JULY/AUG 2023 VOLUME 10 | NO 4

AINDT

INDUSTRIAL EYE

THE OFFICIAL JOURNAL OF THE AUSTRALIAN INSTITUTE FOR NON-DESTRUCTIVE TESTING

RADIOGRAPHY ▪ ULTRASONICS ▪ EDDY CURRENT ▪ PENETRANT ▪ MAGNETIC PARTICLE

VIBRATION ANALYSIS ▪ LUBRICATION ANALYSIS ▪ THERMOGRAPHY ▪ ACOUSTIC EMISSION

THE ASSET RELIABILITY EDITION

CEO Message

Dr. Irene Pettigrew

I am honoured and excited to continue my dedication to the AINDT community as the new CEO. As I step into this role, I want to take a moment to express my gratitude for the warm welcome and the opportunity to work with such a talented and dedicated team.

First and foremost, I want to commend the remarkable work that AINDT has accomplished over the past 60 years. Your commitment to excellence in NDT and CM has established AINDT as a leader in the industry, and I am thrilled to be part of this journey.

I have lived and breathed NDT all my professional career and have been actively involved on a voluntary basis within NDT and materials related not-for-profit organisations for the past 20 years.

I have had experience at all levels within the industry spanning from academia, on-site technician work across Australia, technical management and been active behind the scenes of the AINDT for 10 years (branch level, federal level, board level, various certification board responsibilities and most recently as Federal President). This exposure to all aspects of the industry has provided an invaluable foundation with working with the AINDT for making strategic decisions and leading the overall operations.

As we embark on this new chapter together, I want to emphasize my unwavering commitment to our shared goals: education and training, to continue delivering outstanding certification and membership services, driving innovation, and exceeding customer expectations. Our commitment as an industry to maintaining the highest standards of quality, safety, and professionalism will remain at the core of everything we do.

I strongly believe in the power of collaboration and open communication. Your experience, expertise, knowledge, and insights are invaluable assets that will guide us towards new horizons. I encourage each and every one of you to actively participate, share your ideas, and contribute to our collective success. Together, we will chart a path that leads to even greater achievements.

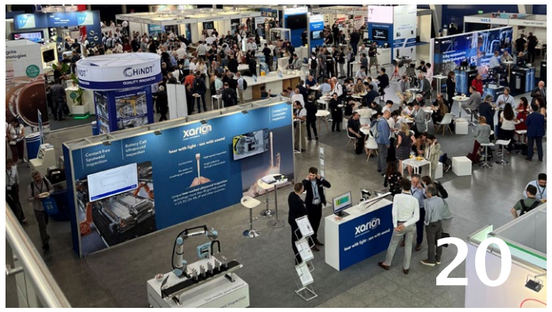
In the rapidly evolving landscape of NDT and CM, it is crucial for us to stay ahead of the curve and ensure longevity. We will embrace digital transformation, foster a culture of continuous professional development and learning and continue to deliver a premium certification and membership service. By doing so, we will continue to grow the NDT and CM community, adapt to industry trends, seize opportunities, and strengthen our position as a trusted partner in asset reliability.

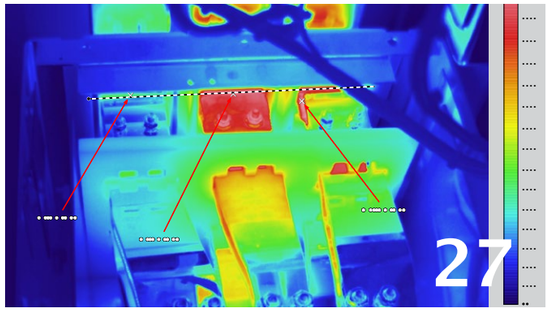
Lastly, I want to acknowledge that success is not just measured by financial metrics, but also by the positive impact we have on our employees, certification holders, members, volunteers, customers, and the communities we serve. I am committed to fostering an inclusive and diverse work environment where every individual feels valued, empowered, and motivated to thrive.

Thank you for your dedication and commitment to the AINDT. Together, we will navigate the future with confidence, integrity, and a shared passion for excellence. As incoming CEO my six leading priorities include people and culture, finding growth, taking on risk, managing regulatory requirements, leveraging technology and innovation. I look forward sharing more on how these will be incorporated into the AINDT's strategic plan, getting to know each of you and working together.

Haste Ye Back!
Dr Irene Pettigrew

CONTENTS





AINDT News

Industry News

Technical Article

Product & Services

Cover Image

TBC

INSTRUCTIONS TO AUTHORS OF TECHNICAL ARTICLES

Manuscripts should be submitted in electronic form:
1. in word
2. typed with single spacing
3. with figures as tif or jpeg files at better than 300dpi

Manuscripts should include:
1. symbols and abbreviations conforming to recognised standards; metric units (SI)
2. references listed, after the text, in the order in which they occur in the paper
3. references indicated in the text by arabic numerals in square brackets
4. tables and figures numbered separately but consecutively with Arabic numerals and brief, descriptive titles
5. a reference in the text to all tables and figures
6. graphs and diagrams made with lines of sufficient thickness to reproduce well
7. titles and address of authors

Procedure for submission of manuscripts:
1. articles should be sent to: journal@aindt.com.au
2. manuscripts will be submitted to referees who will remain anonymous
3. reprints of each paper will be supplied free to the author

Published by:
The Australian Institute for Non-Destructive Testing,
PO Box 52, Parkville, Vic 3052 Australia

ISSN: 2203-2940

The purpose of the Certification Boards, in accordance with ISO 17024.

The most critical role of the AINDT NDT and CM Certification Boards in maintaining compliance with ISO 17024 and the JAS-ANZ accredited status for ISO 9712 and ISO 18436. The responsibilities of the Certification Boards are discussed, focusing on impartiality management and ensuring unbiased certification activities.

Impartiality is a key priority, and the certification body must document its structure, policies, and procedures to maintain fairness. Top management commitment to impartiality is crucial, and a public statement emphasising the importance of impartiality, conflict of interest management, and objectivity assurance is required.

The certification body is responsible for treating applicants, candidates, and certified individuals impartially and fairly. Certification shall not be restricted by financial or other limiting conditions, and measures are in place to avoid unfair practices. Ongoing identification of threats to impartiality is emphasised, and steps are taken to analyse, document, and minimise potential conflicts of interest.

To safeguard impartiality, certification activities involve balanced involvement of interested parties. Structural requirements, including organisational structure documentation, are essential to maintain impartiality throughout the certification process.

