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ADVANCED TECHNOLOGIES

hotsense® | Powered by ionix

Piezoceramic & Ultrasound Extreme Environment Experts

Ionix Advanced Technologies is the leading manufacturer of extreme environment and tailored ultrasonic sensors for asset integrity and process control solutions. Our unique in-house disciplinary team focus within three core elements which include piezoelectric ceramics, ultrasonic probes and automated monitoring solutions.

A WELCOME MESSAGE

Welcome to Ionix Advanced Technologies. We have created a versatile technology platform, HotSense™, offering on-stream, real time, asset and process intelligence, even in extreme environments. Based on our unique piezo-electric ceramics, our ultrasonic & acoustic sensors offer asset integrity and condition or process monitoring at low and high temperatures, in explosive atmospheres and are radiation resistant offering capability for total plant digitalisation. This has allowed us to become true leaders in industrial sensing.

Tim Stevenson
Chief Executive Officer

ABOUT

UK-based Ionix Advanced Technologies is a supplier of specialist extreme environment ultrasonic testing transducers and monitoring systems, providing clients with access to on-stream asset inspection and continuous, online data to monitor the condition and performance of their assets.

Ionix holds a portfolio of patents covering the novel piezoceramic components which power its devices and its HotSense™ extreme environment sensor platform.

Our HotSense™ UT transducers are ideal for non-destructive testing evaluations conducted by inspectors or robotic platforms in challenging environments, such as high and low temperature, explosive atmospheres, or high wear such as scanning.

HotSense™ monitoring probes are intrinsically safe and designed to be installed on site for high precision measurement collection and trending. Data can be collected locally or transmitted to a control room or remote server for review and planning of interventions.

Ionix has an integrated probe design & development team and in-house manufacturing and testing capabilities. Our unique in-house multi-disciplinary team has capabilities including; piezoceramic manufacture, sensor design, system design and integration, and training capabilities.

Ionix holds ISO9001:2015 and intrinsically safe manufacturing certificates to build and supply extreme environment sensors and device components.

Introduction to Ionix

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LEADERS IN ADVANCED PIEZOELECTRIC CERAMICS AND ULTRASOUND DEVICES

HotSense™ Ultrasonic Testing (UT) transducers enable on-stream non-destructive testing (NDT) and asset integrity measurements to be made in extreme environments. Powered by the proprietary Ionix HPZ piezoceramic, the high-performance transducers enable measurements to be made across a wide range of temperatures and are deployed in industries which include oil & gas, nuclear, energy, petrochemical and mining for applications including thickness/ corrosion/erosion surveys and weld inspection.

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Want to discuss your demanding environment needs?

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HotSense™ Ultrasonic Thickness Gauging Transducers

Minimise operational risk and maximise productivity with on-stream asset intelligence.

Keywords: corrosion, erosion, in-service inspection, extreme environments, high temperature

HOTSENSE™

- Built on the award winning HotSense™ ultrasonic platform powered by the proprietary Ionix HPZ piezoceramic.
- Dual element thickness gauging transducers in a range of frequencies and tip sizes for use in extreme environments.
- -55 to +550°C [-67 to +1,022°F] wide measurement temperature range for all in-service assets.
- No cooling required up to 350°C / 662°F. Increase your productivity between calibrations and reduce duty cycling.
- Stable signal for maximum reliability and repeatability.
- Enhanced wear resistance for the most extreme environments and applications.

APPLICATION

- Make wall thickness measurements on hot assets, in-service, without the need to shutdown or isolate.
- Measure remaining wall thicknesses from 2.5 to 50 mm thick with commercial flaw detectors or 1-500 mm with specific instrument setups.
- Compatible with recommended high-temperature ultrasonic couplants.
- Robust stainless steel construction, and large tip options for scanning.
- Range of accessories available, including port inspection wand, safety guards and scanner probe holders for the highest-temperature applications.

SOLUTIONS

- Maximise productivity with reduced down-time and outages with in-service inspection.
- On-stream corrosion surveys and inspection of forged and cast components.
- Support asset integrity and corrosion management programs (including RBI, FFS & FEA) with high-temperature remaining wall thickness.
- Compatible with industry standard ultrasonic inspection hardware.
- Compliant to ISO 22232-2 and ASTM E/1065 to meet your existing asset integrity UT procedures.

TRANSDUCER RANGE SPECIFICATION

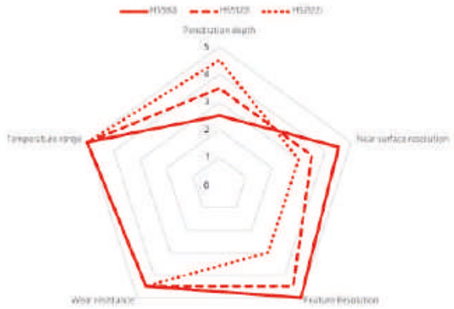
PARAMETER	VALUE	UNIT
Surface temperature range*	-55 to +550 / [-67 to +1,022]	°C / [°F]
Storage temperature	-55 to +80 / [-67 to 176] Store dry and in clean condition	°C / [°F]
Connector type	Dual UNF 10/32 Microdot	
Wear allowance	1.5 / [0.06]	mm / [inch]
Ruggedisation	Weatherproof Stainless steel construction	
Ex certification	Ex options available	

PRODUCT CODE	DESCRIPTION	RANGE IN STEEL	FOCUS
HS 582i	5 MHz, 8 mm diameter / 2 active element Tip diameter 11 mm / [0.434"]	2 to 50 mm [0.08 to 2"]	10 mm [0.39"]
HS 5122i	5 MHz, 12 mm diameter / 2 active element Tip diameter 18 mm / [0.708"]	2.5 to 250 mm [0.98 to 9.84"]	20 mm [0.79"]
HS 2122i	2.5 MHz, 12 mm diameter / 2 active element Tip diameter 18 mm / [0.708"]	10 to 500 mm [0.39 to 19.7"]	30 mm [1.18"]

