

Redefining Reliability

TCR Technology Newsletter

2nd Quarter 2024

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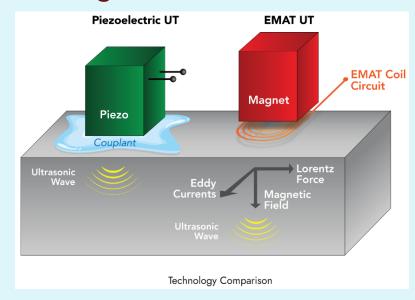
Topic of the \mathbf{Q} uarter

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Electro Magnetic Acoustic Transducer (EMAT)



What is Ultrasonic Testing (UT)

Ultrasonic Testing is the use of high-frequency sound waves to detect imperfections, take measurements or to locate changes in material properties of solid objects. Because of its capabilities and reliability, UT is one of the fastest growing Non Destructive Testing techniques. It is the method of choice for critical applications where full volumetric inspection is required, especially when there is only limited access to the object being inspected.

How is ultrasound generated with a piezoelectric transducer?

The piezoelectric crystal creates a mechanical disturbance (ultrasonic wave) when subjected to voltage. This ultrasonic wave is from the transducer into the object to perform the inspection. Because ultrasonic waves do not transmit easily through air due to differences in impedance, the transducer needs to be coupled using a liquid between the transducer and the solid being inspected.









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Electro Magnetic Acoustic Transducer (EMAT)

How is ultrasound generated with an EMAT

An EMAT or Electro Magnetic Acoustic Transducer consists of a magnet and a coil of wire and relies on electro-magnetic acoustic interaction for elastic wave generation (ultrasound). Using Lorentz forces and magnetostriction, the EMAT and the metal test surface interact and generate an acoustic wave within the material. The material being inspected is its own transducer and there is no need to couple the EMAT with the material, which is one of the EMAT advantages.

What kind of waves and what frequencies can you generate with EMAT

EMATs can easily generate any wave mode available with piezoelectric UT (Rayleigh, creeping, shear Vertical, longitudinal) plus others that are very difficult to generate with conventional methods (shear horizontal, Lamb). Also, EMATs can generate shear waves at any angle and sweep the material from 0° to 90° using the same transducer by simply modifying the frequency. In terms of frequencies available in system ranging from 50KHz to 12MHz.

What are the advantages of EMAT

Because the sound is generated in the part inspected, EMAT test has several unique advantages:

- It doesn't require couplant (dry inspection).
- It is not affected by surface conditions.
- It permits easier deployment of probes (especially important for automated inspections).
- It can generate unique wave modes (i.e. horizontally polarized shear energy and lamb waves) that are often difficult to reproduce with piezoelectric transducers.

What is horizontally polarized shear energy used for

Because of the specific particle motion, horizontally polarized shear energy is the only practical means to ultrasonically inspect austenitic welds and materials with dendritic grain structures (e.g. stainless steel welds). Moreover, as a guided or plate wave, horizontal shear waves fill up the thickness of the material and provide complete, thru-thickness inspection in one pass of the transducer.

In summary, what is a good application for EMAT

EMAT is especially well suited industrial applications where speed and accuracy of inspection are paramount and the conditions of the material and process are not always ideal due to the EMAT test advantages we have seen before.









Redefining Reliability

Electro Magnetic Acoustic Transducer (EMAT)

What materials can be inspected with EMAT

EMAT works with any material that conducts electricity. Overall, EMAT works with almost all metals, however some metals are better suited to the technique than others.

Why aren't EMATs used more frequently

EMAT is a relatively new technique still unexplored by many potential users. EMAT transducers also require high power and specific electronic equipment that is not widely available. As industry discovers the advantages of EMAT tests its use will spread to an increasing number of applications.

Are there standards for EMAT inspection

In terms of wave propagation and response to defects, the same standards that apply to conventional UT apply to EMAT. In addition to this, there are recognized ASTM standards on EMAT inspection.

Is EMAT equipment expensive

Because EMAT requires more power to generate the ultrasound, EMAT instruments are generally more expensive than piezoelectric UT instruments. However, by eliminating couplant delivery and disposal and being less affected by process and material conditions, they are significantly more cost effective in integrated inspection systems. In general, integrated EMAT systems are normally equivalent to or less expensive than piezoelectric UT systems.

Can we have fast inspection with EMAT

Real-time inspection at production speeds is one of EMAT's most interesting advantages. We currently have weld inspection systems operating at 3m/s, and some applications have reached inspection speeds of 26m/s.