The responsibilities of the parties involved in the certification body's operation, implementation of policies and procedures, finances of the certification body's, resources, development and maintenance of certification schemes, assessment activities, and decisions on certification and contractual arrangements.

AINDT takes immense pride in its certification scheme and is fully committed to delivering world-class service to all certified personnel. You can be rest assured that your certification holds the utmost value and recognition in the industry.

Non-destructive Testing Certification Board (NDTCB) – Chairperson's Message

Barry Cooper

The Certification Board has had a few enquiries this year pertaining to Certification in UT-PAUT or UT-TOFD. Namely the pre-requisite to hold a minimum of UT 2 in the main method to hold Certification in UT-PAUT or UT-TOFD.

This is a requirement of ISO 9712:2021; Paragraph F.2.2 states that: ' Certification in a technique is valid as long as the certification in the main method is valid'.

Further to this, ISO 9712:2021 Table F.4 specifies that UT 2 is the prerequisite for both. Some of the arguments that have been offered up to challenge this pre-requisite is that other Certifications schemes don't have this pre-requisite, or it wasn't a pre-requisite before. The CB can't cherry pick parts of the standard we agree with or disagree with; especially when changes to ISO:9712 are introduced. To maintain our third-party accreditation, we must meet all requirements of the standard and enforce them.

I was recently asked why AINDT has not ever offered up Certification in Radiographic Interpretation Level 2 Welds (RI-2W), like other ISO:9712 Schemes? This has come about by the growing number, especially in Western Australia, of NDT Technicians with a State Radiation Safety Licence and RI-2W Certification from other ISO:9712 Certification Schemes, working as full Radiographers within our industry; without also gaining the full Radiography Test Level 2 Welds certification (RT2-W). My personnel view is that you need to be trained and certified with the additional competencies and training hours to take a quality radiograph to the applicable Code; not just be trained and certification to interpret and report results to the Code, to perform the whole task.

I am not challenging the validity of Radiographic Interpretation Certification, and I believe this is a valid Certification for what it was originally designed for; being image Interpretation and reporting.

But I personally believe it is an overreach to use RI-2W and a State Radiation Safety Licence to perform the whole task for code compliance. The practice of accepting just RI-2W and a State Radiation Safety Licence to perform the whole radiographic task is acceptable at some work sites and not at others, causing further confusion in our industry.

Finally, it is a new financial year, please renew your AINDT Membership if you haven't already. That reminds me, mine is due as well.

Barry Cooper
Chairperson – AINDT NDT Certification Board

Condition Monitoring Certification Board (CMCB) – Chairperson's Message

Shawn Moore

Progress is ongoing in the process of transforming the paper-based certification exam papers into digital format. Within the upcoming six months, the conversion is projected to be finalised for all existing certification examinations presently offered. Once the examination papers have been thoroughly finalised and made accessible, a notification will be sent to inform individuals of their availability.

Upon implementation, candidates will be required to take the exams using tablet computers, that are equipped with controls limiting the device's functionality exclusively to the examination. These controls will ensure that candidates can only access the necessary features and applications required for the examination process, maintaining a secure and controlled environment.

The transition from paper-based to digital certification exams signifies a significant advancement, streamlining the examination procedure and offering a more efficient and convenient experience for candidates. The completion of this conversion initiative will mark a crucial milestone in modernising the CM certification process, aligning it with the technological advancements of the digital era. The commencement of online examinations is anticipated to occur at the earliest opportunity. This innovation will enable improved protection of the examination data base, and improvement of statistical data collection for review of examinations. Online examinations also provide a more efficient process for sitting exams and processing the results from the examinations.

Shifting the focus to a different topic, the Vibration Analysis group have been busy preparing the Cat 3 Vibration Analysis examination papers. It is expected the exams will be finalised and be available for candidates by mid-year. Notification will be sent out when these exams are available. Lastly, AUSPTA will be holding a thermography conference in Brisbane at Hotel Grand Chancellor, Brisbane, Queensland on the 27 October 2023. This is the first time AUSPTA has held a conference in Queensland, and will be a great opportunity tosee presentations on condition monitoring for mining, electrical, as well as many other areas of thermography.

For details check out the website www.auspta.asn.au. All registrations include complimentary morning tea, lunch, and afternoon tea. Attendance at all AUSPTA events is free for members and their guests

Shawn Moore
Chairman – AINDT CM Certification Board

From the Institute

With open arms and immense delight, we proudly introduce Irene Pettigrew as the new CEO of AINDT. Irene brings a vast reservoir of NDT expertise, and we have no doubt that she will steer AINDT towards a prosperous future.

With the AINDT Branch Annual General Meetings (AGMs) in full swing, the Federal Office has been diligently assisting the various branch councils to ensure a successful and engaging event for members.

The AGMs serve as the pinnacle event for each branch, where members have the opportunity to attend, network, and share their experiences and activities in the NDT & CM industry.

The branch councils invest a significant amount of time and effort to meticulously plan every aspect of these events, striving for perfection. It is of utmost importance for each state to celebrate its activities and recognise the invaluable contributions of volunteers who have dedicated countless hours throughout the year to support the state-based membership.

In addition to the AGMs, the branches organise a series of technical events throughout the year, which are offered free of charge to members. These events provide an opportunity to earn recertification points for Certification as per the requirements outlined in the AINDT Guide to Certification. One particularly popular event is the 'Intro to NDT' evening, presented by Mr. Paul Grosser, which caters to both experienced NDT practitioners and non-NDT personnel.

The primary objective of the 'Intro to NDT' events is to offer individuals who are not actively engaged in the NDT industry a better understanding of the various NDT methods and their significance in the broader engineering sector. These events have already been successfully conducted in South Australia, and similar events are planned to be held in Western Australia, Queensland, and New South Wales in the upcoming months.

For more information about these events and all other AINDT activities, it is recommended to follow the AINDT's LinkedIn page or visit the events page on the AINDT website.

Furthermore, the AINDT website is currently undergoing a revamp, and the newly designed website is scheduled to be launched within the next month. Taking into account feedback received from AINDT certificate holders and members, the new website layout aims to offer an improved user experience with easier navigation. Once the website is launched, the Federal Office eagerly welcomes additional feedback to ensure continuous improvements and enhancements in the customer experience provided by the Melbourne-based team.