Acoustic characteristics certificate of conformity to ISO 22232-2 supplied with each unit

Compatible with UT gauges, flaw detectors and scanners.
*See "temperature cycle chart"

MEASUREMENT PERFORMANCE



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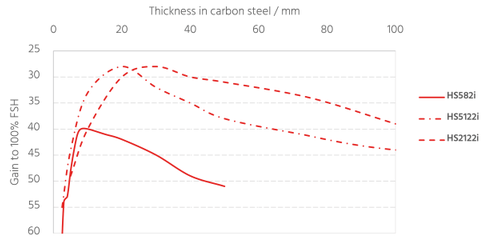
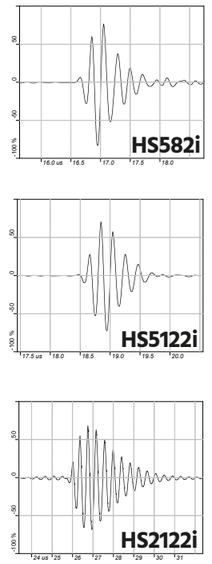


TYPICAL ULTRASONIC RESPONSE



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CERTIFICATION

Meets the requirements of ISO 22232-2 and ASTM E/1065

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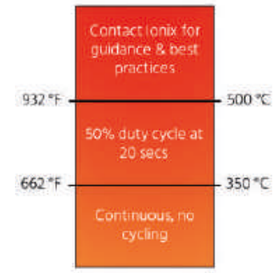
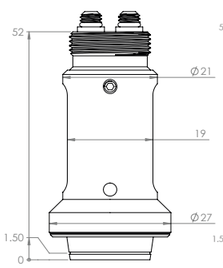
TEMPERATURE CYCLE CHART

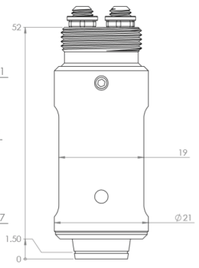


Due to the varied range of applications, this chart is provided as a guide only. Use outside of these parameters can reduce the lifetime of the transducer.

HSX122i



HSX82i



Scan the QR code to explore more about Ionix and the HotSense™ UT Thickness Gauging Transducers.

In-Service High-Temperature UT Inspection Survey by a U.S. Oil Refinery

In-service, high-temperature corrosion surveying to maximise productivity, safety and plant availability.

OVERVIEW

A solution was sought by one of the largest suppliers of integrity and inspection services, for an inspection project at a US West Coast oil refinery that involved Ultrasonic Testing (UT) measurements of on-stream process pipework and equipment at high temperatures, in the range 350°F to 700°F (177°C -371°C). UT is a critical activity in the maintenance and up-time of this high value processing unit at the refinery. Measurements were scheduled to be made at a number of identified corrosion monitoring locations (CMLs) during normal production, and this required the use of UT transducers which were able to make high temperature thickness measurements.

THE CHALLENGE

Before adopting the Ionix HS582i high temperature UT probe mid-way through the project, the main challenge articulated by the inspectors at the oil refinery was:

- The time consumed by having to wait for transducers to cool between each reading (duty cycling).
- The ensuing lack of repeatable thickness data.

THE SOLUTION

Ionix' HS582i dual element 5 MHz transducers, based on the HotSense™ ultrasonic platform, were deployed with the refineries own standard UT flaw detectors making for immediate implementation.

- The HS582i transducers were chosen for their wide operating temperature range; -67°F to +1,022°F (-55°C to +550°C), minimising the need for intermittent cooling (duty cycling) and re-calibrating to reduce the inspection time and prevent the need for shutdown or isolation of equipment.
- Increased wear resistance / longer probe life maximised continuous usage and measurement collection.
- Probe accessories including high temperature couplants and handles made measurements fast, repeatable and safe.
- Manufactured in compliance with international standards to easily fit directly into the prevailing project UT inspection procedures.
- Compatible with commercial high temperature couplants.

Fig. 1 (Left) Ionix HS582i probe in use at US Oil Refinery by a Inspector. Pipe temperature readings at time of this inspection were 582°F (305°C). (Right) The thickness measurements were able to be repeated several times with minimal cool down periods.

EXECUTION

- The Ionix HS582i probe was deployed as a replacement for the incumbent transducer. Wall thickness measurements at the designated CMLs were undertaken with the HS582i using conventional UT flaw detectors, and required no additional training or setup.
- Many wall thickness measurements were made with a single probe without causing damage to the probe from heating or excess wear.

TESTIMONIAL

"Our team at the Refinery have been working on projects for process piping ranging from 350°F to 700°F. It was very time consuming having to wait for our transducers to cool between each reading and not getting repeatable thickness data. We started using the Ionix HS582i 5 MHz transducer and it made a significant difference in time between readings and accuracy. In conclusion, the Ionix transducer worked exactly as advertised for the higher range that we utilised it on ."
ASNT Level III UT inspector

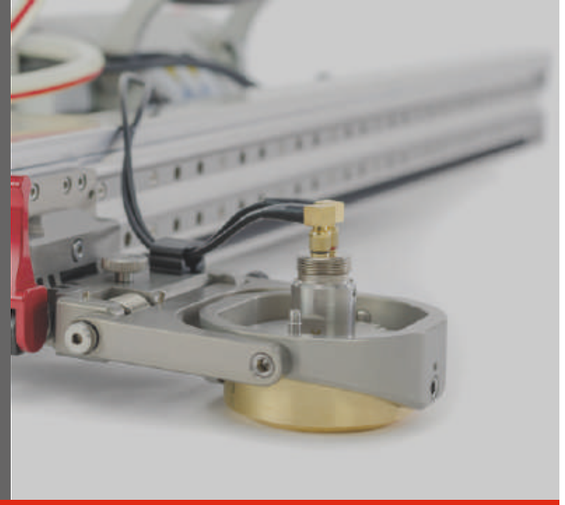
Scan the QR code to download full case study.