Is EMAT safe

Yes. There are no health risks associated with either the technology or the equipment.

Can EMAT transducers be used in phased array

Yes, EMAT transducers can be used in phased array. EMAT manufacturers has developed several applications with phased array for inspection of welds and large volumes.









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Certifications:

ISO 9001-2015 Certificate

intertek Total Quality Assured

CERTIFICATE OF REGISTRATION

This is to certify that the management system of:

TCR Arabia Company Ltd.

Main Site: King Abdul Aziz Seaport Facility, P.O. Box 8143, Dammam 32211, Kingdom of Saudi Arabia

has been registered by Intertek as conforming to the requirements of:

ISO 9001:2015

The management system is applicable to:

Conventional Non-Destructive Testing Services (NDT), Advanced Non-Destructive Testing Services (ANDT), Metallurgical Services, Mechanical Laboratory Testing Services, Welding Inspection Service, Post Weld Heat Treatment (PWHT). Certificate Number: 21111010003

Initial Certification Date: 25 March 2014

Date of Certification Decision: 02 March 2023

Issuing Date: 02 March 2023

Valid Until: 24 March 2026



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President, Business Assurance

Intertek Certification Limited, 10A Victory Park, Victory Road, Derby DE24 82F, United Kingdom

Intertek Certification Limited is a UKAS accredited body under schedule of accreditation no. 014.



In the issuance of this certificate, Interfet assumes no liability to any party other than to the Client, and then only in accordance with the agreed upon Certification. Agreement. This certificate's validity is subject to the organization maintaining their system in accordance with Interfet's requirements for systems certification. Validity may be confirmed via email at certificate availation@interfet.com or by scanning the code to the right with a smartphone. The certificate remains the property of Interfet, to whom it must be returned upon request.





TCR Arabia Company Limited Inspection, Testing & Advisory Redefining Reliability

Certifications:

Mechanical Testing Lab of TCR Arabia is now ISO-17025 Accredited







Redefining Reliability

Certifications:

TCR Arabia is now ISO 14001 & 45001 Accredited



CERTIFICATE

This is hereby certified that the Environmental Management System of

TCR ARABIA COMPANY LTD.

P.O. Box 8143, Dammam 32211, TCR Arabia Company Ltd. Gas Gardens, King Abdul Aziz Seaport Facility, Dammam, Kingdom of Saudi Arabia.

Has been found to comply with the requirements of

ISO 14001: 2015

This certificate is applicable for the following scope:

Conventional Non-Destructive Testing Services (NDT), Advanced Non-Destructive Testing Services (ANDT), Metallurgical Services, Mechanical Laboratory Testing Services, Welding Inspection Service, Post Weld Heat Treatment (PWHT).

Certificate Number: KAEM202405031

Date of initial registration: 13 May 2024
Surveillance audit on/before: 13 April 2025
Certificate expiry: 13 May 2025

Receitification due.



CARROLL

KVQA Assessment Private Limited is accredited to United Accreditation Foundation (UAF), UAF is internationally recognized by having a signatory status across multilateral recognition arrangement of International Accreditation Forum (IAF) and Asia Pacific Accreditation Forum (IAF) and Asia Pacific Accreditation

The certificate is valid subject to successful completion of surveillance audits. Verify validity/status on www.iso-registration.com or on mail at info@iso-registration.com

UAF address: 400, North Centre Dr, STE 202, Norfolk, VA23502, United States of America



CERTIFICATE

This is hereby certified that the Occupational Health & Safety Management System of

TCR ARABIA COMPANY LTD.

P.O. Box 8143, Dammam 32211, TCR Arabia Company Ltd. Gas Gardens, King Abdul Aziz Seaport Facility, Dammam, Kingdom of Saudi Arabia.

Has been found to comply with the requirements of

ISO 45001: 2018

This certificate is applicable for the following scope:

Conventional Non-Destructive Testing Services (NDT), Advanced Non-Destructive Testing Services (ANDT), Metallurgical Services, Mechanical Laboratory Testing Services, Welding Inspection Service, Post Weld Heat Treatment (PWHT).

Certificate Number: KAOH202405032

Date of initial registration: 13 May 2024
Surveillance audit on/before: 13 April 2025
Certificate expiry: 13 May 2025
Recertification due: 12 May 2027









Website: www.iso-registration.com | Email: info@iso-registration.com

(VOA Assessment Private Limited is accredited to United Accreditation Foundation (UAF). UAF is internationally recognized by having signatory status across multilateral recognition arrangement of International Accreditation Forum (IAF) and Asia Pacific Accreditation cooperation (APAC).