INTRODUCTION TO NON-DESTRUCTIVE TESTING (NDT) INFORMATION SESSION

Are you seeking to enhance your staff's expertise and knowledge in Non-Destructive Testing (NDT)? **Look no further!**

We are pleased to present our free "Introduction to NDT" training session, specially tailored to provide your QA professionals and non-technical personnel with a deeper understanding of this critical industry topic.

Course Overview:

Including the basic NDT methods, the session will also cover:

- Advanced Techniques (Digital Radiography, PAUT, ToFD, Acoustic Emmision)
- Australian and International Standards
- Qualification / Certification and Career Pathways
- General Q&A

Our Expert Presenter:

We take immense pride in providing top-tier instruction for our participants. Our experienced trainer Paul Grosser, Level 3 NDT, has a successful track record in the NDT industry, ensuring an engaging learning experience.

Date: 11 August 2023 **Time:** 1:00pm **Duration:** 4.5 hours
Location: Parmelia Hilton, 14 Mill Street, Perth **Cost: Free**

Membership Registrar's Message

Hi AINDT members,

The AINDT CEO, branch presidents and Membership Registrar had their third 2023 meeting to identify any areas of the AINDT membership benefits, which can be enhanced to give membership what they deem as good membership benefits/incentives.

On behalf of the AINDT membership, we extend our sincere congratulations to Irene Pettigrew on her appointment as the CEO of AINDT. Throughout the rigorous interview process, several AINDT Board and Federal Council members represented the institute, and I express my gratitude to them for their efforts and time. As the new AINDT CEO, Irene holds the role of making corporate decisions, overseeing operations, charting the institute's future and strategic course, and being accountable to the board of directors. I have confidence that Irene will excel in her new position and lead the institute towards continued success.

Would like to acknowledge Peter Milligan's efforts in supporting AINDT whilst this search continues. The institute continues to operate smoothly due to his ongoing commitment to its staff and members as well as running his own company. Thank you for your dedication and hard work.

AGM Importance, an AGM facilitates open communication between members and the Federal board. It is a chance to for two way dialogue accountability for actions raised over the past year to ensure decisions are made in the best interest of AINDT.

Make sure you contact your local state branch or look at AINDT website for AGM date and venue closest to you.

Member Benefits

- As you may be aware, the AINDT website is currently being updated to improve navigation for its members.
- Members Portal has seen AINDT membership and certification go electronic providing certification details, payment of membership, in progress applications and logbook.
- AINDT employment opportunities site for NDT/CM professionals.
- Regular editions of the AINDT Journal.
- Discounted certification and renewal fees.
- Free and discounted advertising on AINDT website.
- On and Off-site technical advice.
- Membership discounts for Corporate & Sustaining member employees.
- Exclusive Corporate benefits.

Please continue to support AINDT.
Regards, Craig Taylor

Member List

May 2023

The AINDT is a national peak body which promotes the professional practices of non-destructive testing and condition monitoring personnel. Our mission is to provide members, industry and the community with an independent and professional level of service in relation to the science and practice of non-destructive testing.

Through the State Branches and Federal Office, the AINDT aims to be an efficient and effective technical society by operating as a recognised notification body and providing membership to individuals, companies and government bodies who wish to keep informed or have an interest in non-destructive testing, engineering, or materials and quality testing in general.

AINDT provides businesses with the opportunity to be recognised as a contributor of this professional Institute by becoming a Company, Corporate or Sustaining member. By holding such membership, companies can benefit from advertising opportunities, heightened support, staff certification control and much more.

We would like to thank the following companies for their valued support:

SUSTAINING MEMBERS

ATTAR
D R May Inspections
EnerMech
Intertek - Adelaide Inspection Services
SRG Industrial Pty Ltd

SUSTAINING MEMBERS

Chevron

CORPORATE MEMBERS

Azure NDT Quality Services Pty Ltd
Baker Hughes
Bureau Veritas Australia
Chemetall (Australasia) Pty Ltd
Evident Australia Pty Ltd
Hofco Oilfield Services
MDR Certification Engineers Pty Ltd
OMS Engineering Pty Ltd
SafeRad SE Asia Pty Ltd
Sonomatic Ltd
TR Pty Ltd

COMPANY MEMBERS

NSW

ARL Laboratory Services Pty Ltd (Yennora)
AXT Pty Ltd
Barry Evans Lifting World
Bluescope Steel (Wollongong)
EN DE TEK
Hot Engineering
HVT Inspection Services
Magnetic Analysis Aust Pty Ltd
NBQC and Inspections Services
NDT Equipment Sales Pty Ltd
Nobel Engineering Services
Reliance Hexham
Russell Fraser Sales Pty Ltd
Simplifi Nii P/L
SmartChem Industries Pty Ltd
Sonix NDT Pty Ltd
Thermal Imaging Services (AUS)

QLD

AXS Pty Ltd (Mackay)
Industrial Mining Inspection Solutions
International Tube Testing Pty Ltd
Lucas Drilling
Metal Testing Pty Ltd
M-Test Mackay
Queensland Alumina Limited
Testing Inspection and Calibration Services

VIC / TAS

ABEN Technical Services
ATCL
Defence Science and Techology Organisation (DSTO - Fishermans Bend)
Gippsland NDT Services Pty Ltd
iTest NDT
LMATS Pty Ltd (Williamstown)
NATA
OMS Software Pty Ltd
QENOS
Shantou Institute of Ultrasonic Instruments Co Ltd
Stocks and Partners Ltd
Total Asset Solutions

SA / NT

ASC Pty Ltd
Kuzer Technical
NDE Solutions
Red Earth NDT Pty Ltd

WA

Alliance Solutions Group
Applecross Electrical & Testing Service
Asset Reliability Inspections Pty Ltd
Assurity NDT & Consulting
Australian Institute of Maintenance Engineering
GoldFields NDT
Hofmann Engineering
ICM Training Solutions
Integrity Engineering Solutions
Metlabs Australia
MJ Engineering Inspection Services (Welshpool)
Vertech
NDT Instruments Pty Ltd
Weld Integrity
Wood - Asset Performance Optimisation

NOTICE OF THE 56TH ANNUAL GENERAL MEETING OF THE AINDT

The AINDT extends a warm invitation to all financial members for its 56th Annual General Meeting, scheduled to take place at the Rendezvous Hotel Melbourne.

