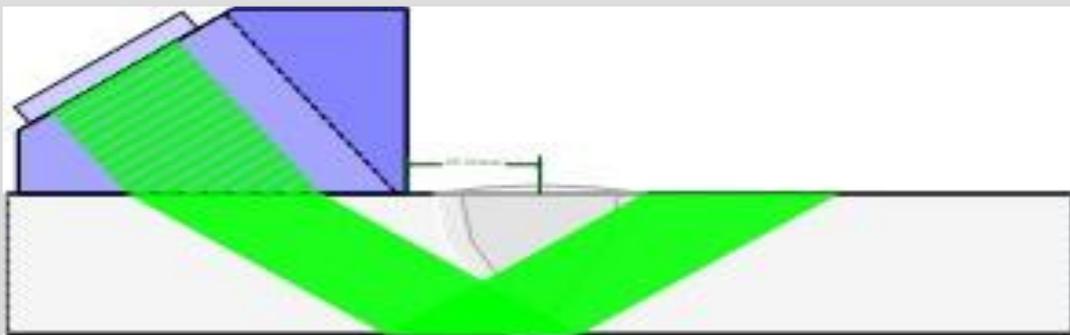
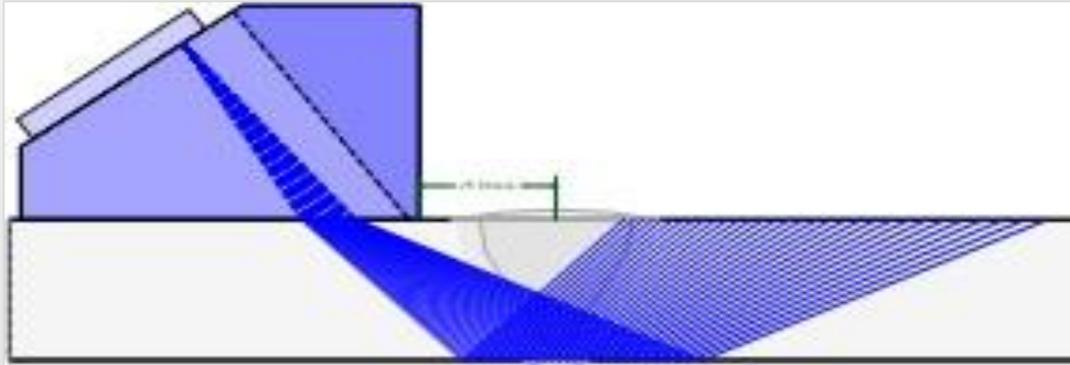


INTRODUCTION:

The ultrasonic technique can be widely used in different sectors to determine component quality and to detect failures like flaws or cracks.

Phased Array can also be effectively used for thickness measurements in conjunction with Corrosion testing.

The combined use of many angles and focus depths during the inspection through one probe guarantees the efficiency of the tool, as several different inspections can be conducted without the need for changing the transducer assembly.



BENEFITS OF PHASED ARRAY:

- Simplified inspection of components that have complex geometry.
- Inspection of many different materials possible.
- High temperature inspections possible up to over 350°C.
- Speedy inspection compared to conventional ultrasonic testing.
- Higher probability of problem detection and testing from multiple angles with a single probe.
- All inspection data presented in an understandable graphic format.

PAUT FLAW CHARACTERIZATION-EXAMPLE

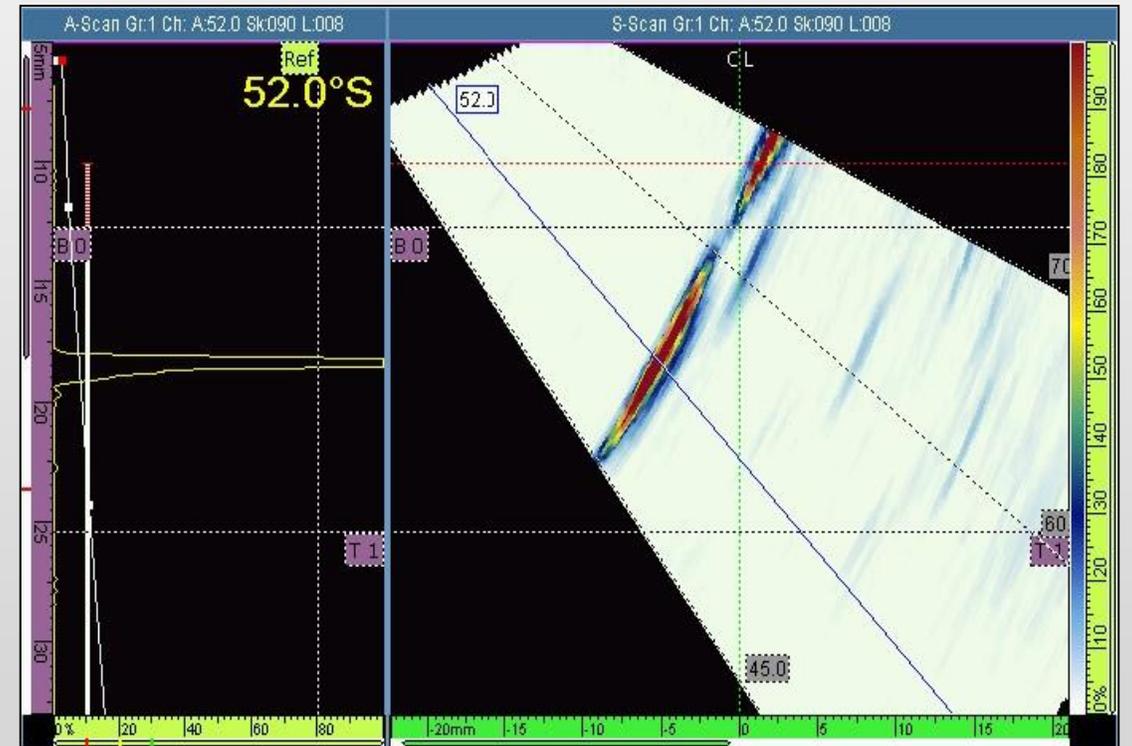
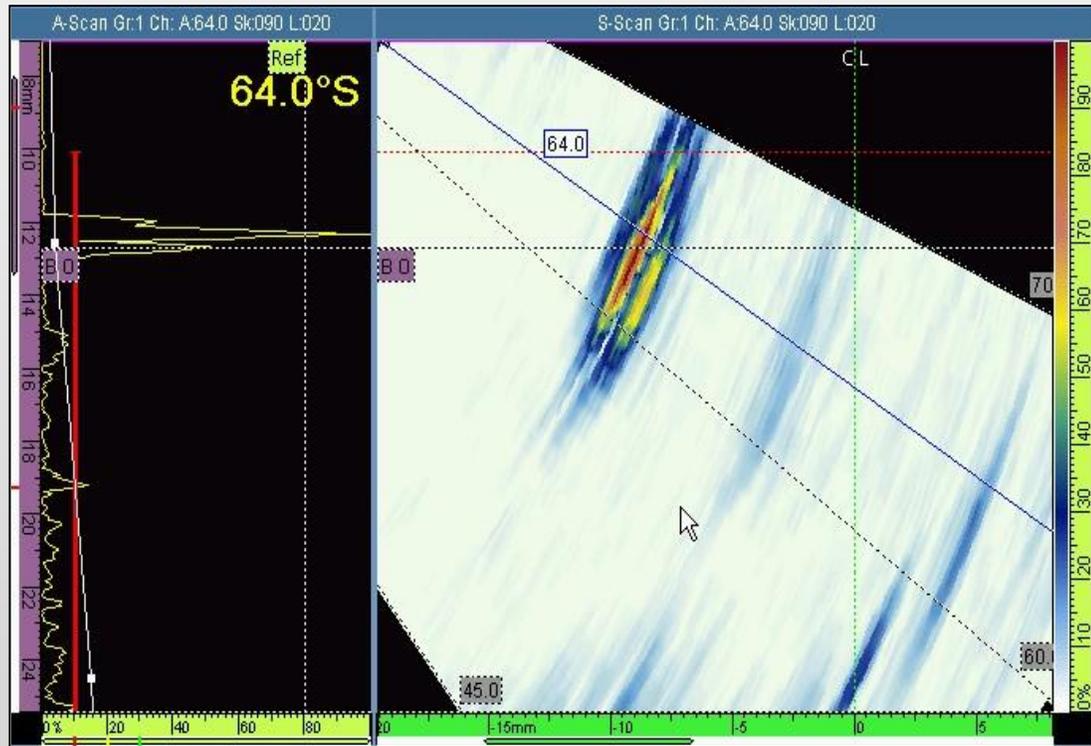


Figure-1,scan characterization of ID connected crack

Figure-2, scan characterization of lack of side wall fusion



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TIME OF FLIGHT DIFFRACTION (TOFD)



Time of flight diffraction (TOFD) is one of the ultrasonic methods used for volumetric inspection of welds. Due to its accurate sizing ability, it is widely applied for pipeline Automated Ultrasonic Testing (AUT) as well as for pressure vessels.

Advantages:

TOFD defect detection does not depend on the defect orientation, in contrast to the pulse echo technique .

In contrast to the radiography method, planar defects and cracks, which are not perpendicular to the measured surface can be detected .

Defect height can be exactly determined.

Higher POD improves risk reduction and calculation.