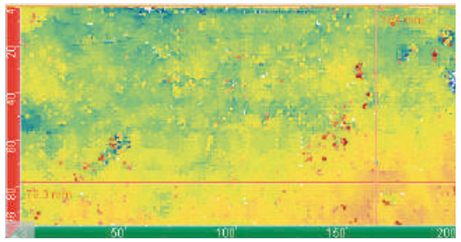
Case Study

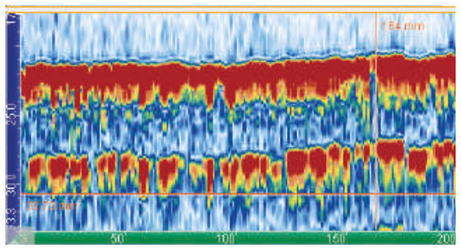
On-Stream, High-Temperature Corrosion Mapping with HotSense™

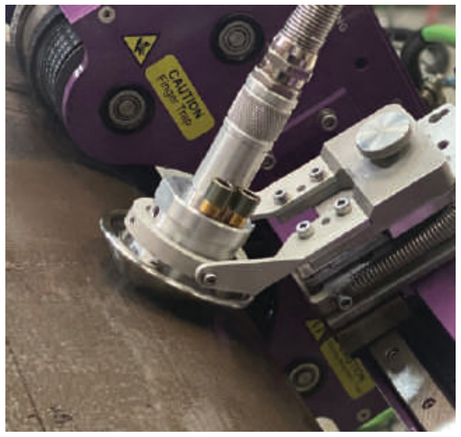
Minimise operational risk and maximise productivity with on-stream asset intelligence.

Keywords: corrosion, erosion, in-service inspection, extreme environments, high temperature









HOTSENSE™

- Built on the award winning HotSense™ ultrasonic platform powered by the proprietary Ionix HPZ piezoceramic.
- Dual element thickness transducer for use in extreme environments.
- -20 to +550°C [-4 to +1,022°F] wide measurement temperature range for all.
- No cooling required.
- Stable signal for maximum reliability and repeatability.
- Enhanced wear resistance for the most extreme environments and applications.
- Compatible with industry standard ultrasonic inspection hardware.

APPLICATION

- Map remaining wall thickness on hot assets, on-stream, without the need to shutdown or isolate.
- Measure remaining wall thicknesses from 2.5 to 50 mm thick with commercial flaw detectors or 1-500 mm with specific instrument setups.
- Compatible with recommended high-temperature ultrasonic couplants.
- Robust stainless steel construction.
- Range of accessories available, including guards, high-temperature cabling and probe holders for the highest-temperatures.

SOLUTIONS

- On-stream mapping of high-temperature assets to reduce failure and un-planned outages and shutdowns.
- Increase safety with reduced exposure and man-hours at asset.
- Support asset integrity and corrosion management programs (including RBI, FFS & FEA) with high-temperature remaining wall thickness.
- Compliant to ISO 22232-2 and ASTM E/1065 to meet your existing asset integrity UT procedures.

HS582i AUT

HS 582i TRANSDUCER SPECIFICATION

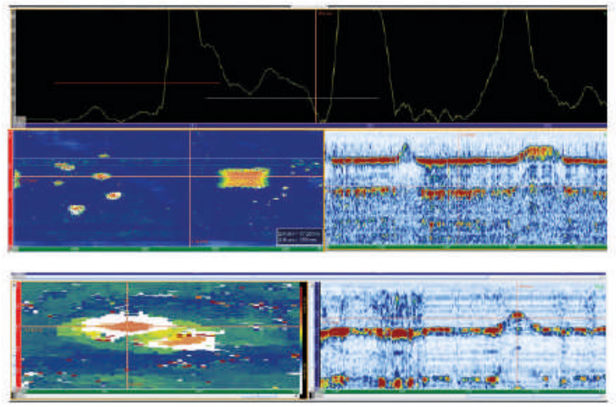
PARAMETER	VALUE	UNIT
Surface temperature range	-20 to +550 / [-4 to +1022]	°C / [°F]
Storage temperature	-55 to +80 / [-67 to +176]	°C / [°F]
Tip diameter	11 / [0.434]	mm / [in]
Custom geometries available on request		
Connector type	Dual UNF 10/32 Microdot	
Ruggedisation	IP 68 Stainless steel construction	
Transducer centre frequency	5	MHz
Active element diameter	8	mm
Wear allowance	1.5	mm

Compatible with UT flaw detectors and thickness gauges.
Acoustic characteristics certificate of conformity to ISO 22232-2 supplied with each unit.

For other specification requirements please contact our sales team.

Compatible with a wide range of commercial calipers, encoders, scanners and crawlers for pipe and vessel inspection.

CORROSION MAP AT 250°C



C-Scan at 250°C on Carbon Steel

CERTIFICATION

Meets the requirements of ISO 22232-2 and ASTM E/1065

CE IP 68

Universal Probe Holder: ACC-HS-001

Scan the QR code to explore more about HotSense™ UT probes for High Temperature Corrosion Mapping.

In-Service Automated UT Corrosion Mapping Of Pipeline At Risk Of Sulfidation

In-service, high-temperature corrosion mapping to maximise productivity, safety and plant availability.