The certificate is valid subject to successful completion of surveillance audits. Verify validity/status on www.iso-registration.com or on email at info@iso-registration.com

UAF address: 400, North Centre Dr. STE 202, Norfolk, VA23502, United States of America



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Approvals:

TCR Arabia is now an approved contractor in SABIC for providing high-end inspection services like HTHA/FFS, Metallurgy Solutions and Root Cause Analysis.











TCR Arabia Company Limited

Inspection, Testing & Advisory Redefining Reliability

ARAMCO & SABIC Appreciation Letters:







Redefining Reliability

Services Portfolio



TESTING

Material Testing

Mechanical
Tensile, Impact, Hardness, Bend,
Elongation, Yield

Corrosion

ASTM A923, A262, G28, G48

Welder Qualification

WPS, PQR, WQT, Welder Certification

Civil Laboratory

Soil, Aggregates & Field Tests

Construction Material Testing, Concrete,



INSPECTION

Non-Destructive Testing (NDT)

Conventional NDT

RT, MT, PT, UT, UTT, FM, PMI, HT

Advanced NDT

ToFD, PAUT, Corrosion Mapping

Helium Leak, Thermography, MFL

ECT, RFT, IRIS, HTHA, High Temp UT

Inspection Manpower NDT Technicians, Plant Inspectors, Inspection Engineers, Corrosion Engineers



Inspection of buried & above ground assets

Metallurgy Testing

In-situ Metallography,

Remaining Life Assessment

Failure Investigation

Fitness for Service

Non-Metallic Testing Lab. FRP/GRP/Composite Lab Testing



CONSULTING

- Stress Analysis
- Risk Based Inspections (RBI)
- Damage Mechanism Study
- Third Party Inspection
- Coker Drum Inspection
- Trainings (NDT, Metallurgy, Welding)
- Plant Asset Integrity Management
- Corrosion Study







Redefining Reliability

Location

TCR Arabia Head Office & Labs are located in Dammam Branch Offices in Jubail & Yanbu































Redefining Reliability

Events

TCR Arabia is featured on The Gulf Time newspaper page 8 under Energy dated 14 June 2023

TCR Arabia, an Indian JV company, completes 15 successful years in Kingdom of Saudi Arabia

One of the key reasons for TCR Arabia's success is the expertise of its founding companies

SAUDI ARABIA /GULF TIME

CR Arabia is a company that specializes in engineering services specifically in the field of Material Testing, Advanced Non-Destructive Testing and Metallurgical investigation. Founded in 2007 as a joint venture between TCR Engineering Services (India) and GAS Arabian Service (Saudi Arabia). The company is based in Saudi Arabia and has rapidly established a reputation for reliability and quality in all sectors it services namely oil & gas, petrochemical, mining, desalination, power, fertilizer and other such process and manufacturing industries.

One of the key reasons for TCR
Arabia's success is the expertise of its
founding companies. TCR Engineering
Services (India) has over 50 years of experience in providing engineering solutions for a wide range of industries, including oil
and gas, power, and infrastructure. On the other
hand, GAS Arabian Service is a leading provider of
engineering services in the Middle East, with a
strong reputation for delivering high-quality projects on time and within budget.

Together, TCR Arabia combines the best of both worlds: The experience and knowledge of TCR Engineering Services (India) with the local expertise and understanding of GAS Arabian Services. This unique combination of expertise enables TCR Arabia to provide a comprehensive range of engineering services to its clients in the

region.

TCR Arabia offers a wide range of services, including Advanced Non-Destructive Testing Services, Material Testing Services (Mechanical, Metallurgical and Non-Metallic Products), Engineering & Consulting on all process related assets, Welding Inspections, Welder Qualifications, Heat Treatment etc. TCR Arabia has partnered with global specialized companies in providing solutions to clients on Robotic Inspections, Coke Drum Inspections, Boiler Inspection & Life Assessment etc.

As an ISO-9001-2015 Certified and ISO-17025 Accredited Organization, TCR Arabia ensures all its services are delivered to its clients as per global standards and prescribed procedures. Trained and qualified staff ensure that quality is not compromised at any level of testing and inspection works.

As an employee oriented organization, we value the contributions of every single employee in the growth of our organization. Our employees play a key role in planned expansion, strategic

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| Vectori

TCR Arabia serves majority of its clients in the downstream industry' which includes Saudi Aramco, SABIC, TASNEE, CHEVRON, ADVIANCED, SNCC, Saudi Electricity Company, Petrorabigh, SADARA, SATORE, MAADEN and so on. It also serves all major contracting companies in infrastructure development and maintenance projects

development and technical expertise which results in winning the trust of our valued clients and to serve them to higher standards everytime. Today we are a strong team of qualified API Engineers, NDT Engineers, Metallurgists, Skilled Technicians.