Venue: **Rendezvous Hotel Melbourne**
Address: **328 Flinders St, Melbourne**
Date: **Friday, October 13, 2023**
Time: **5:00 PM AEDT**

The AGM serves as a significant occasion to commemorate achievements, reflect on past accomplishments, and set sights on the upcoming year. It also presents an excellent opportunity to connect and network with colleagues and peers in the industry.

All financial members of the AINDT are eligible to participate in the AGM. In the event that a member is unable to attend, they have the option to nominate another member as their proxy to represent them. To obtain a proxy form, interested members can request one by emailing: office@aindt.com.au.

Members who wish to include additional agenda items must submit their requests in writing no later than Thursday 15 September 2023.

Statements of Income and Expenditure for the period from 1 July 2022 to 30 June 2023, as well as Statements of Assets and Liabilities as of 30 June 2023, will be distributed during the AGM. In the lead-up to the event, these documents will be made available on the AINDT website, along with the draft minutes from the 2022 AINDT AGM.

AGENDA

1. Attendees / Apologies / Proxies
2. Disclosure of interest
3. Confirmation of the Minutes of the 54th AGM held at Rendezvous Hotel Melbourne 7 October 2022
4. Business arising from the Minutes
5. Receipt of the 55th Annual Report
6. Receipt and acceptance of the Statements of Income and Expenditure for the period1/7/22 to 30/6/23 and statements of assets and liabilities as at 30/6/23
7. Appointment of Auditor
8. a) Election of Office Bearers(Directors): for 2023-2024

   b) Ratification of Federal Councilors (Regional & Office Bearers) for 2023 - 2024
9. Close.

AINDT

JSNDI celebrates its 70th Anniversary in Tokyo June 2023

The Japanese Society For Non-Destructive Inspection (JSNDI) welcomed the AINDT to join them in celebrating their 70th Anniversary in Tokyo in June of 2023. Through this great opportunity, we further developed our relationship with not only all those who have been involved with JSNDI but also with other esteemed NDT associations and institutes from around the world. The AINDT was represented by Mr Richard Stocker and Mr Paul Grosser.

This JSNDI 70th Anniversary was celebrated over four days that consisted of:

Sunday 4th – Welcoming dinner at the Japanese Pub Restaurant "Mekikinoginji"

Monday 5th – A technical tour of the Toshiba facility and sightseeing tours of Yokohama and Kamakura, followed by a casual dinner "Japanese Pancake" at Tsukishima

Tuesday 6th – The main event hosted at Gakushi-Kaikan, Tokyo

JSNDI 70th International Invited Lectures

- Chair: Prof. Ikuo Ihara, President, JSNDI
- Dr. Takamasa Ogata, Chair, JSNDI 70th Anniversary Committee – Welcome Address
- Dr. S. K. Babu, Chair, International Committee for Non-Destructive Testing (ICNDT)
- "Implementation of ISO 9712:2021 Certification in Asia Pacific Region"
- Mr. Danny Keck, President, The American Society for Nondestructive Testing (ASNT) – "Ethics in the NDT Industry"
- Mr. David Gilbert, Chief Executive Officer, The British Institute of Non-Destructive Testing (BINDT) & Ms. Caroline Bull, UK Research Centre in NDE Director and Past President of BINDT – "Collaboration is the key to engineering the future"
- Dr. Ralf Holstein, Chief Executive Officer, Education and Training Director, German Society for Non-Destructive Testing (DGZfP) –"NDE 4.0 & Training" – How will the 4th Industrial Revolution influence our qualification system?
- Prof. Emer. Teruo Kishi, Director-General, Sakura Science Program Headquarters, Japan Science and Technology Agency (JST), Professor Emeritus, the University of Tokyo – "Science and Technology Diplomacy"

70th Anniversary Commemorative Ceremony

- Opening Address – Dr. Takamasa Ogata, JSNDI 70th Anniversary Chair
- Greetings and Remarks – Prof. Ikuo Ihara, JSNDI President

Dr Takamasa Ogata & Richard Stocker.

JSNDI President Professor Ikuo Ihara, Richard Stocker, Paul Grosser & Dr Takamasa Ogata – AINDT presenting JSNDI with Congratulatory Gift.

Kagami-Biraki Ceremony

- Congratulatory Remarks from Invited Guests:
  - Dr. Eisuke Mori, The House of Representatives, Former Minister of Justice, Japan
  - Mr. Atsushi Yasuda, Director, Ministry of Economy, Trade and Industry, Japan (METI)
  - Prof. Sunao Ishihara, The Japan Federation of Engineering Societies (JFES), Vice-President
  - Dr. Sajeesh K. Babu, The International Committee for Non-Destructive Testing (ICNDT), Chair
- Introduction of International Invited Guests, JSNDI 70th Anniversary Acknowledgement of Gratitude

70th Anniversary Celebration

- Welcome Address – Dr. Takamasa Ogata, JSNDI 70th Anniversary Chair
- Chorus (Japanese Songs) – Foresta (Japanese Chorus Group)
- Kagami-Biraki Ceremony (Japanese Traditional Event) – Signifying the end of a period and the start of another.
- Celebratory Toast – Dr. Teruo Kishi
- Congratulatory Address to International Guests – To Prof. Ikuo Ihara, JSNDI President and Dr. Takamasa Ogata

Wednesday 8th – Technical Tours of the JSNDI Training Centres in both Mizue and Kameido followed by lunch at Masumoto then a sightseeing tour of Tokyo including the famous Tokyo Sky Tree and Soramachi. Then the event being wrapped up with the JSNDI Symposium Gala Dinner.

Throughout the entire celebration we enjoyed the unparalleled hospitality shown by our Japanese hosts, who left no detail unattended. This meticulously planned celebration was certainly one to cherish and remember. The JSNDI looked after both attendees attending in a professional capacity along with family members in attendance like gold and nothing was too much at any stage.

JSNDI Presenting the AINDT with a thankyou gift.

In thanks for our invitation and to show our gratitude along with congratulations, the AINDT presented the JSNDI with a canvas depicting their 70th Anniversary celebration logo, painted by a local indigenous artist in a traditional method that was warmly received and front and centre when displaying all of the wonderful gifts they received from around the world.

Again, the AINDT congratulates the JSNDI on such an achievement and thanks you for your wonderful hospitality and the invitation to celebrate this milestone with you!

2022 AINDT Examination Awards for Highest Marks

Each year, AINDT presents awards for outstanding performance in its examinations. The primary purpose of these awards is to promote the advancement of skills in the NDT field and enhance professionalism within our industry.

