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## TOTAL FOCUSING METHOD

One of the methods used in HTHA Detection.

The Total Focusing Method (TFM) is an ultrasonic array technique which is used to synthetically focus at every point of a region of interest.

Main Advantages of TFM Optimal focusing and spatial resolution everywhere Direct imaging of a large area for one probe position All reachable angles with the array simultaneously Defect characterization Comprehensive imaging of defect 3D imaging.



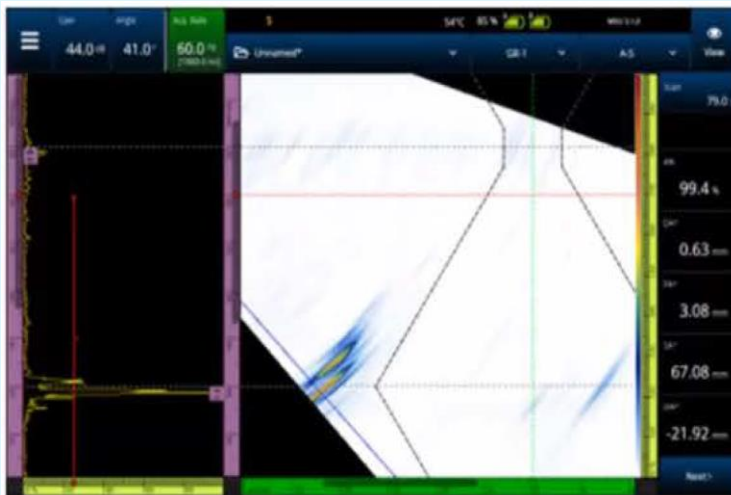
### TFM

#### Advantages

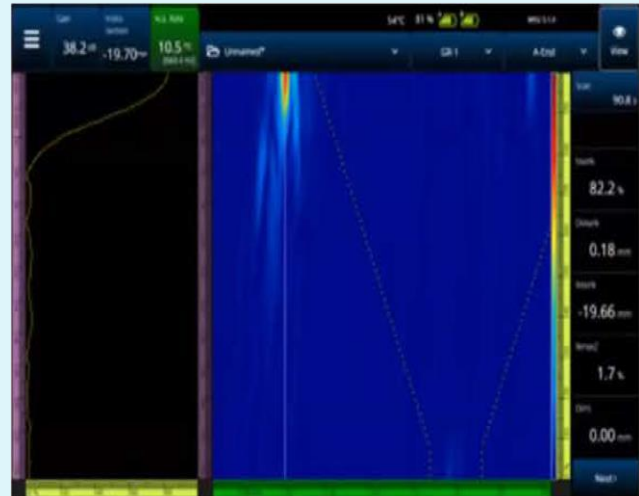
- Accurate visualization
- Image is focused at all points
- Sound propagation
- Near Surface resolution
- All reachable angles with the array simultaneously
- Defect characterisation
- Comprehensive imaging of defect

#### Limitations

- Selection of proper wave set for type of flaws
- "Expected" focus at all points
- Penetration / attenuation for (some probe vs PAUT)



PAUT OD Crack



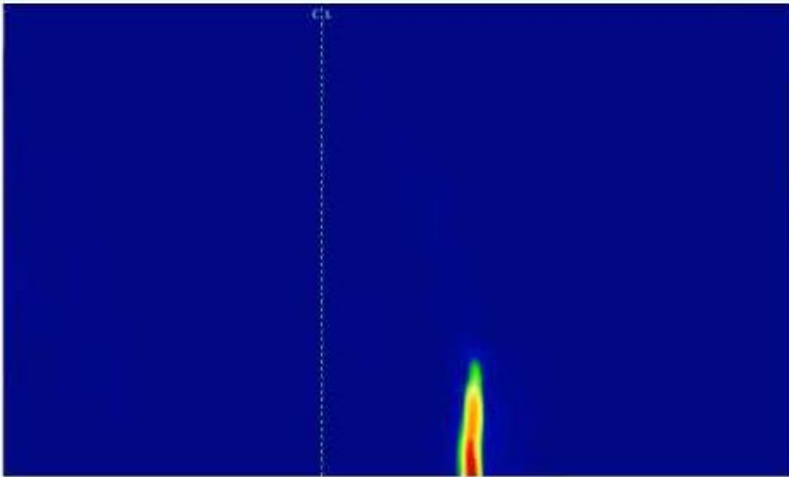
TFM 5T OD Crack

✓ Typical detection with PAUT vs TFM and how self-tandem mode can improve characterization