One of the key factors that sets TCR Arabia apart from its competitors is its commitment to safety. The company places a strong emphasis on safety in all of its projects, and it has implemented strict safety procedures to ensure the safety of its employees, as well as its clients. TCR Arabia also carries out regular safety audits to ensure that all of its projects are being carried out in compliance with the highest safety standards.

TCR Arabia is committed to develop the local manpower (Saudi Nationals) by providing 'on the job' trainings, class-room trainings in the field of NDT & Material Testing. Consistent growth in the percentage of IKTVA (In-Kingdom Total Value Addition) has yielded positive results in the success of TCR Arabia.

In conclusion, TCR Arabia is a leading engineering services company in Saudi Arabia and the Middle East. Backed by the trust of its valued clients and the ability of its staff to deliver quality services, the organization is motivated to serve and deliver best results year after year.

Syed Ameen Hassan, Country Manager, TCR Arabia, Saudi Arabia

Syed Ameen heads the TCR Arabia operations in Saudi Arabia. MBA in Marketing and Finance, from Chifley University, Australia, Syed Ameen has been instrumental in developing the business of TCR Arabia from its inception stage. Experience of over 25 years in the Saudi Arabian and Middle East market, specifically in the m-stream industry business, helps Syed sen to reach out to the decision makers.

Middle East market, specifically in the down-stream industry business, helps Syed Ameen to reach out to the decision makers and also run the operations in a professional manner Business plans, budgeting, decisions on CAPEX / OPEX and Resources Management are his key roles and reports to the EXCOM & Board Members on the performance of the Organization.

Under the leadership of Syed Ameen, the anginzation has grown from its incubation stage to one of the top Inspection & Testing Companies in Saudi Arabia. Ensuring routine business with all major clients is the key to sustenance of the Organization and Syed Ameen has been instrumental in gaining long term contracts with major clients like Saudi Aramoo, SABIC, TASNEE, MAADEN, SWCC etc. Expansion of the organization by setting up new service areas like Robotic Inspection Services, Welder Qualification Department, Mechanical Testing Lab, Metallurgical Testing Lab, Corrosion Testing Lab are some of key achievements.

Operational alliance with major international service providers like CANAP Engineering of India for Stress Analysis Studies, CIA of Canada for Coker Drum Inspections, Planys of India for Submersible Robotic Inspection and so on were formed under the leadership of Syed Ameen to provide advance inspection and technical support to all of TCR's valued clients in KSA. Adapting to the fast evolving Inspection Field with new and advanced techniques to help the client save loss of production time and improve profitability. TCR team is consistently working in offering safer, faster and reliable inspection and testing techniques to clients under the leadership of Syed Ameen.

An Active team player and a firm believer in Team Work, Syed Ameen has been able to develop a team of professional engineers, technicians, admin staff, and support staff to work towards a common goal of developing the organization.



Redefining Reliability

Events

Celebrating 50 years of TCR



Since 1973, TCR Engineering Services is well known for its work ethics, precision, transparency, & reliability and has been trusted by over 3500 customers across India. TCR's expertise guarantees superior quality, safety, and reliability, empowering business to reach new heights while fueling the national economy through enhanced product performance, reduced downtime, and accelerated innovation. Together, we are the key drivers of the "Make in India" movement to build a vibrant and prosperous economy.

TCR has completed NDT works on over 3000 kms. of Cross-Country Pipeline for EPC companies on IOCL and GAIL sites. TCR offers specialized fatigue testing for Reinforcement Couplers and Grouter for Mechanical Splices of Bars in Concrete used in Infrastructure and Road construction projects. Defence industry vertical is served by undertaking Fracture Toughness and Fatigue Crack Growth Rate analysis. TCR has worked on over 5000 failure investigation cases, over 75 Fitness For Service assignments and over 300 boiler RLA projects.

TCR is approved by IOCL, GAIL, RIL, L&T, JSW, HAL, NMRL, DMRL, PDIL, DRDO, CQAE, RITES, BMC, Mecon, EIL, BSE, NSE, Mazagon Dock, NPCIL, Customs Authority India and Saudi Aramco, SABIC, PDO, QCHEM, QAFCO, KOC, KNPC, Iraq Ministry of Oil, SHELL, National Oilwell Varco, Sakhalin Energy and many others internationally. TCR is the preferred laboratory for members of the Bombay Metal Exchange and the Mumbai Steel Traders Association.