To be eligible for these awards, individuals must be a financial member of AINDT at the time of the examination and apply for certification within the same year (2022).

We would like to express our congratulations to all the below winners, for their remarkable accomplishment and achieving the Highest Marks in the 2022 AINDT Examination Awards.

New South Wales

Andrew James Bryant – Overall total score 275

Total Asset Solutions Penetrant Academic Excellence Award

Highest percentage pass mark in the AINDT level 2 overall exam results (General, specific and practical) penetrant examination.

Jake Graham – Overall total score 180

Duerr NDT & ENDETEK Radiographic Testing – CR/DR Award

Highest Percentage Pass Mark for Overall exam results (General, Specific and Practical) in the AINDT Level 2 Radiographic Testing – CR/DR examination

Jamie Flores – 82%

Baker Hughes Ultrasonic General Award

Highest Percentage Pass Mark in the AINDT Level 2 Ultrasonic General Examination in the Year 2021:

Jamie Flores – Overall total score 252

OMS Software Pty Ltd Ultrasonic Award

Highest Percentage Pass Mark in the AINDT Level 2 UT 2 Overall Exam Results (General, Specific and Practical).

Tyler Wakefield Burman – Overall total score 292

AINDT Magnetic Particle Academic Excellence Award

Highest Percentage Pass Mark in the AINDT Level 2 Overall Exam Results (General, Specific and Practical) Magnetic Particle Examination in the Year 2021

Queensland

Dean Pozzan – 98%

Chemetall Magnetic Particle Award

Highest Percentage Pass Mark in the AINDT Level 2 Magnetic Particle Practical Examination

Digby Sever – 95%

SmartChem Penetrant Award

Highest Percentage Pass Mark in the AINDT Level 2 General Penetrant Theory Examination.

Eric Callingham – Overall total score 263

Endetek Eddy Current Academic Excellence Award

Highest Percentage Pass Mark in the AINDT Level 2 Overall Exam Results (General, Specific and Practical) Eddy Current Examination

Marcus Wheeler – 97%

SmartChem General Magnetic Particle Award

Highest Percentage Pass Mark in the AINDT Level 2 General Magnetic Particle theory examination

Paul Riley – Overall total score 185%

Evident Phrased Array Ultrasonic Award

Highest Percentage Pass Mark in the AINDT Level 2 Specific and Practical Examination

South Australia

Leslie Daniel – 95%

Baker Hughes Radiography Award

Highest Percentage Pass Mark in the AINDT Level 2 Radiography Practical Examination

Timothy Wiggins – Overall total score 258

LMATS Pty Ltd Radiographic Award

Highest Percentage Pass Mark in the AINDT Level 2 Best Overall Exam Result (General, Specific and Practical) Radiographic Examination.

Benjamin Searle – Overall total score 176

Evident Time Of Flight Diffraction Award

Highest Percentage Pass Mark for Overall Exam Results in the AINDT Level 2 Examination.

Victoria

Steve Ledwidge – 97%

Chemetall Penetrant Award

Highest Percentage Pass Mark in the AINDT Level 2 Penetrant Practical Examination.

SA/NT Branch Report July 2023

Greetings from the SA branch!

We are halfway through the calendar year and have seen another financial year come and go. On the 14th of July we celebrated the achievements of the South Australia & Northern Territory Branch at the much-anticipated annual SA/NT branch AGM and social night which took place at the Adelaide Oval function rooms.

The Oval is an amazing venue and has been the setting for the AGM for the past few years. This year over 50 members were in attendance. It was a hugely successful evening thanks to member participation and the generosity of our evening sponsors, who once again 'came to the party'. A very big and grateful thank you to NDE Solutions, Red Earth NDT, Kuzer Technical and Evident Scientific for the sponsorship you provided, without industry support the AGM would be just another meeting on the calendar.

During the evening the typical AGM agenda items were covered including the nomination of new SA/NT Council representatives: **President**: Simon Wilding, **Vice President:** Tyson Jenke **Treasurer**: Hans Zuidland and

Secretary: David Suede

But the highlight of the evening is the presentation of awards. This year SA/NT council were privileged to hand over awards to the following well-deserved candidates:

- Mr Gary Bateup: The AINDT Meritorious Service Award, in recognition of his exceptional service to AINDT and the SA Branch.
- Mr Digby Sever: SmartChem Industries Pty Ltd Penetrant Testing (General Exam)
- Mr Leslie Daniel: Baker Hughes Radiography Award Radiography (Practical Exam)
- Mr Timothy Wiggins: LMATS Pty Ltd Radiographic Award
- Mr Benjamin Searle: Evident Time of Flight Diffraction Award

Though the formalities of the AGM are required for the good governance of the branch, it is also vital for the social health of the industry. In the fast-paced world we work in the AGM is a great place for old friends to be re-acquainted and new acquaintances to become good friends.

One such friend is Mr Karl Saul, who has stepped down as branch president. The AINDT SA/NT branch council and members thank Mr Karl Saul for his unwavering and dedicated leadership over the past year. Although Karl had a career change to a new industry, he held the reigns and lead from the front with his quiet determination and concise decisions. It has been a busy first half of the year, let's see what the second half has in store. On behalf of AINDT SA/NT branch council.

Regards
Simon Wilding, President – AINDT SA/NT Branch.

Simon Wilding SA Branch President presenting Benjamin Searle his Evident Time of Flight Diffraction Award.

Simon Wilding SA Branch President presenting Digby Sever his SmartChem Industries Penetrant Testing (General Exam) award.

Simon Wilding SA Branch President presenting Leslie Daniel his Baker Hughes Radiography (Practical Exam) Award.

Simon Wilding SA Branch President presenting Timothy Wiggins his LMATS Radiographic Award.

QLD Branch News

I hope this report finds you well. As the President Queensland Branch of the Australian Institute for Non-Destructive Testing (AINDT), it is my pleasure to present to you an overview of our Branch's activities and accomplishments over the past 12 months.

The AINDT Queensland Branch has experienced only a small decline in membership since the beginning of the year. We have welcomed several new members as some older members retire, and our total membership now stands at 189. This consistency demonstrates the increasing interest and recognition of non-destructive testing (NDT) within the industry.