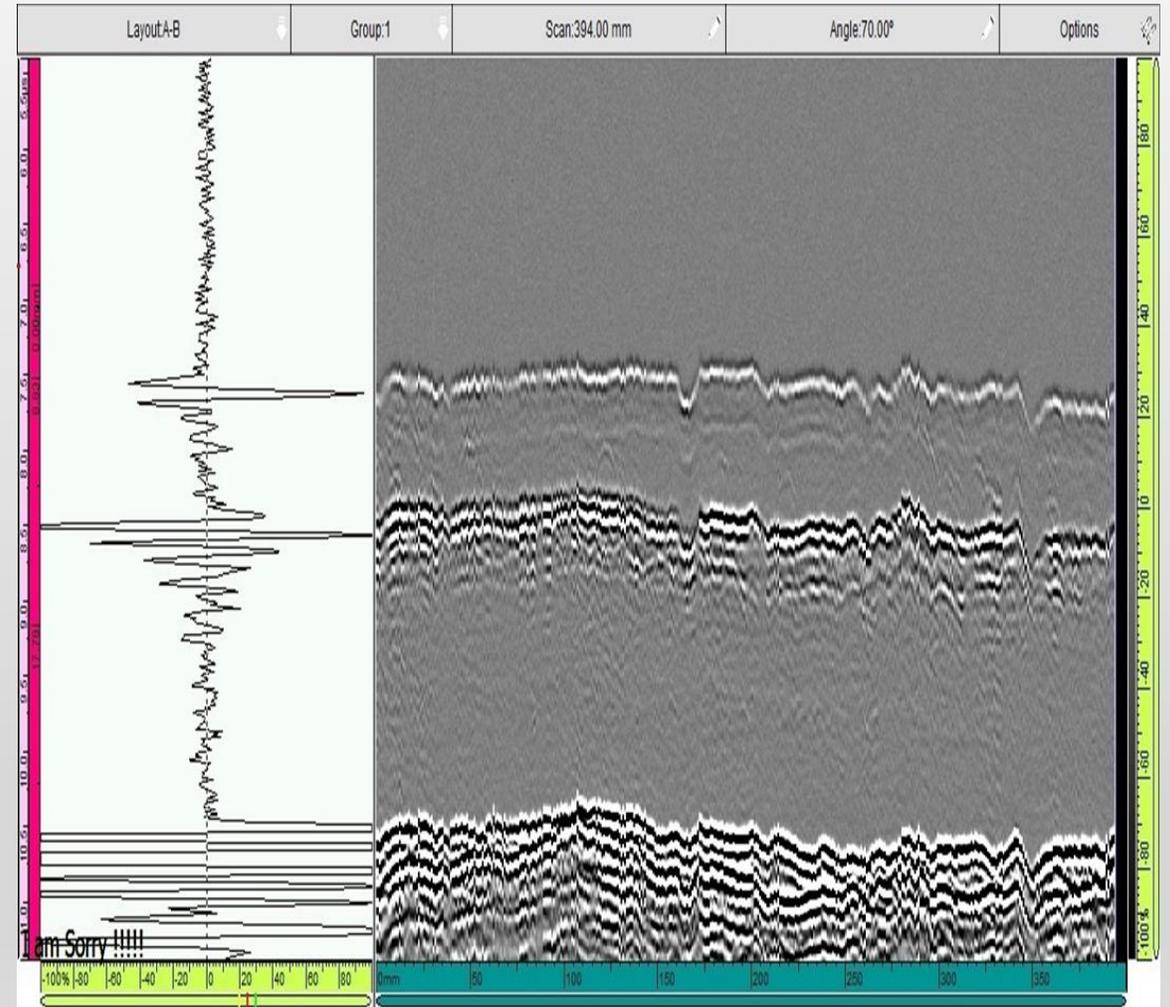
The evacuation of areas because of radiation is not necessary.

The inspection results are immediately available as is a permanent record and a permanent print.

Because of the high test speed the costs are less than those for radiography testing.



TIME OF FLIGHT DIFFRACTION (TOFD)





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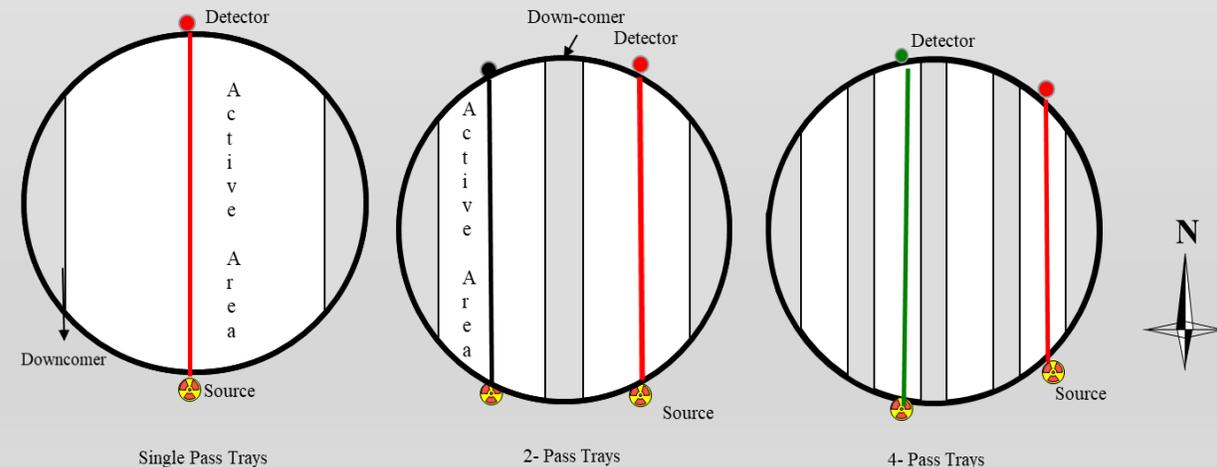
GAMMA SCANNING FOR TOWERS AND COLUMNS, PIPE BLOCKSGE

Process Diagnostic by using Gamma Scanning Techniques

The gamma scanning is a process diagnostic technique utilized to check the mechanical integrity of internals of a distillation column and to determine the process performance of these internals by diagnosis of any process related issues inside the column as well as this technique can also be serviced to determine for level or deposition measurements in separators, exchangers, or knockout drums.

Types of Scanning Techniques

- Tower Scan (Trayed Column)
- Grid Scan (Packed Column)
- Pipe Scanning

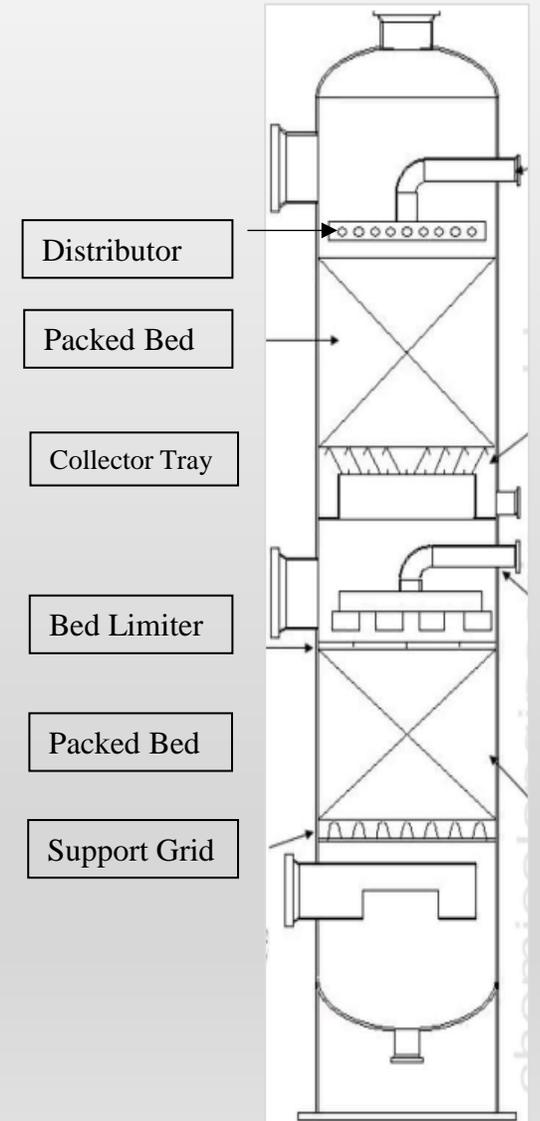
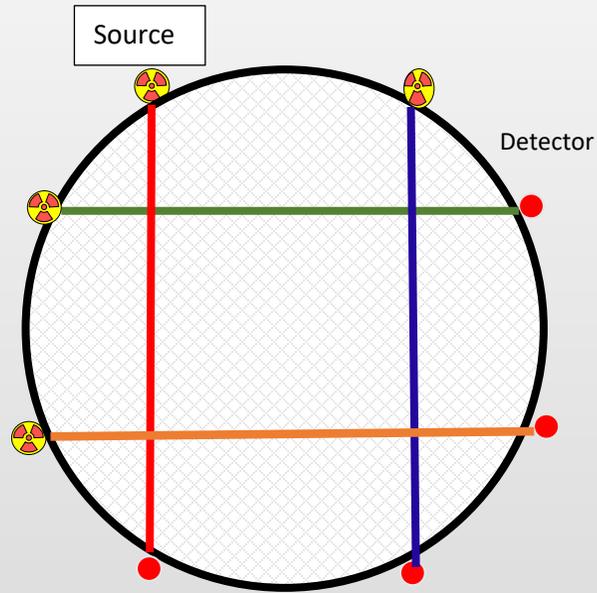
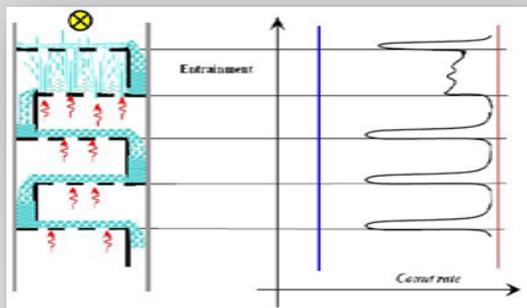
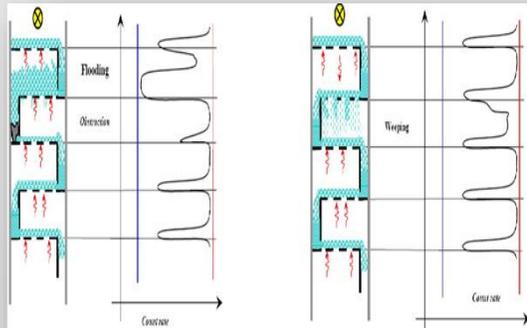
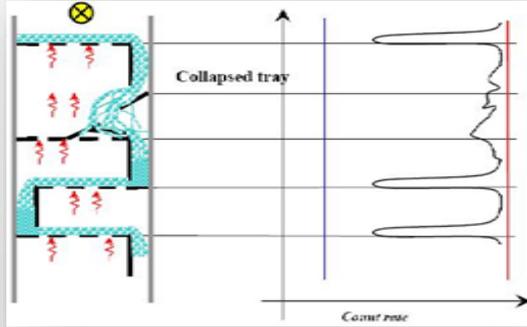