OVERVIEW

A solution was sought by IRISNDT, a global supplier of integrity, inspection and engineering services, for an automated corrosion mapping of a high-temperature hydrocarbon pipeline susceptible to sulfidation. Automated UT is a primary means of determining areas of accelerated corrosion from sulfidation, as it is the most ubiquitous damage mechanism from naturally occurring sulphur compounds in hydrocarbon products when in contact with low alloy or carbon steel components above a critical temperature of ~260°C / 500°F. Remaining wall thickness measurements were required to made on a number of identified piping circuits on a refinery and required the use of UT transducers which were able to produce reliable scans with sufficient wear resistance to survive maximise productivity over the length of the circuits.

THE CHALLENGE

A ~5 m piping circuit consisting of 6" and 8" NPS diameter carbon steel piping carrying hydrocarbons was identified as being at risk of sulfidation. Ultrasonic corrosion mapping is the primary means of determining areas of accelerated wall loss, and is traditionally undertaken using multiple probes due to soft polymer or graphite wear faces, which leads to degradation of data during the scan, and replacing probes throughout.

THE SOLUTION

Ionix' HS582i dual element 5 MHz transducers, based on the HotSense™ ultrasonic platform, were deployed with automated magnetic crawlers and standard UT flaw detectors making for immediate implementation.

- The HS582i transducers were chosen for their wide operating temperature range; -67°F to +1,022°F (-55°C to +550°C).
- Increased wear resistance / longer probe life maximised continuous usage and measurement collection.
- Manufactured in compliance with international standards to easily fit directly into existing UT inspection procedures.
- Compatible with commercial scanners and UT sets. Quick to deploy, calibrate and begin scanning.

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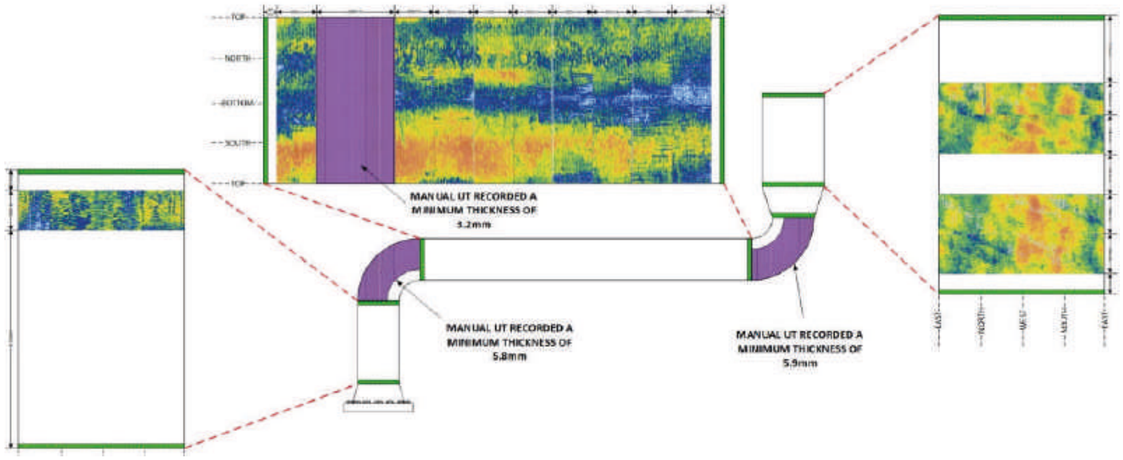
EXECUTION

- The Ionix HS582i probe was deployed as a replacement for the incumbent phased array corrosion mapping transducers.
- Wall thickness maps on the designated piping circuits were undertaken with the HS582i using conventional UT flaw detectors, and required no additional training or setup.
- Multiple section thickness measurements were made with a single probe without causing damage to the probe from excess wear.



TESTIMONIAL

"The HS582i has become our go to transducer for wall thickness measurements - whether its manual point measurements or scanning. The wide operating temperature range and high wear resistance makes it the perfect tool for the modern inspection professional. The Ionix transducer has made a significant difference increasing productivity"
IRISNDT Level 3 UT.

Scan the QR code to download full case study.

Case Study

Ionix HotSense™ UT NDT Probes, Accessories and Masterclass

Enabling on-stream ultrasonic non-destructive testing measurements to maximise productivity and reduce operational risk

Keywords: corrosion, erosion, weld inspection, on-stream inspection, high performance, extreme environments, high temperature

HotSense™ UT Transducers

Pages 3 - 6

Key Benefits

- Dual element ultrasonic thickness gauging transducers in a range of frequencies and tip sizes suitable for use in extreme environments.
- -55 to +550 °C [-67 to +1,022 °F] wide measurement temperature range for all on-stream assets.
- No cooling required up to 350 °C [662 °F] for continuous operation.
- 50% duty cycle up to and beyond 550 °C [1022 °F].
- Increased wear resistance.
- Compatible with industry standard ultrasonic flaw detectors and scanners.

Key Applications

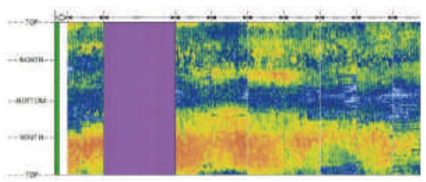
- Wall thickness UT point measurements, maps and surveys for corrosion, erosion and wear.
- Versatile, high-performance probes for every inspection.
- On-stream inspection of hot assets without burning out probes.

Case Study

- In-Service High-Temperature UT Inspection Survey By A U.S. Oil Refinery.

Corrosion Mapping

Pages 7 - 10



Key Benefits

- Ultrasonic probes for continuous scanning and mapping without cooling up to 350 °C [662 °F].
- Increased wear resistance.
- Measure remaining wall thicknesses from 1 to 500 mm thick.
- Compatible with industry standard ultrasonic flaw detectors and scanners.