We are also proud to announce the David Kirk and Roger Hardy have received the Tony Sonneveld meritorious service award for their continued service to AINDT over the last few decades. Along with those awards a number of the Queensland branch members received awards for the highest examination marks:

- 2022 SmartChem Magnetic Particle Award
  Mr. Marcus Wheeler
- 2022 Chemetall Magnetic Particle Award
  Mr. Dean Pozzan
- Evident Phrased Array Ultrasonic Award Mr. Paul Riley
- Endetek Eddy Current Academic Excellence Award
  Mr. Eric Callingham

To enhance member engagement, in the next 6 months we have organised various events, including technical seminars, workshops, and networking sessions.

These initiatives have provided valuable opportunities for knowledge sharing, professional development, and networking among our members. We encourage your active participation in these events to maximize the benefits of your AINDT membership.

The AINDT Queensland Branch remains committed to promoting continuous learning and professional development among our members. We would like to remind members that these events and council involvement assist with your accreditation and continued learning. The more people we have involved the easier the lifting is.

Looking ahead, the AINDT Queensland Branch has plans to further enhance our services and benefits to members. We will continue organising informative events, expanding our network of collaborations, and advocating for the recognition and importance of NDT within the industry.

Justing Cavanagh QLD Branch President and Roger Hardy and David Kirk – Tony Sonnoveld Meritorious Service Award Winners.

Justing Cavanagh QLD Branch President and Paul Riley receiving his Evident Phased Array Ultrasonic Award.

We also encourage active involvement from our members in shaping the direction of our Branch. If you have any suggestions, ideas, or would like to contribute to our initiatives, please do not hesitate to reach out to us.

In conclusion, I would like to express my gratitude to the AINDT Queensland Branch committee members, volunteers, and all our members for their continued support and dedication. Together, we can make a significant impact in advancing the field of non-destructive testing.

Regards
Justin

VIC Branch News

2023 AGM

A busy and eventful year has just come to a close for the Victorian branch of the Australian Institute for Non-Destructive Testing (AINDT). The year was capped off with an Annual General Meeting (AGM) and at the historic Esplanade Hotel in St Kilda. The AGM was held in the enchanting Ghost of Alfred Felton area, beautifully styled with antiques and paintings from around the world, dedicated to the memory of Alfred Felton, a renowned entrepreneur, chemist, philanthropist, and art collector who once resided at the Espy until his passing in 1904.

The members and guests who attended enjoyed an evening of delightful food, drinks, and mingling. We are grateful for the generous support from our sponsors, OMS (Gold Sponsor), and EVIDENT (Silver Sponsor), who have been long-time supporters of our branch and this event. We extend our genuine thanks to both OMS and EVIDENT for their continued support and contribution to the success of the AGM and Victorian branch.

AGM Highlights

During the AGM, President Paul Trigg addressed the attendees and highlighted the accomplishments of the Victorian branch throughout the year. The branch successfully organised five technical events and two social events, which were met with positive responses from our members who found them to be of immense value.

One significant event that stood out was the APCNDT Conference in Melbourne, which provided an excellent opportunity for local members to gather and participate in a knowledge-sharing experience with like minded people from around the world.

We are pleased to announce that the Victorian Branch Council will continue with the same councillors this year.

Awards and Recognitions

At the AGM, we were proud to announce Steve Ledwidge as the recipient of the prestigious 2022 Chemetall Penetrant Award. Steve's exceptional achievements in exam results have been recognised, and we extend our congratulations to him on this well-deserved award.

Image TBC

Image TBC

Additionally, we would like to acknowledge the commendable contributions of two of our esteemed members, Paul Grosser and Richard Nowak, who were presented with the JB Cole award during the APCNDT Conference. Their dedication to advancing the field of non-destructive testing is truly praiseworthy, and we congratulate them on this achievement.

Tech Night: Welds and NDT Part 2!

One of the highlights of the year was the "Tech Night: Welds and NDT Part 2," where Sadegh Abbasour delivered a captivating presentation on welding techniques, specifically on SAW (Submerged Arc Welding) and GTAW (Gas Tungsten Arc Welding). The feedback received from our members was overwhelmingly positive, with many finding it to be an enriching refresher and a valuable opportunity to gain deeper insights into these welding processes, including common challenges and potential issues.

VIC Branch Tech Night, Sadegh Abbasour presenting Welds and NDT Part 2.

From the branch

The Victorian branch of AINDT had a remarkable year full of engaging events and productive activities. We extend our sincere gratitude to all our members, sponsors, and presenters who have contributed to the success and growth of the branch. The enthusiasm and dedication displayed by our members reaffirm our commitment to furthering the field of non-destructive testing in the region.

As we look forward, we are excited about the possibilities and opportunities that lie ahead and are eager to continue our mission of promoting excellence and innovation in non-destructive testing within the Victorian community.

NSW Branch News

The NSW Branch Annual AGM and Dinner took place in Sydney's iconic area, The Rocks, where the NSW Branch celebrated the accomplishments of the previous year.

We were privileged to present the prestigious AINDT 2022 awards for members from NSW. To have so many talented and dedicated individuals in NSW, speaks volumes about the abundance of skill and commitment within our Institute, assuring a promising future for the industry.

Mr Andrew James Bryant
2022 Total Asset Solutions Penetrant Academic Excellence Award

Mr Tyler Wakefield Burman
AINDT Magnetic Particle Academic Excellence Award

Mr Jake Graham
2022 Duerr/EN DE TEK RT CR/DR

Mr Jamie Flores
2022 Baker Hughes Ultrasonic Award & 2022 OMS Software Pty Ltd Award

The NSW branch will be hosting numerous upcoming events.

An EOI has been sent out by the NSW branch for a Suppliers night (please contact if not received), to be held in the 2nd half of 2023. Pleasingly, there has already been a huge amount of interest and we'll work in the background with all interested parties to make sure this is a great success for all.

The MFL technical evening is getting closer, and slightly delayed form last quarter. Dates will be locked in shortly. En De Tek is supporting a night all about the maintenance requirements for tank testing equipment.

This will get down and dirty in the MFL space as often this equipment is neglected, banged in and out of manholes, and the bare minimum completed to keep it in production. We will focus on maintenance to ensure good ongoing working condition and extending the life of these very important assets.

NSW Branch Council Members – Stuart Smart, Gary Bowden, Karen Ashby, Paul Ashby, Frank Galea, Darren Quinn, Chris Howson, Frank Edward, Sam Hallifax.

Peter Milligan presenting Tyler Wakefield Burman with his AINDT Magnetic Particle Academic Excellence Award.

Peter Milligan presenting Jamie Flores with his OMS Software Ultrasonic Award and Baker Hughes Ultrasonic Award.