It helps plant engineers to pin-point and diagnose any mechanical integrity related issues with internals and its performance by checking other process related anomalies in a column;

- To determine any liquid being carried overhead or damage to demister pad
- To check damaged, buckled or displaced trays
- To determine any missing man-way panels or tray supports
- To diagnose any process related issues; flooding, severe entrainment/jet flooding or puking, characteristic of foaming, weeping/dumping, blockages in down-comers, and fouling above active areas
- To determine tray capacity by measuring the froth heights above the active areas and liquid levels in down-comers
- To measure the liquid levels on the chimney/collector trays
- To locate the bottoms liquid level at the bottom of the column

Grid Scan (Packed Column)





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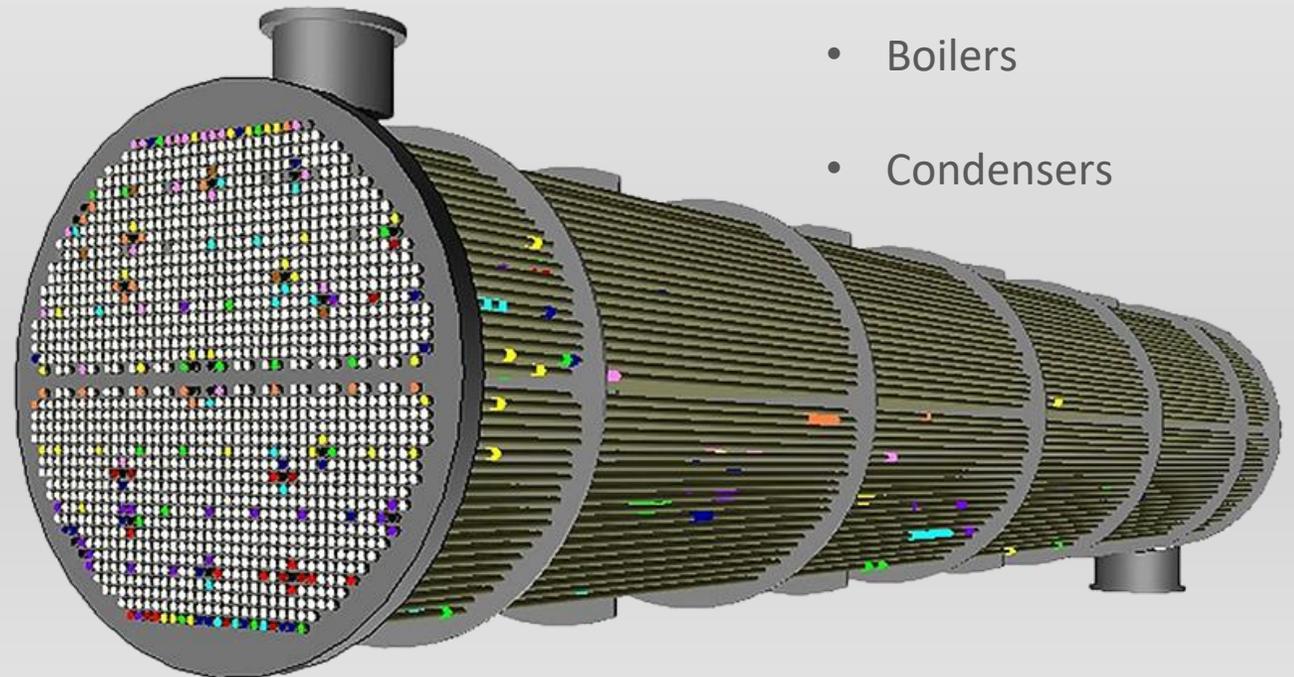
TUBE INSPECTION

AVAILABLE TECHNIQUES:

- Remote Field Technology (RFT)
- Near Field Testing/Near Field Array
(NFT/NFA)
- Magnetic Flux Leakage (MFL)
- Eddy Current Testing/Eddy Current Array
(ECT/ECA)
- Internal Rotary Inspection System (IRIS)

APPLICATION ;

- Heat Exchanger
- Air Coolers
- Heaters
- Boilers
- Condensers





Technique/Probe Selection

Depends On:

Tube Material
Type

Equipment
Configuration

Expected Damage
Mechanism

Proper Damage
Locations

Tube ID and
Thickness

Data Required :

Tube Material
Type

Tube Outer / Inner
Dia.

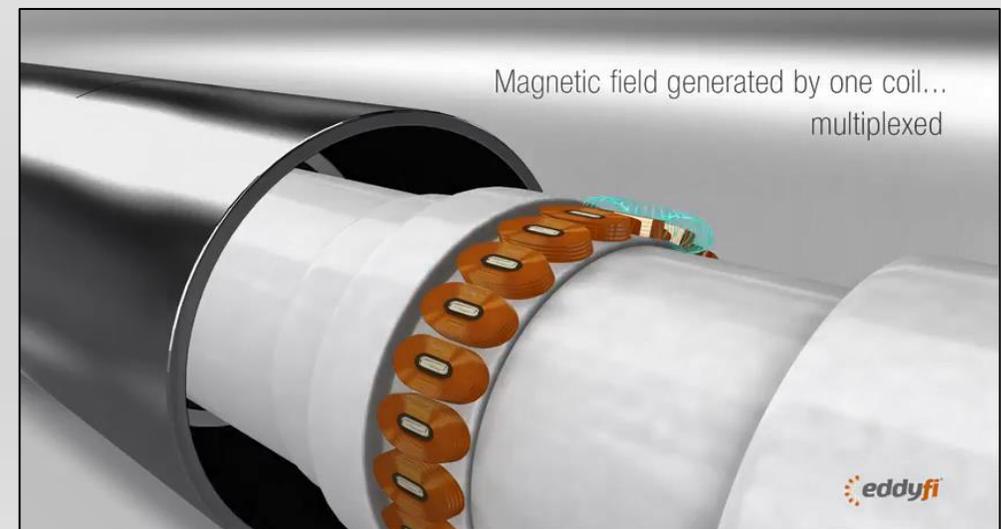
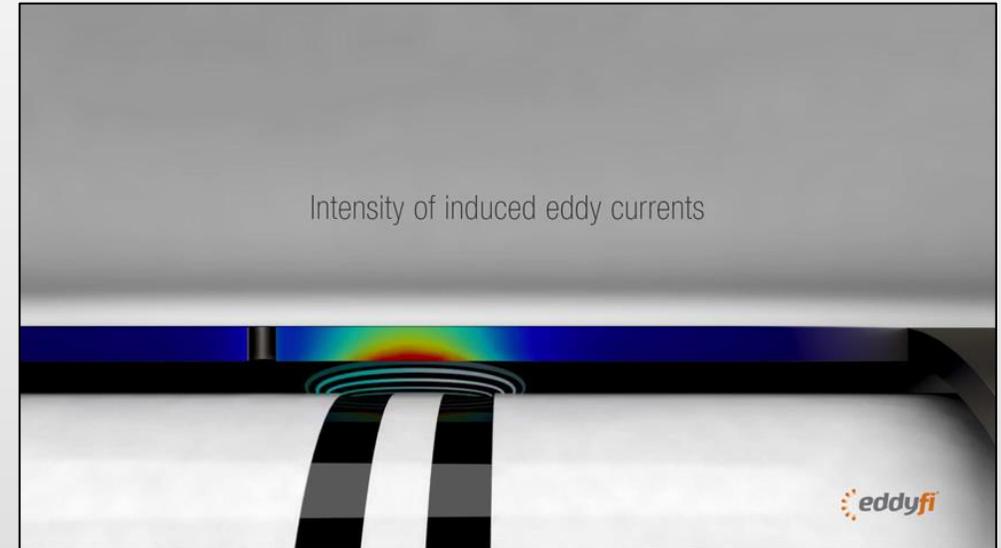
Tube Wall
Thickness

Tube Length

Number of Tubes

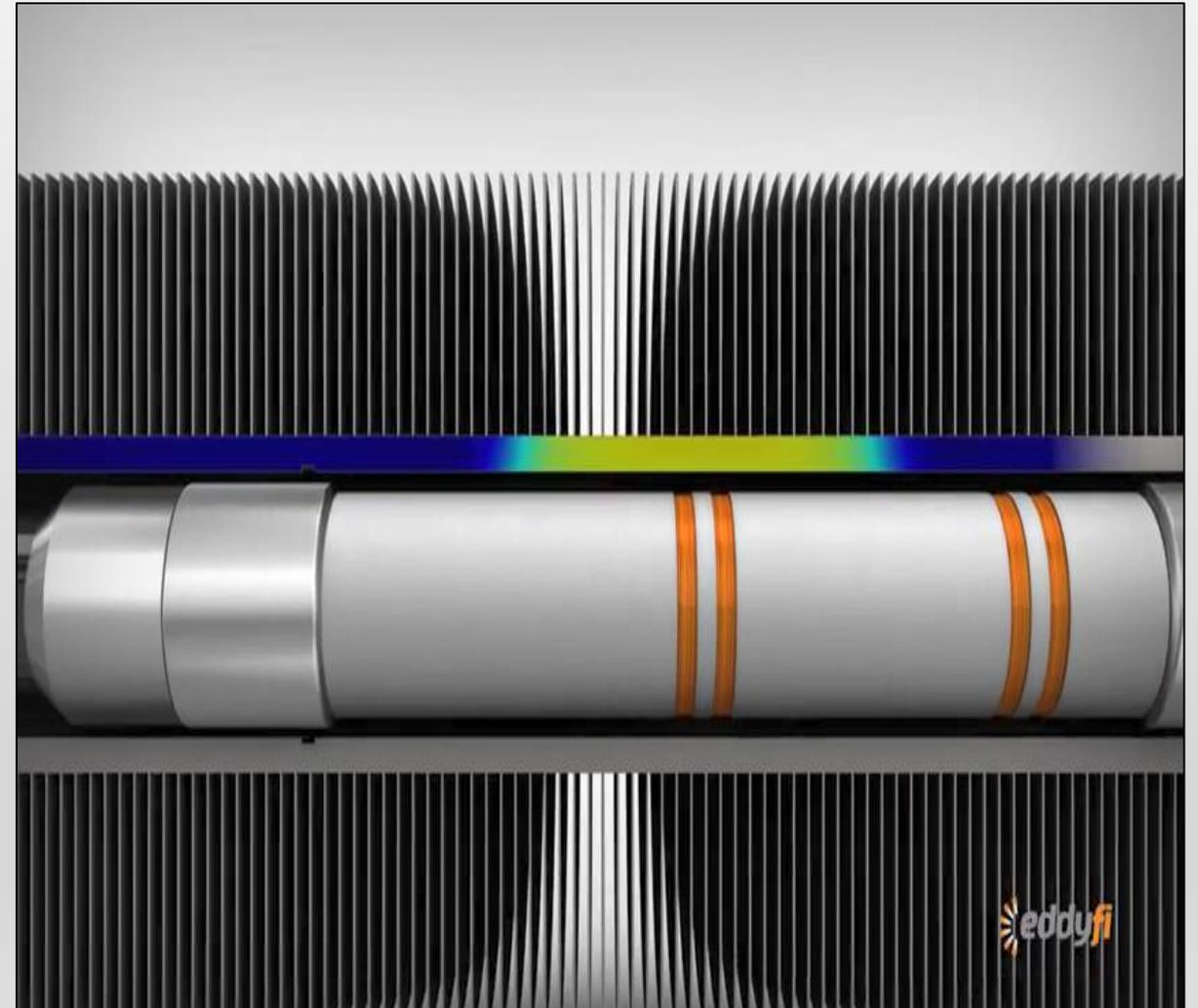
• **EDDY CURRENT TESTING/EDDY CURRENT ARRAY**