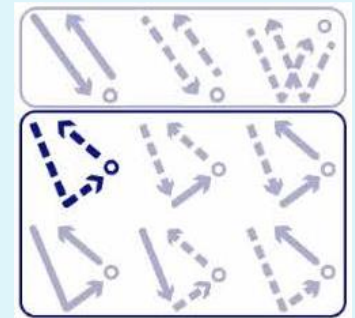
✓ OD Crack using PAUT and 5T (self-tandem) wave set

### TFM Advantages

- Typical detection with PAUT vs TFM and how self-tandem mode can improve characterization
- OD Crack using PAUT and 5T (self-tandem) wave set

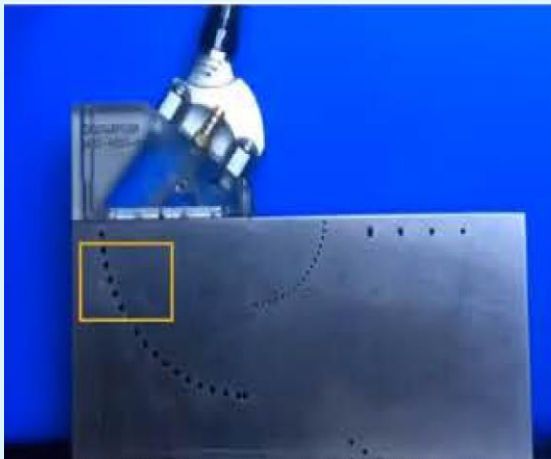


ID Crack in TTT



### TFM Limitations

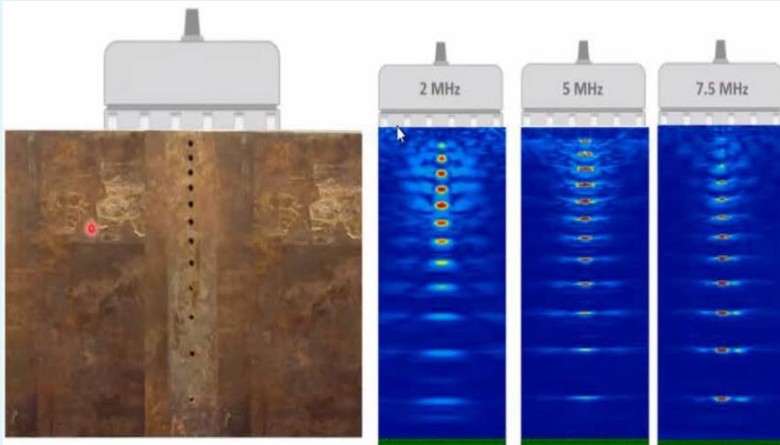
- Selection of proper wave set for the type of flaws.



SDH on resolution block



### TFM Limitations



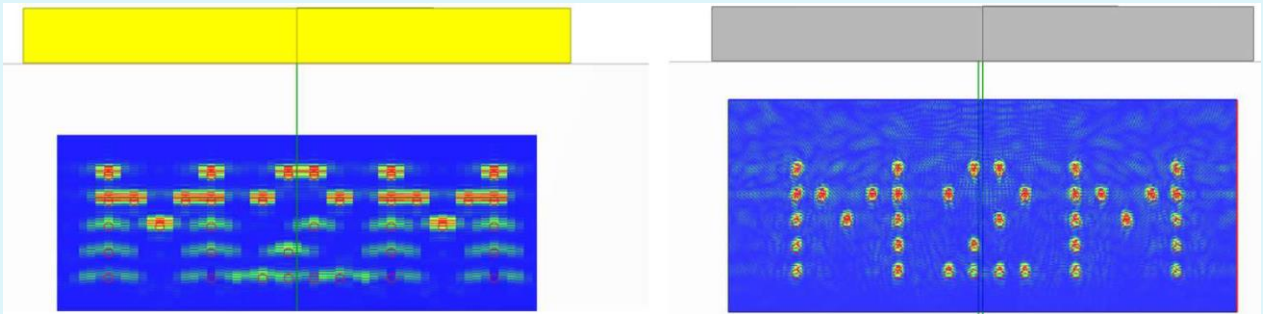
ID Crack in TTT

### Other considerations for TFM inspection

- ✓ Amplitude Fidelity and Zone Resolution
- ✓ Thickness variations
- ✓ Velocity variations
- ✓ Geometry variations