Member Profile: Luke Jones

Luke Jones

How many years have you worked in the NDT Industry?

17 Years

Why did you choose a career in NDT?

Like so many others, I fell into NDT. Out of school I was torn between becoming a music teacher and working for the family business. I choose the latter and worked for my old man and learnt everything about building, civil works and gerneral hard, back breaking labour. I did give music teaching a try for a few years, got my Cert IV Music and pulled out halfway through my Diploma. A friend of mine was in NDT and saw me flipping between music and building and suggested I try NDT, and I've never looked back.

Briefly describe your current role?

I am currently a trainer and consultant for Kuzer Technical in South Australia. It's nice to be able to pass on the lessons I've learnt throughout my career as an NDT Tech.

I genuinely love my life as a trainer, where I can meet new people, catch up with old work colleagues and be on the forefront of helping steer the industry in a positive direction.

Do you have any advice for people new to the industry?

Take a look at the most recent release of the standards! Many technicians simply follow instructions without actively seeking out the necessary information on their own. Standards undergo regular changes and updates. If someone tells you that "XYZ fails," make the effort to locate the corresponding reference document, read it, and acquire the most up-to-date and precise knowledge instead of relying solely on someone else's word!

How has your career benefited from being a member?

- Enjoying the company of new friends and colleagues through networking at AINDT branch events
- Some great reading and advice in the AINDT Industrial Eye
- Tech nights for learning new techniques and products
- The sweet discounts on re-certification is a definite benefit

Can you share with us a career highlight?

A penetrant test on Wild Turkey and Cola bottles comes time mind; and the objective? To spot tiny cracks in the threaded areas. The result: no cracks, but we got four cartons, fresh off the shelves. And trust me, we handled the beverage disposal with utmost responsibility.

Possibly more relevantly, another major highlight involved performing radiography on the Deepsea Challenger, the personal submarine of James Cameron, which daringly plunged into the Mariana Trench's unimaginable depths. His successful encounter with the mysteries of the deep was a tangible experience that strongly reinforced the reasons behind my career choice.

What is the best piece of advice you have ever received?

I discovered these uplifting words of wisdom, jotted down on a small post-it-note by my 8-year-old daughter:

- Never give up!
- Always be happy.
- Try again
- Be nice, even if you're sad

Who/what inspires you?

Everyday mysteries! As an NDT trainer, nothing fires up my inspiration like the unknown. Seeing beneath the surface, uncovering hidden faults, and solving puzzles that the naked eye can't see – it's like being a detective in a world of materials. And when I get to pass on that sense of curiosity to others, that's when I truly feel inspired.

What are the top 3 things on your bucket list?

1. Perform NDT on spacecraft: There's a thrilling allure to the idea of inspecting something that's journeyed through the cosmic unknown.
2. Travel more
3. Make a pilgrimage to the Gibson Factory in Nashville and place an order for a custom guitar: It would be a dream come true to touch, see, and hear the birth of a personally crafted instrument.

Fun fact that people probably don't know about you!

When I'm not navigating the world of NDT, I'm a musician. I frequently perform in various bands and have six spotify releases. Currently, I'm recording a blues album, and a solo album. My music career highlight was when I got featured in Australian Guitarist Magazine.

What would be the theme song of your life right now?

Don't worry, Be happy.

ECNDT2023 Conference Report

The 13th European Conference on NDT (ECNDT) was held in Lisbon Portugal, one of the oldest and reportedly the third most hospitable cities in the world.

The ECNDT which took place from the 3rd to 7th July 2023, brought together almost 1200 participants with around half of these specifically attending the technical programme including NDT researchers, industry professionals and experts around the world to exchange advancements and knowledge in the field of NDT.

The face-to-face engagement at the exhibition with experts and suppliers in the latest technologies was invaluable with a mass of 135 exhibitors spilling over two large halls. As a bonus, there was also a dedicated village for 21 countries representing their national NDT societies and associations.

There were different ways for accessing information, collaboration, idea sharing and assisting others with knowledge of our best practice to certification.

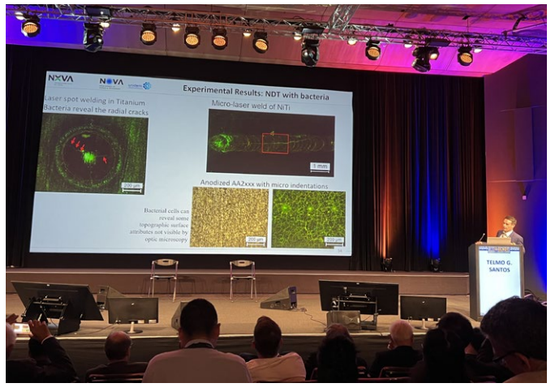
The technical programme itself had 5 parallel sessions covering 24 topics. In total 321 oral contributions and 25 posters were available to enjoy and learn from. In addition to this, a full day was devoted to academic research. The common theme from each presentation delivered at the academia research day was the lack and uptake of further education at degree and post-graduate level in NDT and an international feel in the room for the need of formal education for NDT engineers.

Why is this such a difficult task?

NDT is specialist whereby it cannot be easily pigeon-holed as one type of science or engineering discipline. NDT embraces physics, instrumentation, engineering (mechanical, electrical, integrity) as well materials science disciplines. Developing a career pathway beyond NDT practitioner level for further education that combines all of these would be necessary to progress as a qualified NDT engineer. The learnings of what has worked well, typical course syllabi and challenges faced from our sister societies and other countries are instrumental for the AINDT to work with our own education system and government to invest in NDT career pathways in Australia.

Two inspiring technical presentations that stood out purely due to their diverse uses of NDT were firstly Mohamed Elkarmoty's talk on using NDT to discover a hidden corridor (unknown for 2500 years) in the Great Pyramid of Giza where a combination of 6 NDT methods provided confirmation that NDT is not just for finding defects, but also secrets, and secondly, Telmos G Santos discussion about how no new physics phenomena has been introduced to NDT since the 1950s and his proposition for the use of bacteria in lieu of PT. It was communicated this would pose no biological risks to the operator or asset and be a faster and safer method for surface-breaking anomalies. It is worth keeping on an eye this development.

Mohamed Elkarmoty's presentation on ScanPyramids project.



Telmo G.Santos persentation on Experimental Results NDT with Bacteria.

Gala Dinner at the Convento do Beato

Hive of activity in the ECNDT2023 exhibition.