- Inner and outer corrosion, erosion, pitting and circumferential cracks on non-ferrous materials
- Applicable on all non-ferrous materials, small bore heat exchangers
- Special applications on OD finned non-ferrous materials
- Rigid, flexible (U-Bend type tubes), full saturation and detachable (multi diameter) probes
- High-resolution inspection and detection on circumferential and axial cracking, on both inner and outer diameter (ECA)
- C-scan
- Productivity : 300-350 Tubes per shift (10 hrs)



- **MAGNETIC FLUX LEAKAGE**

- Inner and outer corrosion, erosion, pitting and circumferential cracks
- Applicable on all ferrous materials
- Special application on ferrous tubes and Aluminum fins air-fins coolers
- Excellent sensitivity
- High-speed screening solution
- Productivity : 200-250 Tubes per shift (10 hrs)



- **NEAR FIELD TESTING/NEAR FIELD ARRAY**

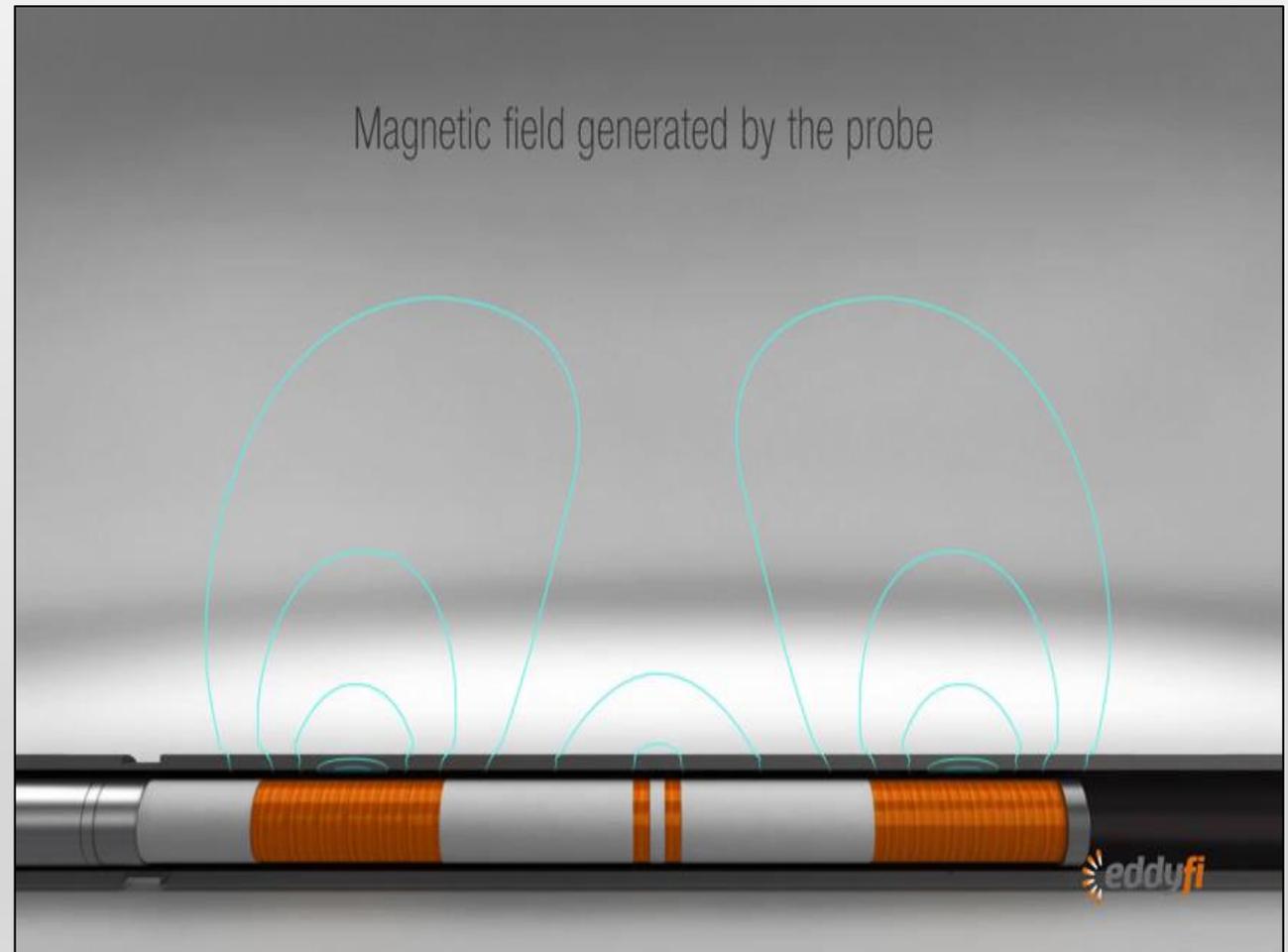
- Inner corrosion, erosion, pitting, axial cracking
- Ferrous tubes on coolers, air fin cooler
- Internal circumferential cracking and cracking on the tube sheet
- Ultra fast screening tool
- Productivity : 200-250 Tubes per shift (10 hrs)



REMOTE-FIELD TESTING (RFT)

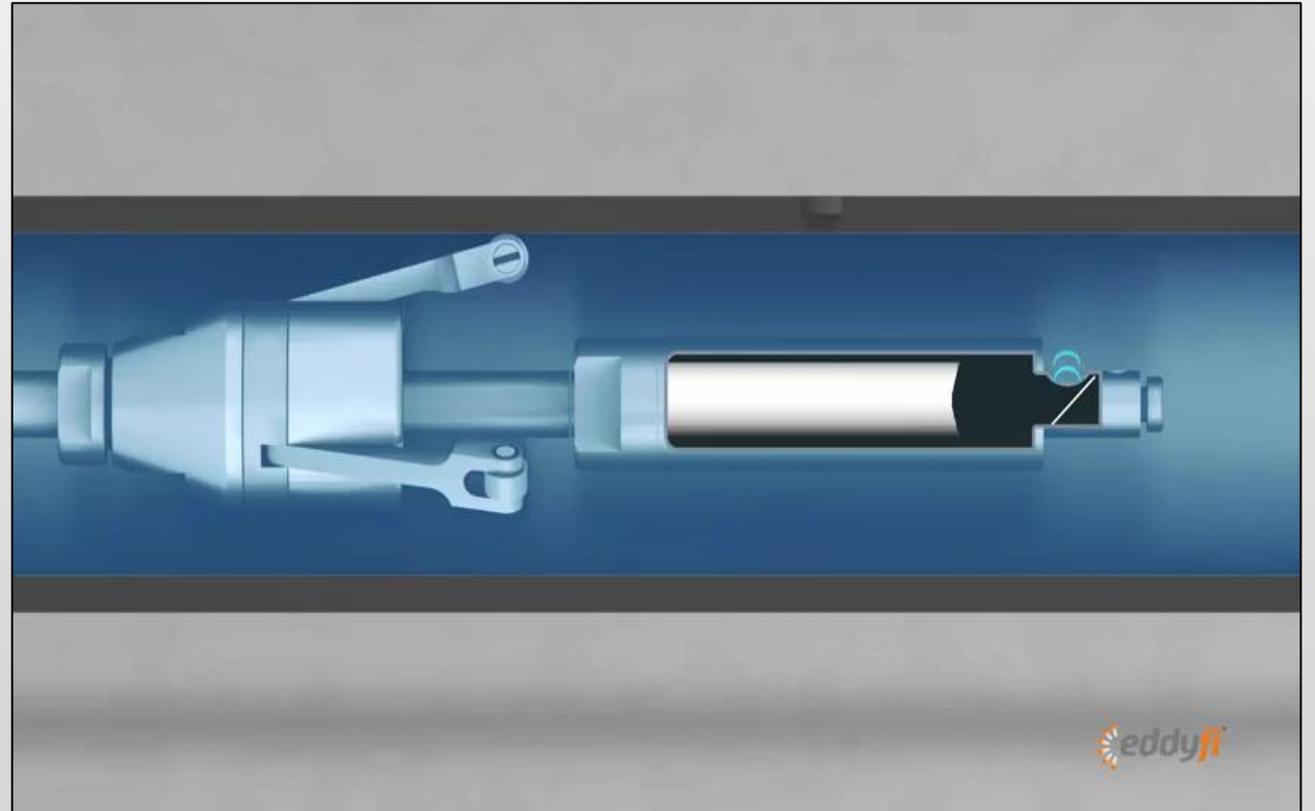
RFT has several benefits over other electromagnetic testing techniques:

- Suitable for ferromagnetic materials
- Equal sensitivity at the inner and outer surfaces
- Highly sensitive to wall thickness variations
- Can be used with lesser fill factors than ECT
- Productivity : 200-250 Tubes per shift (10 hrs)