TCR prides itself in being a Pan-India based material testing and inspection services company with global operations in Saudi Arabia, Qatar, Kuwait, Malaysia and Nigeria.

MATERIAL TESTING LAB

- Mechanical Testing
- Chemical Analysis Spectro
- NACE Sour Gas Corrosion
- CTOD & Fracture Toughness
- Coupler & Rebar Fatigue Test
- Railtrack butt joint Fatigue
- Microstructure Studies
- SEM & EDAX Analysis
 Welder Qualification
- Hot Tensile
- RoHS Compliance
- Construction/Civil Lab
- Composite Testing
- Wet Chemical

NDT & INSPECTION

- Cross Country Pipeline RT
- ToFD and PaUT
- Robotic Reformer Tube Inspect
- Robotic Tank Inspection
- Hobotic Tank Inspection
- Eddy Current Test for Tubes
 IRIS, RFET and MFL
- Metallographic Replica
- Wetallographic Replica
- Helium Leak Detection
- PMI-Positive Material Id
- Gamma Radiography
 PWHT and Heat Treatment
- Civil NDT for Concrete
- Inspection of BridgesThird Party Inspection

ENGINEERING CONSULTING

- · Asset Integrity Management
- · Pipeline Integrity
- Fitness for Service
- Remaining Life Assessment
- Boiler Audit
- · Failure Analysis Investigation
- Insurance & Litigation Referee
- · Digitalization of RT Films
- Plant Relocation Advisory
- Manpower Supply for Turn Around
- · CAD/CAM and Piping Stress Analysis
- Custom Research
- Welding Consulting
- · Plant Reliability Training



Redefining Reliability

Events

Celebrating 50 years of TCR



BME House, 88/90 Kika Street, 2nd Floor, Room #18, Gulalwadi, Mumbai - 400 004 Tel: +91-9699210864 / 9920011298 +91-9820008656 / 8779216510

TCR Engineering (Eastern)

Plot No.114/1955, Vishnu Vihar, Jayapur Pahala, Bhubaneswar, Odisha - 752101 Tel: +91 - 9776704680

TCR Nashik

Shubham Park, Building No. 7 # 30, 'C' Wing, Near Bhole Mangal Karyalay, Cidco, New Nashik - 422010 Tel.: +91 - 8421922315

TCR Assam

H. No. 28, Saiz Lane, Bethal Path, Bagharbori, Guwahati, Assam - 781037 Tel.: +91 - 9932034791

TCR Southern

52, A4, 3rd Main Rd, Mogappair West, Chennai, Tamil Nadu - 600037 Tel: +91 - 9566615842

TCR Advanced (Bharuch Division)

711, 7X-The Business Hub, Opp. K. J. Polytechnic College, Above Sales India Showroom, Bholav, Bharuch - 392001, Gujarat Tel: +91- 9898084235

Pune - Sample Collection Center

Shop No A53, Plot No T 204, Next to D Y Patil Hospital, Pavana Complex, Bhosari, Pune, Maharashtra, India Tel: +91 - 9762801034

Evolve by TCR

215, Pancham Icon, Vasna Road, near D-Mart, Vadodara, Gujarat - 390007 Tel: +91 - 7574801050

www.tcreng.com | sales@tcreng.com



ISO/IEC 17025 : 2017 Accredited Testing Laboratory by

NABL

Vide Certificate No. TC - 6905



Redefining Reliability

Events

TCR Arabia will be participating in the following exhibitions:



Jubail Corrosion Conference & Exhibition September 2-4, 2024



SABIC CONFEX 2025 January 26-30, 2025



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Events

2nd Asset Integrity and Process Safety Conference & Exhibition 2024













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Events

2nd Asset Integrity and Process Safety Conference & Exhibition 2024













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Events

Br-CAT Training





NRCC Audit













TCR Arabia Company Limited

Inspection, Testing & Advisory

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Events

Client Visits





Client Visits













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Rohit V. Bafna and Advanced Infra Visit













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Events

Client Visits





Audit by L&T













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Events

Training: Pulse Eddy Current by Mr. Waheed





Product Training













TCR Arabia Company Limited Inspection, Testing & Advisory Redefining Reliability

Events

TCR PLANYS Robotics Presentation held at Berri Gas Plant





Inspection Technology Roadshow 2024 held at ARAMCO Khurais













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Inspection Technology Roadshow 2024 held at ARAMCO Khurais