Key Applications

- Map remaining wall thickness on hot assets, on-stream, without the need to shutdown or isolate.
- On-stream inspection enables increased data collection to optimize asset integrity and reduce outage length and frequency.

Case Study

- In-Service Automated UT Corrosion Mapping Of Pipeline At Risk Of Sulfidation.

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HotSense™ TOFD

Pages 13 - 17

Key Benefits

- -55 to +350 °C [-67 to +662 °F] continuous use without cooling.
- High performance with a stable and strong signal.
- High sensitivity with integrated wedges.
- Available in a range of frequencies, angles and profiles.
- Optional complete kit with carry case and accessories.
- Compatible with commercial scanners and flaw detectors.

Key Applications

- High performance probes for all TOFD inspections.
- Make weld inspections on hot assets, on-stream, without the need to shutdown or isolate.
- Detect and size cracks or defects in welds or parent material on-stream.
- Weld qualification during production.
- Weld root corrosion surveys.

Case Study

- High-Temperature Weld Root Corrosion Inspection.

Accessories

Pages 18 - 20

Couplants

- High temperature couplants to facilitate fast and reliable measurements across a range of temperatures.
- Gels or pastes with different viscosities from -45 to +675 °C.
- Non-toxic with low smoke and no residue options available.
- Options which meet ASTM F519 and offer long-term corrosion resistance and inhibition.
- Low viscosity options for scanning.

Cables

- High quality, UT cables to connect probes to any thickness gauge or flaw detector using compatible connectors.
- For use with dual probes for thickness, corrosion, erosion surveys and TOFD probes for weld inspection.
- Cables available in standard or high temperature variants with several connectors, lengths and identification pin options including custom configurations.

Handles

- Detachable handles to provide extra grip and protection from high temperatures.

High Temperature UT Masterclass

Page 21

Key Benefits

- High temperature UT thickness training delivered on-site, at your office or at Ionix.
- An introduction to producing safe, reliable and high-quality ultrasonic measurements for applications in oil and gas, chemical, energy and nuclear industries.
- Includes training on making high temperature thickness measurements to ultrasonic testing procedures and guidance for on-stream corrosion and erosion surveys.
- Workshop content delivered within ASTM E797 and ISO 16809 framework.
- Hands-on high temperature inspection practice.
- Safety and best practices.

Key Applications

- Ensure technicians and inspectors have the skills, knowledge and core competencies to make safe and reliable measurements of on-stream hot assets.
- Preform pre-shutdown inspections or inspect following process and IOW change.
- Expand your service offering to cover critical high temperature assets.

HotSense™ Ultrasonic Time-Of-Flight Diffraction (TOFD) Transducers

Minimise operational risk and maximise productivity with on-stream asset intelligence.

Keywords: TOFD, weld inspection, on-stream inspection, extreme environments, ultrasonic testing

HOTSENSE™

- Built on the award winning HotSense™ ultrasonic platform powered by the proprietary Ionix HPZ piezoceramic.
- -55 to +350°C [-67 to +662°F] continuous use temperature range.
- No cooling required. Increase your productivity by eliminating duty cycling.
- High sensitivity with integrated wedges across the temperature range.
- Stable signal for reliability and repeatability - no duty cycling means no drift from thermal gradients in the wedges.
- Short approach to beam exit to get closer to weld caps.
- Enhanced wear resistance for the most extreme environments and applications.
- Compatible with commercial scanners, calipers and crawlers.

APPLICATION

- Make weld inspections on hot assets, on-stream, without the need to shutdown or isolate.
- Make effective weld root corrosion assessments rapidly at high-temperature.
- Detect and size cracks or defects in welds or parent material on-stream.
- Screen for HTHA in-service.
- TOFD carries the highest POD for NDT methods.

SOLUTIONS

- Maximise productivity with reduced down-time and outages with on-stream inspection.
- Perform high-temperature pre-inspection to optimise shutdowns.
- Standardise data collection using commercial UT flaw detectors and scanners.
- Reduce operational costs and maximise production margins.
- Compliant to ISO 22232-2 and ASTM E/1065 to meet your existing asset integrity UT procedures.

STANDARD TRANSDUCER SPECIFICATION

PARAMETER	VALUE	UNIT
Operating Temperature	-55 to +350 / [-67 to +667]	°C / [°F]
Refracted beam	50, 60 and 70, longitudinal at 200°C / 392°F *	degrees
Wedges	Engineering polymer in steel, integrated Profiled on request	
Connector type	Lemo 00	
Pivot pins	5mm pins as standard **	
Couplant nozzles	To fit 4 - 4.5 mm tubes	
Ruggedisation	Designed to meet IP 65 Stainless steel construction	
Acoustic characteristics certificate of conformity to ISO 22232-2 supplied with each unit		
Transducer centre frequency	5.0 at 50 & 60 deg wedge angle 6.0 at 70 deg wedge angle	MHz
Active element diameter	6.0	mm
Beam exit distance from edge	1.5	mm

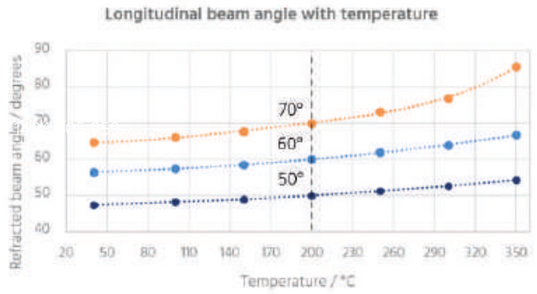
Compatible with UT flaw detectors and scanners

**Other variations available via special request.
For couplant, cables accessories and other specifications please contact our sales team.

MEASUREMENT RANGE

PARAMETER	VALUE	VARIABLES
Minimum wall thickness	6 mm	at 20 °C

*Refracted angle temperature dependence on steel



Scan the QR code to explore more about Ionix and the HotSense™ Ultrasonic TOFD Transducers.