- **INTERNAL ROTARY INSPECTION SYSTEM (IRIS)**

- Comprehensive method for detection and sizing of corrosion, erosion, pitting, fretting, baffle cuts and cracking.
- Applicable on all materials
- All type of heat exchangers
- Solution for different inner diameters
- Corrosion mapping and monitoring in high resolution c-scan
- Productivity : 60-80 Tubes per shift (10 hrs)





Detection Capabilities According to Defect Type in Tubing

Defect/Tech	ECT	ECA	IRIS	RFT	RFA	NFT	NFA	MFL	PSEC
ID pitting	●	●	●	●	●	●	●	●	●
OD pitting	●	●	●	●	●	●	●	●	●
Axial cracking	●	●	●	●	●	●	●	●	●
Circumferential cracking	●	●	●	●	●	●	●	●	●
ID corrosion	●	●	●	●	●	●	●	●	●
OD corrosion	●	●	●	●	●	●	●	●	●
At tubesheet	●	●	●	●	●	●	●	●	●

● Excellent ● Acceptable, but limited ● Not suitable

Sizing Capabilities According to Defect Type in Tubing

Defect/Tech	ECT	ECA	IRIS	RFT	RFA	NFT	NFA	MFL	PSEC
ID pitting	●	●	●	●	●	●	●	●	●
OD pitting	●	●	●	●	●	●	●	●	●
Axial cracking	●	●	●	●	●	●	●	●	●
Circumferential cracking	●	●	●	●	●	●	●	●	●
ID corrosion	●	●	●	●	●	●	●	●	●
OD corrosion	●	●	●	●	●	●	●	●	●
At tubesheet	●	●	●	●	●	●	●	●	●

● Excellent ● Acceptable, but limited ● Not suitable

Suitability According to Tubing Material

Material/Tech		ECT	ECA	IRIS	RFT	RFA	NFT	NFA	MFL	PSEC
Non-ferromagnetic	Tube	●	●	●	●	●	●	●	●	●
	Internal finned tube	●	●	●	●	●	●	●	●	●
Low-ferromagnetic	Tube	●	●	●	●	●	●	●	●	●
	Internal finned tube	●	●	●	●	●	●	●	●	●
Ferromagnetic	Tube	●	●	●	●	●	●	●	●	●
	Internal finned tube	●	●	●	●	●	●	●	●	●
	Aluminium finned tube	●	●	●	●	●	●	●	●	●

● Excellent
 ● Acceptable, but limited
 ● Not suitable



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RADIOGRAPHY OF PIPEWORK FOR WALL THICKNESS AND CORROSION / EROSION ASSESSMENT

Digital Radiographic Technology" (DRT)

1. Computed Radiography (CR)

- using a re-usable phosphor coated imaging plate,
- converted into digital form,
- using a high resolution laser scanner,



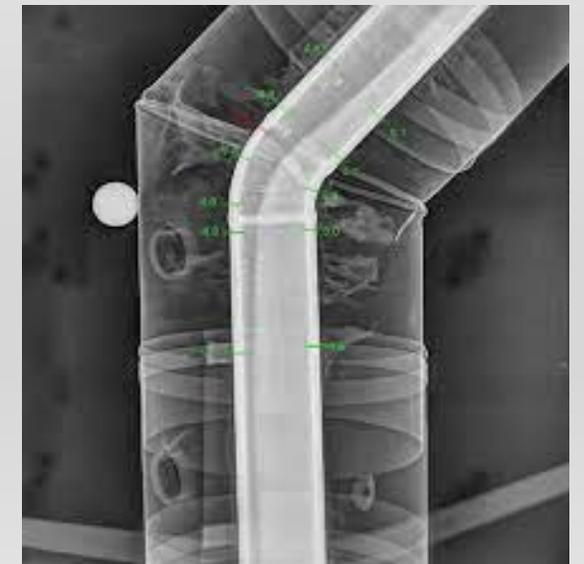
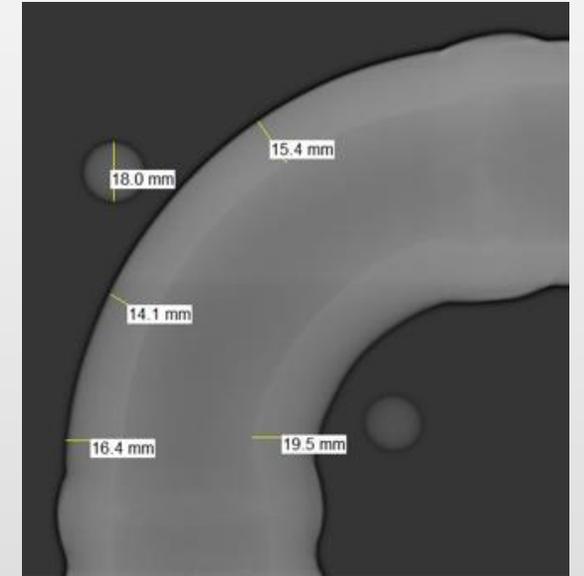
2. Digital Detector Array (DDA)

- 2D array of detectors that are exposed directly to the radiation,
- linked to a computer to give a series of digital images in near realtime,
- sometimes referred to as "Direct Radiography",



Digital Radiographic Technology" (DRT)

- Pipes may be insulated or not and can be assessed,
- loss of material is suspected either internally or externally,
- Piping systems containing product may also be assessed,
- depending on the volume and radiation absorption characteristics of the product,





Classification of Techniques

1- DWSI

Double wall single image with the film/ detector plate wrapped around the pipe to indicate areas for further investigation (generally applicable to pipes > 4" (100mm) diameter).

2- DWDI (PROFILE or TANGENTIAL - SOURCE CENTRAL)

Double wall double image with source and film/detector plate, positioned on the centre line of the pipe, to examine both tangents and provide an indication of corrosion erosion in the material between the tangents (generally applicable to pipes \leq 4" (100mm) diameter (profile technique)).

3- DWSI (TANGENTIAL - SOURCE OFFSET)

Double wall single image (DWSI) with source and film detector plate offset to examine a single tangent (generally applicable to pipes > 4" (100mm) diameter or where greater wall measurement accuracy is required on a specific area (tangential technique) .



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**FURNACE TUBE INSPECTION SYSTEM FTIS™
ULTRASONIC INTELLIGENT PIGGING**



FTIS™ Ultrasonic Intelligent Pigging

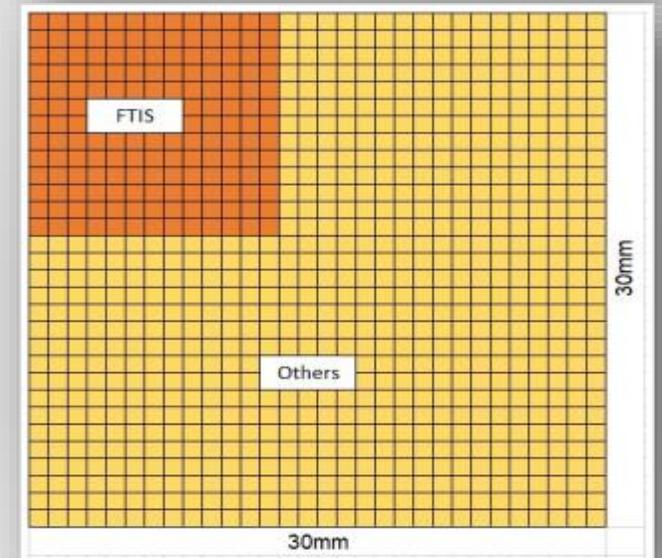
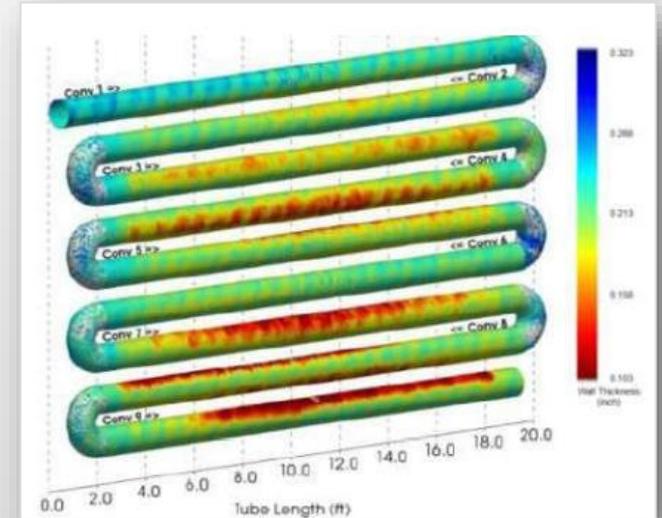
FTIS™, utilizes 100% ultrasonic circumferential and axial data coverage to quickly and accurately inspect the entire convection coil length.