### Comparison with PAUT

#### Comparison of Linear Scanning with TFM



#### Electronic Scanning

- 8 Element aperture
- Focused along the defect in the middle
- 57 shots
- Focusing capability limited by selected aperture
- Directive beam (along direction of propagation)

#### TFM

- 64 Element aperture
- Focused everywhere
- 64 shots
- Complete aperture for focusing
- Omni-directional beam

### SUMMARY

1. Image: Both PAUT and TFM can display an excellent image. TFM can be set to display an image that is closer to the actual geometry.
2. Focus: TFM is engineered to be focused everywhere in the near-field region.
3. Detection: Both TFM and PAUT can provide an equivalent or better detection performance than the other, depending on the application:
  - ✓ The ability of TFM to focus everywhere can help resolve smaller indications, such as inclusions and porosities.
  - ✓ However, the TFM's sensitivity drops significantly in areas outside its main acoustic influence zone.
  - ✓ Operating a TFM inspection without proper preparation can lead to poor or lack of detection, just like PAUT.

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. Box8143, 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) and Microbiology Testing Services, Civil Laboratory Testing Services

Certificate Number:

21111010003

Initial Certification Date:

25 March 2014

Date of Certification Decision:

10 March 2020

Issuing Date:

10 March 2020

Valid Until:

24 March 2023



Intertek



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Calin Moldovean

President, Business Assurance

Intertek Certification Limited, 10A Victory  
Park, Victory Road, Derby DE24 8ZF, United  
Kingdom

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



### Certifications:

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



## CERTIFICATE OF ACCREDITATION

*This is to attest that*

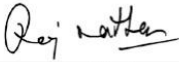
**TCR ARABIA COMPANY LTD**  
KING ABDUL AZIZ SEAPORT FACILITY  
DAMMAM 32224, KINGDOM OF SAUDI ARABIA

**Testing Laboratory TL-783**

has met the requirements of AC89, *IAS Accreditation Criteria for Testing Laboratories*, and has demonstrated compliance with ISO/IEC Standard 17025:2017, *General requirements for the competence of testing and calibration laboratories*. This organization is accredited to provide the services specified in the scope of accreditation.

Effective Date May 11, 2020



  
\_\_\_\_\_  
**President**

Visit [www.iasonline.org](http://www.iasonline.org) for current accreditation information.



### 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.

Classification: Internal Use



Tuesday, August 20, 2019

Subject: APPROVED CONTRACTOR CONFIRMATION

Dear Mr. Darwin,

This is to confirm that "TCR Arabia Ltd. KSA" is an approved third party and part of "Approved Contractor List" (ACL) of SAUDI BASIC INDUSTRIES CORPORATION (SABIC) to conduct business as a third party inspection & testing contractor for onshore/ offshore services for SABIC site & Mega projects. The onshore/offshore services are:

- Conventional NDT techniques (RT,UT, PT, MPT, VT & PMI)
- Advanced NDT techniques (ToFD, PAUT, MFL & tube inspection).
- Material testing (destructive)
- Welder qualification
- HTHA/FFS services
- Metallurgy solutions
- Root Cause Analysis

However, this certificate has been issued upon the request of above named contractor for whatever purpose it may serve him without any liability on the part of SABIC.

Best Regards,

*Gehad Al-Otaibi*  
for *Gehad Al-Otaibi*  
Gehad Al-Otaibi  
Senior Manager  
Global Suppliers relationship Management



SABIC  
Shared Services  
Global Procurement Services  
P.O. Box 11115  
Jubail Freezone - Il City 31961  
Kingdom of Saudi Arabia  
T: 966 13 350 6600  
F: +966 13 350 6333  
[www.sabic.com](http://www.sabic.com)

Saudi Basic Industries Corporation  
Saudi Joint Stock Corporation  
Authorized capital: SAR 30 billion  
CR: 1010010813

الشركة السعودية للصناعات الأساسية  
شركة مساهمة سعودية  
رأس المال المصرح به 30 بليون ريال  
رقم التسجيل 1010010813

سابق  
الخدمات المشتركة  
خدمات المشتريات العالمية  
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ص. ب. 11115 المنطقة الحرة  
الجبيل - المملكة العربية السعودية  
هاتف: +966 13 350 6600  
فاكس: +966 13 350 6333  
[www.sabic.com](http://www.sabic.com)