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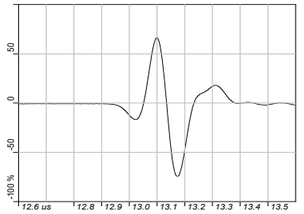
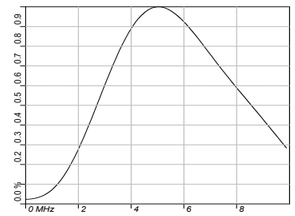
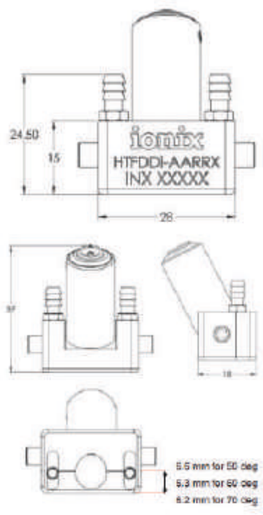
CERTIFICATION

Meets the requirements of ISO 16828 and ISO 22232-2 CE

TYPICAL ULTRASONIC RESPONSE







HotSense™ Ultrasonic Time-Of-Flight Diffraction (TOFD) Full Inspection Kit

Be ready for any weld inspection with a complete set of HotSense™ Time-of-Flight Diffraction (TOFD) transducers.

Keywords: TOFD, weld inspection, on-stream inspection, extreme environments, ultrasonic testing

High-Temperature Weld Root Corrosion Inspection

Time-of-flight diffraction on carbon-steel pipe welds at 200°C.

Scan the QR code to explore more about Ionix and the HotSense™ Ultrasonic TOFD.

HOTSENSE™

- Complete set of HotSense™ TOFD probes with integrated 50, 60 and 70˚ wedges with flat, 8”, 12” and 16” profiles to cover pipe diameters from 6” NPS to flat.
- Includes high-temperature couplant feed tubing, splitters and high-temperature cables.
- -55 to +350°C [-67 to +662°F] continuous use temperature range without cooling or duty cycling.

APPLICATION

- Cover scan depths up to 70 mm with a range of wedge angles and frequencies.
- Profiled wedges to maximise coupling and sensitivity on a range of assets.
- Make weld inspections on hot assets, on-stream, without the need to shutdown or isolate.
- Make effective weld root corrosion assessments rapidly at high-temperature.

INCLUDED ACCESSORIES	DESCRIPTION
2 x High-temperature dual cable 5 m Lemo 00 to Lemo 00	Rugged and reliable temperature resilient cables to connect to your scanner of choice
4 x Y-Splitter with tubing for couplant feed	High temperature splitter adapters to connect your couplant feed system to the HotSense™ probes
HotSense™ TOFD - Protective case with cutouts for 24 HotSense™ TOFD Probes, cables and accessories	A secure case to keep your probes safe, together and organised

OVERVIEW

Ultrasonic time-of-flight diffraction (TOFD) is a popular method widely used in petrochemical, energy and other industries for the in-service detection and characterisation of weld defects such as root corrosion, porosity, inclusions, and cracks. However, with increasing demand for on-stream measurements, conventional TOFD is limited due to the temperature at which these probes can operate, often causing failure of the transducer, or causing noise in the wedges to mask the ultrasound signal. Ionix high-temperature TOFD transducers, with integrated wedges, are suitable for weld inspections at continuous elevated temperatures up to 350°C. Here, the transducers with integrated wedges are mounted on to a modified Eddyfi LYNCS scanner for high-temperature encoding, with high-temperature couplant, connected to commercially available Mantis UT set, and a carbon steel pipe weld inspected at 200°C for weld root corrosion.

Highlights:

- The full circumference of the pipe weld was inspected at 200°C surface temperature.
- Remaining ligament of the weld root was accurately determined within ±0.2 mm of the benchmark data taken with conventional TOFD at ambient temperature.
- Suitable resolution was achieved for accurate weld root evaluation at elevated temperature.

METHODOLOGY

A carbon-steel pipe with a circumferential butt weld was inspected for weld root corrosion.

An Eddyfi LYNCS scanner was modified with magnetic wheels, compatible tool posts and encoder for high-temperature operation (up to 350°C) (Figure 1) and connected to an Eddyfi Mantis UT flaw detector set. A pair of Ionix HotSense™, 5 MHz, 6 mm diameter crystal HT TOFD probes with integrated 60 degree (at 200°C) 10”- profiled wedges were fitted with compatible pins for the LYNCS HT scanner, and coupled with Echo Ultrasonics Echo 6 HT pump-able couplant (with an auto-ignition temperature of 421°C) through the couplant channels on a continuous drip feed from a pump.

The probes were connected to the UT set via 5 m, dual lemo 00 to lemo 00 high-temperature cables. The pipe surface temperature was monitored by a K-type thermo couple

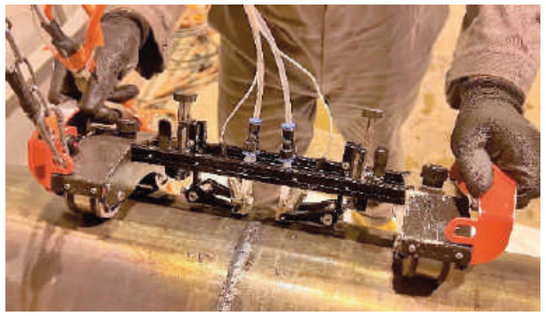


Figure 1: Photograph of the modified LYNCS scanner with probes for high temperature shown on a pipe section.