FTIS™ technology can reliably detect defects more than 4 times smaller than other technologies

POD @ 90% for FTIS™ when compared to the other smart pigging technologies

Critical Flaws Are Identified In Heater Tubes Including Pitting Corrosion

Inspects pipe diameters of 2"-14" (76-355mm) NPS

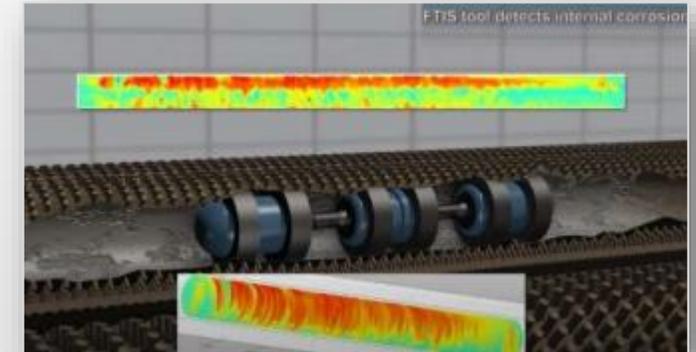


INSPECTION & REPORTING ADVANTAGES

- Simultaneously detects both pipe wall loss and deformation imperfections
- 100% inspection coverage in straight pipes
- Quantitative inspection technique
- Quick on-site data analysis and report generation
- High-density, direct measurement Ultrasonic (UT) provides repeated results
- Flaw sizing and accuracy specifications meet or exceed industry standards

ADDITIONAL BENEFITS

- Reduces inspection cost (no scaffolding or furnace entry required)
- Improves furnace reliability and decreases failure risk
- Improves maintenance accuracy
- Extends life of fired furnace coils
- Eliminates the need for most conventional NDT methods
- Minimizes offline status with time efficient inspections
- Field reports typically generated within 24 hours of inspection completion





FTIS™ detectable damage mechanisms include:

Uniform & localized metal loss

- o Oxidation (external scale)
- o Corrosion and Erosion (Internal & External)
- o Pitting (Internal & External)

Mechanical Deterioration

- o Dents
- o Fretting (tube hangers and supports)
- o Mechanical Cleaning (improper/over cleaning)
- o Vibration & Abrasion

Deformations

- o Creep & Stress Rupture (swelling, growth)
- o Bulging
- o Ovality
- o Denting

Manufacturing Defects

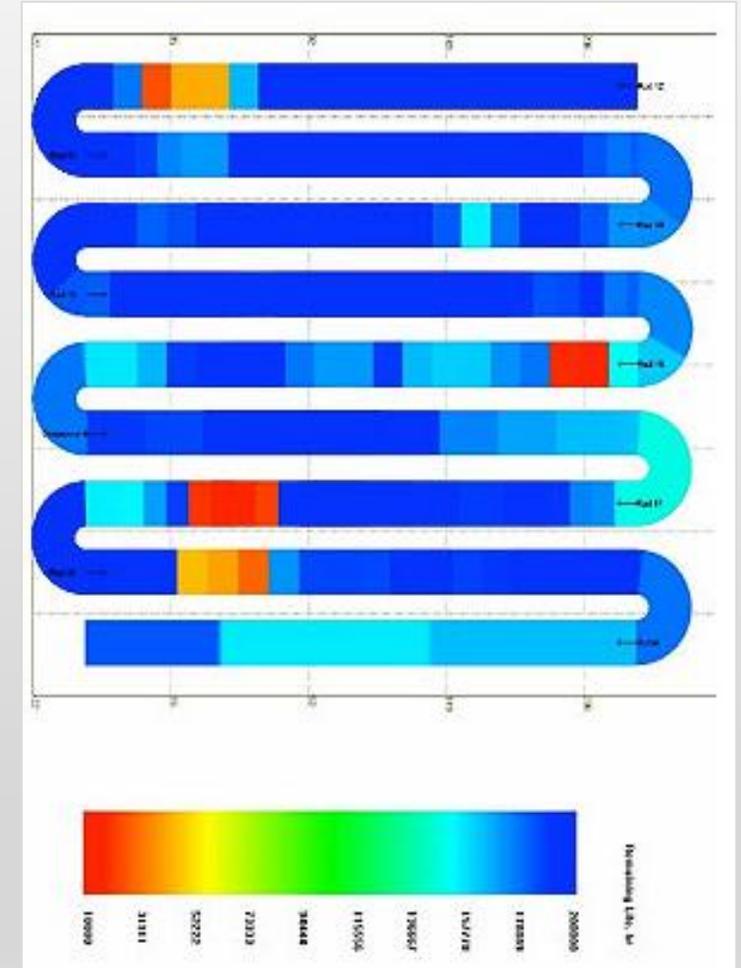
- o Laminations
- o Gouges
- o +/- Mill Tolerances of Wall Thickness

Hot Spots Due to Fouling

- o Scale
- o Coke

The report will be made of the processed data and will contain at least the following information:

- Geometry anomalies (dents, ovalities, deformations)
- Average wall thickness per tube section
- Remaining wall thickness of wall loss anomalies
- Minimal wall thickness per pipe section
- Length and width of anomalies
- Internal/external discrimination of wall loss anomalies
- Defect assessment of wall loss anomalies (optional)
- 3D representation of the data





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IN-SITU REPLICATION METALLOGRAPHY AND REPLICA EXAMINATION SERVICES

Replication metallography is a non-destructive sampling which records and preserves the topography of a metallographic specimen as a negative relief on a plastic film using a light microscope or Scanning Electron Microscope (SEM),

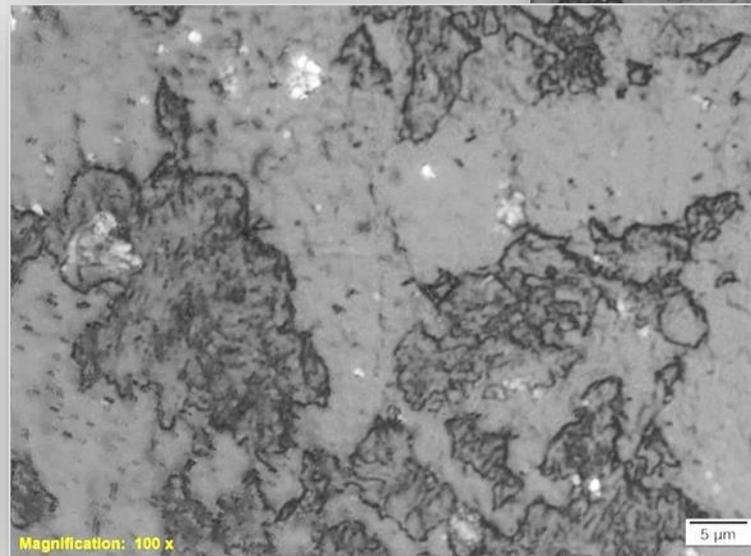
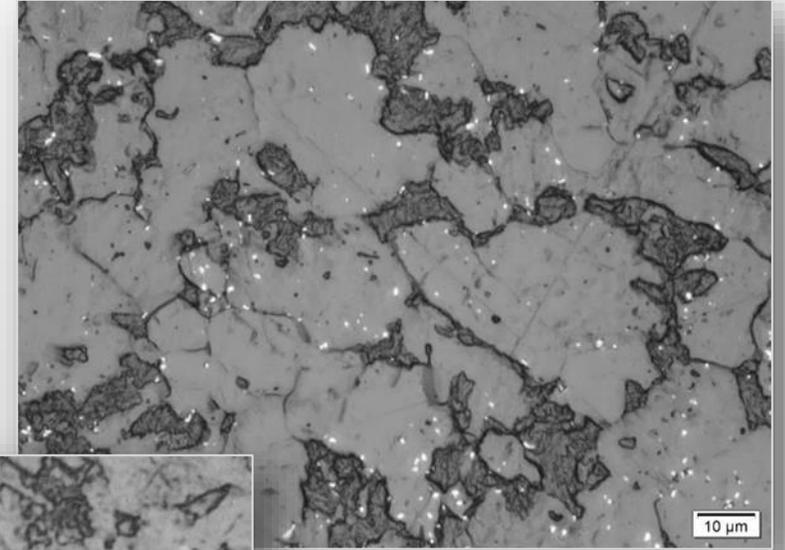
In-situ replication metallography to perform and analyze replica tests for obtaining microstructures on-site, as following:

- Selection of location
- Visual inspection
- Surface and specimen preparation (metallographic grinding, polishing and etching).
- Microstructure examination
- Replication
- Examination of replica



In-situ replication metallography and replica examination services:

- Microstructure evaluation
- Creep damage assessment .
- Thermal degradation of the materials.
- Degree of Sensitization (DOS)
- Failure analysis/crack analysis
- Hydrogen Embrittlement (HE)
- Stress Corrosion Cracking (SCC)
- Intergranular Corrosion (IGC)
- Graphitization



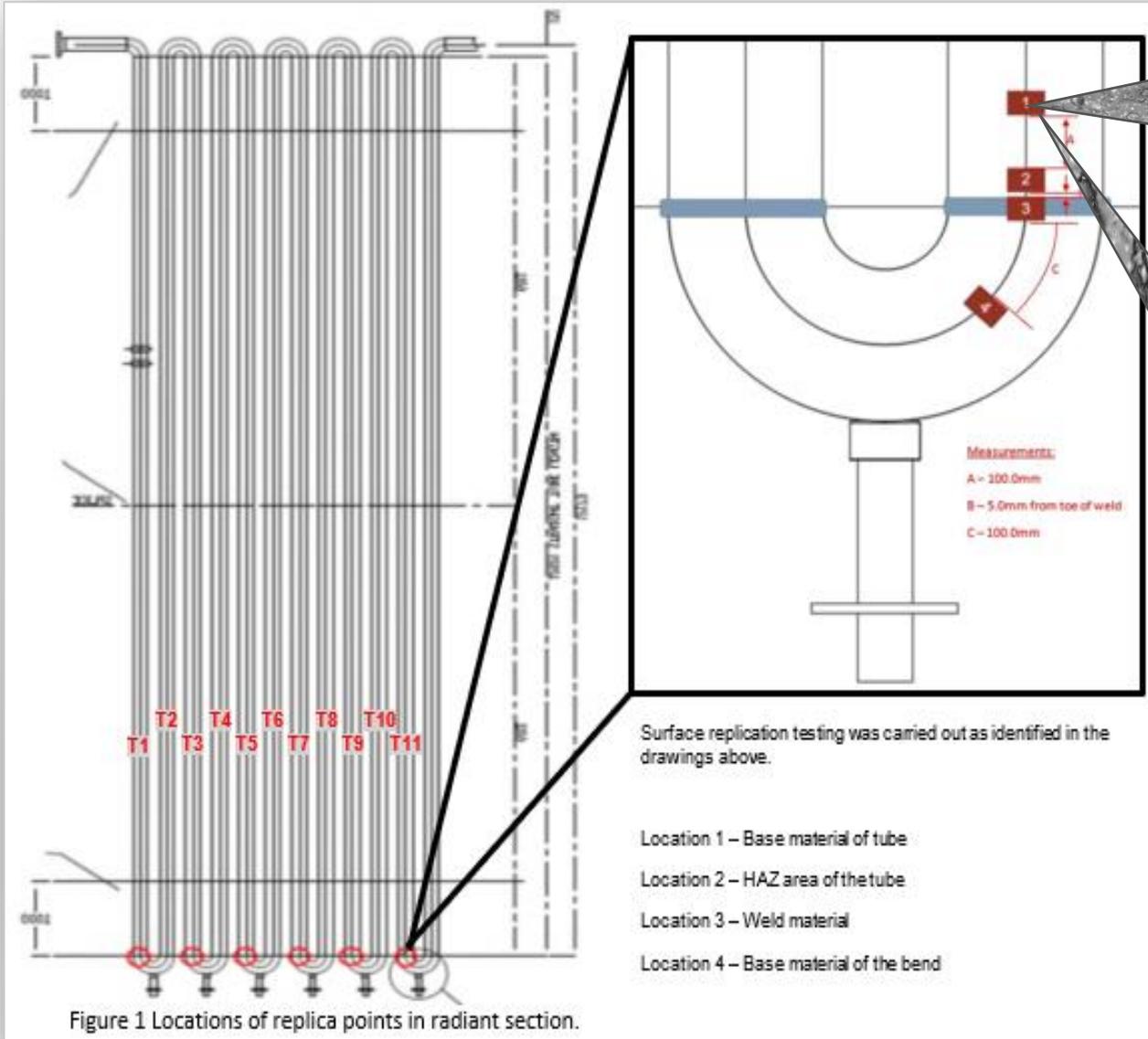
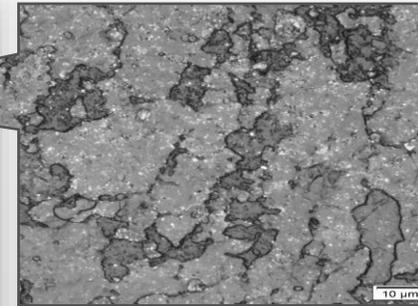