ASNT Partner



ISO 9001-2015 Certified



ISO 17025 Accredited

### ARAMCO Appreciation Letters:





### SINOPEC Appreciation Letters:



## فرع شركة سينوبك انترناشيونال بترولسيوم سيرفيس كورپوريشن Branch of Sinopec International Petroleum Service Corporation

S.No. A 25183

TCR Arabia Company Limited,  
Dammam,  
KSA

20<sup>th</sup> March, 2022

### Letter of Appreciation

SINOPEC would like to appreciate the efforts of TCR Arabia in supporting our emergency welder qualifications requirement by meeting our stringent deadlines with utmost care and professional ability. We would like to express our appreciation to the strong technical team of TCR Arabia for the services rendered to SINOPEC.

We are delighted to find a technically sound, professionally able and a reliable partner to support in our inspection and testing needs.

Wishing TCR Arabia great success in the years ahead.

Best Wishes,



**Zhao Gangchen**

Project Director  
Branch of SINOPEC International  
Petroleum Services Corporation

\* مسح جيوفيزيالي • حفر • المنشآت • تأجير معدات ثقيلة  
س.ت. ٢٠٥١٠٢٩٨٩٢، رأس مال ١٠٢٠٠٠٠٠٠٠٠٠٠ ريال سعودي - ص.ب ٣٣١٥٩ الخير ٣١٩٥٢ - المملكة العربية السعودية - تلفون: +٩٦٦ ١٣ ٨٥٧٥٨٠١ - فاكس: +٩٦٦ ١٣ ٨٥٧٥٨٠٢  
C.R. 2051029892, Capital SR. 102,000,000 - P.O.Box 32159, Al-Khobar 31952, Kingdom of Saudi Arabia - Tel.: +966 13 8575801 - Fax: +966 13 8575803

# CORROSION TESTING LABORATORY

SAUDI ARAMCO APPROVED

ISO 17025 Accredited



Approved by Saudi Aramco for:

- ✓ Mechanical Tests  
(Tensile, Bending, Hardness, V-Charpy Impact)
- ✓ Macrographic and Metallographic
- ✓ Chemical Analysis (PMI and OES)
- ✓ Corrosion Tests (ASTM A923, A262, G28 and G48)
- ✓ Failure Analysis
- ✓ Replica

### 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

Construction Material Testing, Concrete, Soil, Aggregates & Field Tests

##### Metallurgy Testing

In-situ Metallography,

Failure Investigation

Remaining Life Assessment

Fitness for Service



#### 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

##### Robotic Inspection Services

Submersible Inspections

Inspection of buried & above ground assets

##### 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



# TCR Arabia Company Limited

## Inspection, Testing & Advisory

Redefining Reliability

### Location

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



GPS Location: 26.450525, 50.193787



ASNT Partner



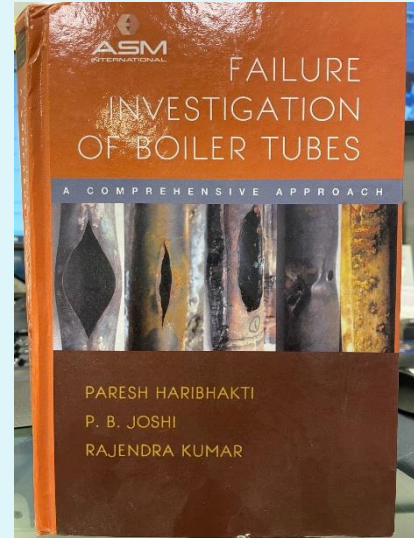
ISO 9001-2015 Certified



ISO 17025 Accredited

### Events

#### Book Presentation – Failure Investigation of Boiler Tubes – A Comprehensive Approach Published by ASM International



#### Failure Investigation of Boiler Tubes: A Comprehensive Approach

Published: 2018

Authors: Paresh Haribhakti, P.B. Joshi, and Rajendra Kumar



Failures or forced shutdowns in power plants are often due to boilers, and particularly failure of boiler tubes. This comprehensive resource deals with the subject of failure investigation of boiler tubes from basic fundamentals to practical applications.

Material Resources / Publications

### ASM Technical Books

When you need a reputable materials reference book, look no further than ASM technical books. The ASM book collection contains hundreds of titles across all fields of materials science from respected experts in the field. Browse through the ASM collection to find exactly what you need for your research, for curiosity, or to add to a library collection.

### Events

### Trainings



### Events

#### Training Clients on Infrared Thermography Level II



### Client Visit