Figure 2: Photograph of the pipe weld inspected at 200 °C.

as 200°C after the probes and scanner were mounted and allowed to stabilise for 5 mins the A-scan range was set capturing the lateral wave, back wall reflection and mode converted wave on the pipe away from the weld, and a PCS set at 56 mm for the wedge angle of 60° with a velocity of 5745 m/s for 200°C in steel.

The pulser voltage was set to the default 200 V with a 100 ns pulse length. Receiver filters used were low pass 10 MHz. B-scans were produced for the circumference, scanning both halves from 12 o-clock position in 1 mm steps, after all loose scale and debris was removed with a steel wire brush (Figure 2).

RESULTS

The B-scan collected at 200°C (Figure 3) shows clear detection of the back wall and weld root corrosion. Remaining ligament analysis is plotted in Figure 4 and shows that the overall minimum ligament sizing is within ±0.2 mm of the benchmark TOFD data.

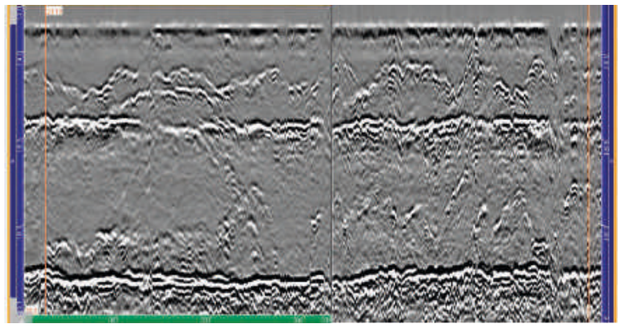


Figure 3: Two Mantis (Eddyfi) B-scan representations (lateral wave straightened) of each half, combined together, collected with 5 MHz, 6 mm dia. transducers with 60-degree integrated 10" profiled wedge from a 8" NPS diameter pipe butt weld at a surface temperature of 200°C with Echo 6HT couplant. Reference gain of 54 dB.

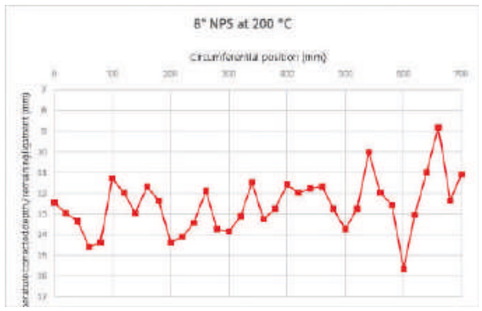


Figure 4: Plot of remaining ligament depth (mm) around the circumferential position at 200°C

CONCLUSION

Throughout the circumferential weld inspection at 200°C;

- Coupling is maintained with good lateral wave signal to noise.
- Acceptable accuracy of the remaining ligament is achieved even at elevated temperature.
- High-temperature TOFD is a suitable technique to determine wall loss due to weld root corrosion.

Scan the QR code to download full case study.

Liquid Couplants

To facilitate fast and reliable measurements across all temperatures

Keywords: liquid couplant, corrosion, erosion, inspection, high temperature

DESCRIPTION

Thickness gauging and corrosion mapping is often conducted in-service at temperatures exceeding 250 °C (482 °F) where not only can the couplant degrade, evaporate, or vaporise, but also reach the temperature at which auto-ignition can occur. Ionix supply a range of couplants for temperatures from -45 to +675 °C (-50 to +1250 °F). Our couplants offer high temperature stability, low corrosion characteristics, low toxicity, and smoke, and have a clear indication of their auto-ignition temperatures.

BENEFITS

- Gels or pastes with different viscosities for all applications.
- Couplants for all measurement applications from -45 to +675°C (-50 to +1250°F).
- Provide strong signals and fast response measurements across a broad range of temperatures.
- Non-toxic with low smoke and no residue options available.
- Options which meet ASTM F519 and offer long-term corrosion resistance and inhibition.
- Low viscosity options for scanning, by request.

APPLICATION

- All thickness measurements from -45 to +675°C (-50 to +1250°F).
- Scanning applications with low viscosity products.

Scan the QR code to explore more about Ionix and our Liquid Accessories.

DESCRIPTION	TEMPERATURE RANGE	PRODUCT CODE	UNIT
VersaSonic®, High Viscosity Meets ASTM F519 for corrosion resistance	-23 to +371°C (-10 to +700°F).	VS-04	4 fl. Oz/ 120mL
HiTempco Ultrasonic Couplant Excellent corrosion inhibition	-45 to +412°C (-50 to +775°F)	HT-04	4 fl. Oz/ 120mL
EchoTherm™ High Temperature Couplant	+93 to +538°C (+200 to +1000°F)	ETM-02	4 fl. Oz/ 120mL
EchoTherm Extreme™ High Temperature Couplant. Meets ASTM F519 for corrosion resistance.	-40 to +675°C (-40 to +1250°F)	ETM-EX-02	4 fl. Oz/ 120mL
Echo 6 High Temperature pumpable couplant	-40 to 357°C (-40° to 675°F)	Echo-6HT	1 Gallon/3.8 litres
Echo 8 High Temperature pumpable couplant	-45 to 425°C (-50° to 800°F)	Echo-8HT	1 Gallon/3.8 litres

Other couplants available by special request to meet any inspection requirement.
Contact Ionix for more information.

Accessories

Extension Handles

UT probe accessories to facilitate accurate, fast and reliable measurements across all temperatures.

Keywords: corrosion, erosion, on-stream inspection, extreme environments, high temperature, port inspection, extension wand

DESCRIPTION

Detachable handles to extend the reach of the HotSense™ UT probes to provide extra grip when wearing PPE and protect the user from extreme temperatures. Specifically designed to make port inspections easier and safer. The handles are simply screwed on to the back of the ultrasonic transducer using the integrated threads. Probes maybe switched between handles providing versatility across different applications. Optional strain relief on the 2" handle has a sealing gland which clamps around the cables to provide additional protection from water, couplant and debris ingress to the probe connector. Ideal for hand held use or automated scanning.