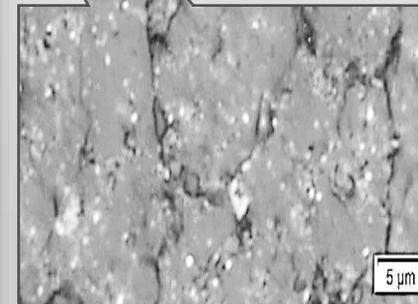
Figure 1 Locations of replica points in radiant section.



Location: Base material of the bend

Description: normal ferrite and pearlite microstructure

Comment: Overheating exposure did not cause any significant microstructural changes, and hence no metallurgical damages.



Degree of damage: No damage.

Recommended action: No action. Repeat replication after 3 to 5 years or when the heater is next out of service, whichever is earlier.



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ACOUSTIC PULSE REFLECTOMETRY (APR)



Acoustic-based technology is enabling to accurately and rapidly perform comprehensive inspections, drastically reducing the chance of catastrophic failures.

APR: Acoustic Pulse Reflectometry, a technology found in the newly-introduced Acoustic Eye Tube Inspection System, meets the markets demand for speed, accuracy and objective report generation.

Acoustic Pulse Reflectometry is applicable to the ID inspection of tubing such that is used in heat exchangers, air heaters, etc. and is capable of detecting and sizing ID defects such as pitting, erosion, blockages (obstructions) and through-wall holes.

Surfaces to be inspected shall be free from scale, slag and adhering or pooled water or other extraneous materials as this may adversely affect inspection results



ID defects detection

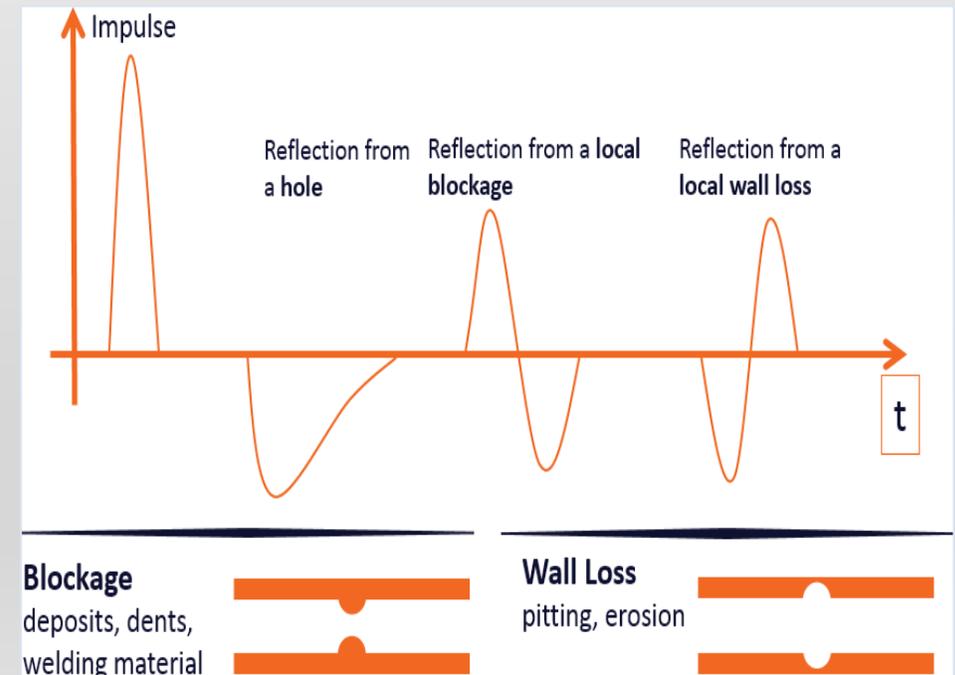
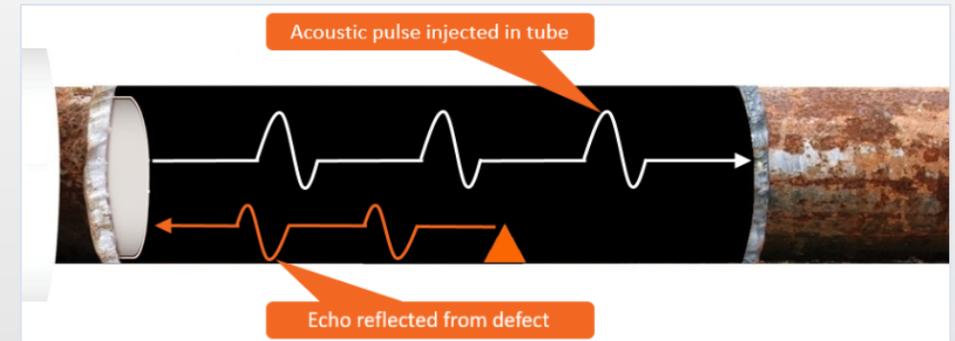
- Extremely sensitive to holes and blockages/restrictions
- Easy detection of ID wall losses (pitting, erosion)

Practical solution

- Extremely-fast, non-invasive inspection/less than 10s per tube
- Both, battery and electricity operated
- No need for inventory of consumable probes or standards
- Single operator with minimal training

Complete ID coverage of all types of tubes

- U-bends, fin-fans, twisted, spiral wound tubes
- Ferromagnetic and non-ferromagnetic metals, graphite and plastics
- ID diameters from 6mm to 52mm
- Up to 20 meters depending on defect size, tube configuration and type





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ADVANCED NDT SOLUTIONS

REMOTE VISUAL INSPECTION (RVI)

Remote visual inspection is a non-destructive testing technique that employs the use of remotely operated cameras and robotic crawlers in order to assess the integrity of components and infrastructure in areas that are too dangerous or remote for direct human intervention.

Benefits

RVI is a cost-effective NDT method for inspection of capital assets and critical components, monitoring conditions and preventing failures that might otherwise cause serious environmental damage and increase risk to human health and safety.

- Removes humans from potentially unsafe conditions
- Reduces or eliminates need for Confined Space Entry (CSE)
- No need for scaffolding or working at heights





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ADVANCED NDT SOLUTIONS

CLEANING BY WATER JETTING



CLEANING BY WATER JETTING

High pressure washing systems use a high velocity stream of water to blast through materials, such as residue that collects inside pipes or vessels.

The term “high pressure washing” refers to a high pressure washing system capable of generating a pressure 3,000 pounds per square inch (psi) or more”. This includes high pressure washing systems used at lower pressures and high volume.

It’s used to **remove** old paint, rust, rubber, chemicals, or other heavy build up **without causing damage** to the surface below it.

This method is perfect for internal and external surfaces.

The power and rotating end which make it the best choice for any application.

Pressures range from 5,000 psi (344 bar) with flows at 45.4 gm (172 lb.) to 40,000 psi (2,750 bar) with flows at 11.9 gm (45 lb.).



The use of high pressure washing equipment is found throughout industry. The most common applications are found in:

Distilleries Cleaning:

- Tanks, vessels, and components
- Process piping
- Evaporators
- Boilers

Petrochemical plants Cleaning:

- Heat exchanger
- Tanks, vessels, and components
- Process piping
- Drains

Oil and Gas Cleaning:

- Tanks, vessels, and components
- Process piping
- Drains
- Surface preparation
- Coating removal





SA INTERNATIONAL Ltd
ADVANCED NDT SOLUTIONS

ONLINE TESTING FOR SAFETY VALVE AND RELIEF VALVES

WHY ON-LINE (ON-SITE, IN-SITU, DURING OPERATION...) SAFETY RELIEF VALVES TESTING?

- Less shut downs – less production loss!
- No system discharges – no fuel costs!
- We improve the environmental conditions!
- No stress on pressure equipment joints, pipelines...
- No removing safety valves from the system – We save time and money.



SAFETY VALVES FUNCTIONS CAN BE MONITORED AND TESTED WITH GREATER ACCURACY, THAN CONVENTIONAL PSV TESTING ON THE TEST BENCH. HOW???

- Because, ACCUTEST is a special high accuracy on-line testing device.
- The total error of both sensors combined (additive) must be less than 0.25% of Valve Set Pressure.
- Load Cell Full scale value (lbs) 0.1% accuracy.
- With an innovative approach in the introduction of testing methods during operation.
- With a very good knowledge of the operation of safety valves and process pressure equipment.



MERITS OF OUR TESTING KIT.

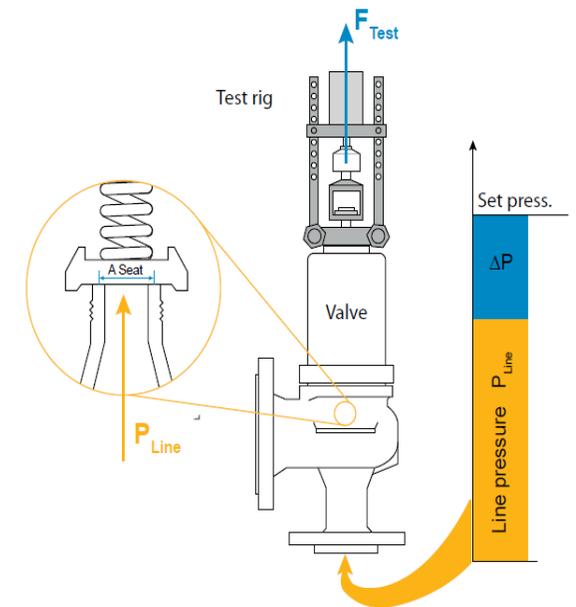
- Totally automated operation, battery operated motor with battery life under normal usage. Set pressures automatically calculated by measuring lift force, line pressure and acoustic trigger.
- Universal mounting assembly ensures use on all types of exposed spindle valves.
- Easy one-handed mounting with innovative iris plate and self-aligning spindle adapter.
- No hydraulics, cylinders, or hand jack.
- Lightweight, compact design for portability in the plant.
- Load rig allows for lift forces up to 4,500 kg (10,000 lb).
- System and sensor calibration services available.



THEORY OF OPERATION

Pressure safety valve in normal operation condition is subjected to 2 types of force, the 1st is line pressure, the second is a result of spring tension keeping the valve closed and tight.

When The airplane aluminum test bracket is adapted to the valve size and positioned on to the spring operated safety valve, and during the test, hence the valve is subjected to 3 types of force, the 1st is line pressure, the second is a result of spring tension keeping the valve closed and tight, and the third is the proportional rising force created by the AccuTEST system bringing the valve to the cracking point(set pressure).



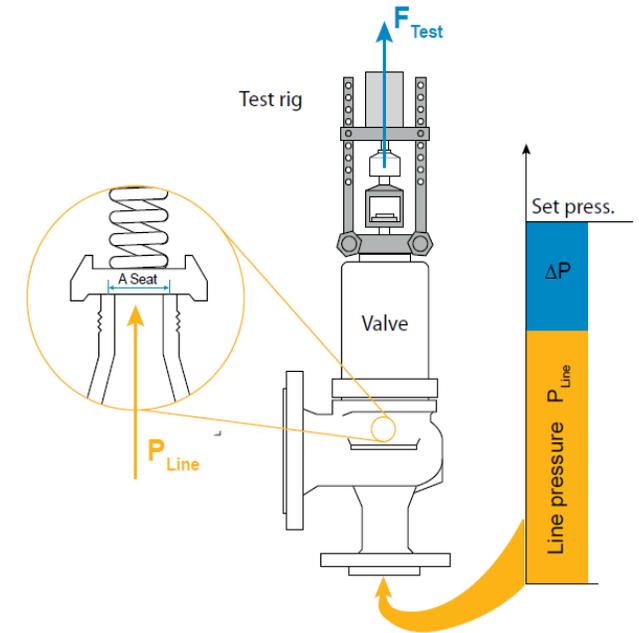
$$P_{set} = P_{line} + \Delta P$$

$$P_{set} = P_{line} + \frac{F_{test}}{A_{seat}}$$

THEORY OF OPERATION

The set pressure is the moment the disc commences to lift, the test detect this point by the lift acoustic and force sensors.

The corresponding measured values used in the automatic set pressure calculations.



Set Pressure=Line Pressure+(Pulling Force/Valve Seat Area)

$$P_{set} = P_{line} + \Delta P$$

$$P_{set} = P_{line} + \frac{F_{test}}{A_{seat}}$$



SA INTERNATIONAL Ltd
ADVANCED NDT SOLUTIONS

LIFTING INSPECTION FOR EQUIPMENT & ACCESSORIES



Effective lifting works depend on the continued integrity of the lifting equipment, proper planning and condition of equipment and lifting tools that are used.

Equipment failure to carry out its mission can result in serious or fatal injuries. All the lifting equipment require regular inspection and proper certification as per the required international standards in the industry to ensure their integrity and safety.

We provide a complete range of Lifting Inspection services for equipment and accessories, maintenance and supply spare parts for the onshore and offshore industries.

Our service not limited to lifting inspection but extensive to cover lifting and rigging planning, lifting supervision and third-party inspection.

Our qualified inspectors carry out a systematic and thorough examination of every individual lifting equipment or gear to ensure that the equipment in use meet the standards prescribed under LOLER (Lifting Operations and Lifting Equipment Regulations), LEEA (Lifting Equipment Engineers Association).



- Inspection and Certification for Lifting Equipment & Lifting Machines.
- All types of Cranes like Crawler, Mobile, Overhead, Gantry and Tower Cranes, Offshore Cranes.
- Forklift Trucks, Lorry mounted Cranes.
- Professional Proof Load Testing and Monitoring for Cranes.
- Periodic Inspections of Lifting Equipment and Lifting Accessories.
- Condition monitoring of Lifting Equipment and Lifting Accessories.
- Load testing for Offshore/ Onshore Rigs.
- Onshore / Offshore Inspection of Pad Eyes..
- Inspections of Lifting Tools/Gears
- Inspections and Certification of Containers, Offshore Baskets, Cargo Baskets.
- Wire rope inspection and certification.
- Inspection for flares guy wire ropes using EMAG technology.
- Annual Examination and it includes NDT/NDE evaluation, Functional test, load test/proof load testing.



Mobile Telescopic Crane

Crawler Lattice Crane

Mobile Telescopic Man Lift

Forklift

Overhead Crane

Scissor Lift

Cargo Crane



Chain hoist

Chain hoist with lever

Wire rope sling

Flat webbing sling

legs

shackles

Mechanical jack

sheaves

Machinery skate

Man basket

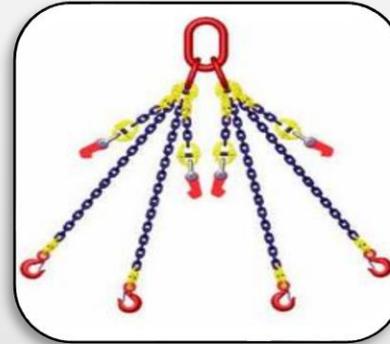
Marina basket

Concrete bucket

Snatch block

Tirfore

Spreader Beam





SA INTERNATIONAL Ltd
ADVANCED NDT SOLUTIONS

COMPLEMENTARY SUPPORTED SCOPE BY SA INTERNATIONAL Ltd



- ❖ Visual Inspection (VT)
- ❖ Radiographic Testing RT (Gamma Ray)
- ❖ Radiographic Testing RT (X - Ray)
- ❖ Magnetic Particle Testing (MT)
- ❖ Penetration Testing (PT)
- ❖ Ultrasonic Thickness Measurements (UTM)
- ❖ Ultrasonic Shear Wave (UT)
- ❖ Hardness Testing
- ❖ Heat Treatment (Pre-Heating / Post Weld Heat Treatment)
- ❖ Ultrasonic Flow Measurements
- ❖ Measurements of Roundness, Settlement and Plumpness
- ❖ Recalibration Above Ground Storage Tanks
- ❖ Positive Material Identification (PMI)
- ❖ Optical Emission Vacuum Spectrometric Analysis
- ❖ Vacuum box Testing (VBT)
- ❖ Scaffolding inspection
- ❖ Bench Test for Pressure Safety Valves
- ❖ Hydrostatic Testing and Pneumatic testing
- ❖ Coating inspection
- ❖ Fitness For Service
- ❖ Rope access
- ❖ Thermography Testing (TG)
- ❖ Vibration Analysis
- ❖ Laser Alignment Testing
- ❖ Small Controlled Area Radiography (SCAR) system
- ❖ Lixi-Profilor Test
- ❖ Alternating Current Field Measurement (ACFM)
- ❖ Cathodic Protection
- ❖ Surface Eddy Current
- ❖ Ultrasonic Leak Detection
- ❖ Maintenance for Lifting Equipment
- ❖ Electrical and Instrumentation Inspection



SA INTERNATIONAL Ltd
ADVANCED NDT SOLUTIONS

MANPOWER SUPPLY SERVICES



SA is one of world's premier Staffing Companies. We specialize in the field of provisioning Engineering Personnel for Oil & Gas, Petroleum, Petrochemicals, Hydrocarbon, Power Generation and Drilling Sectors. Our constantly updated and current database has 100,000+ pre-screened CVs.

Our in-house technical expertise is put to excellent use while submitting focused CVs as per Client requirements in a very short time. We work closely with several multinationals in the Middle East and Far East for their Engineering Manpower requirements.





Various Engineering Specialists

- Project Managers
- Construction Managers
- Procurements Managers
- HSE Managers /Officers
- QA/QC Managers
- Piping Engineers
- Piping Stress Engineers
- AutoCAD Operators/Designers
- Instrumentation Design Engineers
- Pipeline Design Engineers etc
- Planning Engineers
- Rotating Equipment Design
- Static Equipment Design
- Welders 6G GTAW/SMAW
- Pipe Fitters /Foreman
- Workers /Helpers
- Process Design Engineers
- Drilling Supervisors
- Drilling Team
- Quantity Surveyors
- Offshore Staff
- E&I Engineers
- Civil Structural Design Engineers
- PDS/ PDMS Designers
- Electrical Design Engineers
- Procurement Specialists
- Environmental Specialists
- HSE, HAZOP
- QC Inspector (Welding, Electrical, Civil, Quantity Surveyors, Cathodic Protection) etc



Technical Staffing Services:

SA is a leading supplier of Technical Staffing Services to the world's largest energy, engineering and construction companies and possesses the ability to supply an internationally experienced, technically qualified contingent workforce to augment client staff. The expansive recruiting network within SA enables each office to generate qualified candidates as necessary to meet client and/or project needs while keeping costs in-line with budgets.

By utilising SA's staffing services, clients can focus strategies and resources on their core business, reduce and control operating costs, increase access to qualified personnel, and minimise recruitment time and expenses.



SA INTERNATIONAL Ltd
ADVANCED NDT SOLUTIONS

COMPLEMENTARY SCOPE SUPPORTED

THANK YOU