BENEFITS

- Extend the reach of the UT probe to protect the user from extreme temperatures and for making port inspections.
- Provides additional grip when handling the probe whilst wearing personal protective equipment (PPE).
- Protects the cable and probe connections from mechanical damage.
- Strain relief with 2" handle prevents water and dirt build up at the back of the probe.
- Light-weight with knurled surface to enhance grip.
- Hot swappable to adapt handle length as required for the application.
- Compatible with all standard, non-armoured cables.

APPLICATION

- Any extreme environment, or high-temperature spot or grid measurement.
- Ideal for port inspections.
- 2" handle and strain relief provide connector protection and cable lift off during probe scanning.
- 6" and 12" handles are ideal for ultra high-temperature (>350°C / 662°F) measurements.

ACC-18-002

Scan the QR code to explore more about Ionix and our Extension Handles.

DESCRIPTION	PRODUCT CODE	UNIT
2" handle with strain relief*	ACC-18-002	Each
6" port inspection handle	ACC-18-006	Each
12" port inspection handle	ACC-18-012	Each

*compatible with Ionix high-temperature cables, and 3rd party, non-armoured cables.

Transducer Cables

UT probe accessories to facilitate accurate, fast and reliable measurements across all temperatures

Keywords: corrosion, erosion, on-stream inspection, extreme environments, high temperature, cables, connectors

DESCRIPTION

High quality, UT cables to connect probes to any thickness gauge or flaw detector using compatible connectors. Cables are available with several connectors, lengths and identification pin options. Ionix stocks a range of off-the-shelf configurations and custom configurations are also available by request.

BENEFITS

- The fibreglass outer jacket provides heat and abrasion resistance to the cable assembly without impacting flexibility and keeping it lightweight.
- For high temperature variants, fiberglass, as opposed to a flexible metal conduit, prevents conduction of heat through the cable reducing risk of burning the operator or damaging equipment.
- The cable uses common connectors to allow integration to all thickness gauges and flaw detectors with options for gauges specific connectors and identification pins for Evident and Baker Hughes gauges.

APPLICATION

- For use with dual probes for thickness, corrosion, erosion surveys and TOFD probes for weld inspection.
- High temperature cable: up to 250°C continuous or up to 550°C intermittent.
- Standard temperature cable: up to 75°C continuous.
- Ideal for scanning application where a robust, lightweight cable option is required.

HT Dual UT Cable - Microdot to Olympus style

Scan the QR code to view all Transducer Cable options available.

Scan the QR code to explore more about Ionix and our Transducer Cables.

DESCRIPTION	OPTIONS	NOTES
Type	Flexible coaxial cable / Abrasion resitant sleaving	
Channels	1 / 2	
Length	1.5 m / 5 m	Others by special request
Protection	High-temperature fibreglass sleave	Others by special request
Connector 1	Microdot / Lemo 00 male	
Connector 2	Lemo 00 male / Lemo 01 male	Lemo 00-to-BNC adapter by special request
Gauge Identification pins	Evident (Olympus) / Baker Hughes (GE)	Eg. 38DL+
Handle Compatibility	All Ionix Dual Inspection Probes	

Masterclass in High-Temperature Ultrasonic Testing for Thickness, Corrosion and Erosion Surveys

An introduction to producing safe, reliable and high quality ultrasonic measurements for applications in oil and gas, chemical, energy and nuclear industries.

UT EXPERTS

- Content provided by high temperature UT industry experts.
- Includes training on making high temperature thickness measurements to ultrasonic testing procedures and guidance for on-stream corrosion and erosion surveys.
- Workshop content delivered within ASTM E797 and ISO 16809 framework.
- Theory and practical learning with hands-on high temperature inspection practice.
- Suitable for technicians and inspectors at all levels.
- 4 hour session delivered at your site or at Ionix offices.

WORKSHOP

- Safety and best practices.
- High temperature damage mechanisms.
- Influences of temperature on material properties.
- Main sources of error with UT.
- Measurement modes.
- Calibration procedures.
- Probe selection.
- Configuring and using different UT equipment.
- Procedure template.

KEY BENEFITS

- Ensure technicians and inspectors have the skills, knowledge and core competencies to make safe and reliable measurements of on-stream hot assets.
- Preform pre-shutdown inspections or inspect following process and IOW change.
- Expand your service offering to cover critical high temperature assets.

Scan the QR code to explore more about Ionix and the HotSense™ High Temperature Ultrasonic Masterclass.

OTHER SOLUTIONS

ionix
ADVANCED TECHNOLOGIES

ULTRASONIC MONITORING

HotSense™ enabled non-intrusive thickness monitoring solutions for in-service corrosion and erosion management.

- Minimise operational risk and maximise productivity with enhanced asset intelligence.
- Non-invasive, automated and wireless ultrasonic monitoring solutions for applications across refining, oil & gas, nuclear and process sectors.
- Creating value for clients by facilitating process operations and measurement in extreme environments.
- Proprietary high performance piezoelectric materials that can operate in high temperature environments.
- Enabling next-generation sensors, actuators and transducers.

hotsense®

NEXT GENERATION PIEZOCERAMICS

Ionix HPZ piezoceramics, assemblies and solutions level up sensors, actuators and devices within extreme environments.

- A vital ingredient to our HotSense™ sensors, transducers and probes.
- Creating the next generation of materials.
- Ionix HPZ has a range of key properties that make it an ideal piezoelectric material to sit at the core of your sensors, actuators and devices to enhance ruggedisation, increase the operating temperature range and maximise reliability.
- Ionix can produce tailored OEM projects as well as standard piezoceramics.

HPZ

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