Networking with delegates from around the world was a further way that the organisers brought value to the conference. The AINDT representatives were invited by Ether NDT and Baugh & Weedon on a beautiful dinner cruise of the river Tagus and attended the conference gala dinner at the magnificent 16th century built Convento do Beato. Both wonderful experiences and an opportunity for the AINDT to develop and rekindle life friendships, collaborations, and partnerships with global NDT professionals.

The AINDT has a major responsibility of attending ICNDT (international committee for NDT) working groups and subcommittees as well as other various standards committee meetings that run in parallel with the conference. These world organisation for NDT meetings underpin the foundation of our whole profession to ensure longevity, integrity of the community and standardisation of practice globally. One of the highlights is that there will be a guidance document released shortly to aid interpretation of recently adopted ISO 9712 (2021). Visual acuity requirement standardisation has always been a bone of contention in relation to defining what is acceptable for each NDT discipline. A special committee has been formed with eye/optical specialists out with NDT community to assess each discipline and what vision requirements are needed in cases particularly where colour blindness is a condition of the practitioner. This means in the not to distance future, a universal trade colour vision test will be available akin to the existing Ishihara version.

NDT.net is the largest open access portal for NDT and will be publishing the conference proceedings free of charge so it is worth checking this website to read up on the latest research and innovation for your continued professional development.

Lastly, thank you for ECNDT and the organising committee for your warm welcome and hospitality to the AINDT during the conference.

Irene Pettigrew & Keith Arcus on the dinner cruise.

AQB Availability

AINDT examinations are available through a network of AINDT Authorised Qualifying Bodies (AQB's) as well as the two scheduled AINDT exam rounds.

AQB's are free to offer AINDT approved training and initial/recertification examinations in any Australian state at any time throughout the year. The scheduled AINDT examination rounds are conducted twice yearly (normally June and November) with dates being advertised in both the *The Industrial Eye* and the AINDT e-newsletter.

Whilst AINDT makes every effort to notify certificate holders of expiry of certification, it is the certificate holders responsibility to initiate the renewal & recertification process prior to expiry of certification (late fees apply to late certification applications).

Listed below are the AQB's for which AINDT has authorised to conduct AINDT examinations and the AINDT examination.

South Australia

Kuzer Technical

Contact: David Suede
Phone: 1300 199 086
Email: info@kuzer.com
Schedule: kuzer.com/schedule/

NDT Methods Levels Industry Sectors offered:

Ultrasonic Testing 1, General Engineering
Ultrasonic Testing 2, Welds
Radiographic Testing 1,2 Welds
Magnetic Particle Testing 1,2 Multisector
Penetrant Testing 1,2 Multisector
Visual/Optical Testing 2 Multisector
Phased Array Ultrasonic Testing 2 Multisector
Eddycurrent Testing 2 Multisector

Victoria

ATTAR – AQB – Advanced Technology Testing and Research

Contact: Mark Welland
Phone: 03 9574 6144
Fax: 03 9574 6133
Email: training@attar.com.au

NDT Methods Levels Industry Sectors offered:

Computed & Digital Radiography 2, 3
Ultrasonic Testing 1,2,3 Welds, Casting, Wrought, Aerospace, Thickness
Radiographic Testing 2,3 Welds, Casting, Aerospace
Magnetic Particle Testing 1,2,3 Multisector, Aerospace
Penetrant Testing 1,2,3 Multisector, Aerospace
Eddy Current Testing 2,3 Multisector, Aerospace
Magnetic Flux Leakage 2
Tank Bottom Testing
Phased Array levels 2 & 3 Ultrasonics 2 Multisector
Visual/Optical Testing 2 Multisector
Time of Flight Diffraction (TOFD) levels 2 & 3 Welds
Heat Treatment
ISO 9712 UT Level 2 Corrosion/Erosion – Detection and Mapping (CDM)
Limited Certification

Western Australia

SRG Training Academy

Phone: 08 9232 0300
Email: trainingacademy@srgglobal.com

NDT Methods Levels Industry Sectors offered:

Ultrasonic Testing 1,2 Welds
Magnectic Particle Testing 1,2 Multisector
Penetrant Testing 1,2 Multisector
Phased Array Ultrasonic Testing 2 Multisector

ATTAR – Advanced Technology Testing and Research – Authorised Examination Centre

Contact: Mark Welland
Phone: 1300 139 155
Email: training@attar.com.au

NDT Methods Levels Industry Sectors offered:

Computed & Digital Radiography 2, 3
Ultrasonic Testing 1, 2,3 Welds, Casting, Wrought, Aerospace, Thickness
Radiographic Testing 2,3 Welds, Casting, Aerospace
Magnetic Particle Testing 1,2,3 Multisector, Aerospace
Penetrant Testing 1,2,3 Multisector, Aerospace
Eddy Current Testing 2,3 Multisector, Aerospace
Magnetic Flux Leakage 2
Tank Bottom Testing
Phased Array levels 2 & 3 Ultrasonics 2 Multisector
Visual/Optical Testing 2 Multisector
Time of Flight Diffraction (TOFD) levels 2 & 3 Welds
Heat Treatment
ISO 9712 UT Level 2 Corrosion/Erosion – Detection and Mapping (CDM)
Limited Certification

Queensland

SRG Training Academy

Phone: 07 3816 5500

NDT Methods Levels Industry Sectors offered:

Ultrasonic Testing 1,2 Welds
Magnectic Particle Testing 1,2 Multisector
Penetrant Testing 1, 2 Multisector
Phased Array Ultrasonic Testing 2 Multisector

Protecs Global

Contact: Hamed Madani
Phone: 07 3492 9213
Email: Hamed.madani@protecsglobal.com.au

NDT Methods Levels Industry Sectors offered:
Magnetic Particle Testing Level 2 (Multisector)
Penetrant Testing Level 2 (Multisector)
Ultrasonic Testing Level 1 (General Engineering)
Ultrasonic Testing Level 2 (Welds)

Condition Monitoring Training Centres

The below training providers offer training in one or more Condition Monitoring methods, categories and industry sectors.

This training program has received approval from the AINDT as it aligns with the national syllabi as endorsed by the AINDT Certification Board.

To ensure comprehensive understanding, learners are advised to obtain a copy of the training module (syllabus) from either the training body, or by downloading from the AINDT website, when undertaking training in an CM method or industry sector module.

For Certification applicants, it is mandatory to successfully complete the training program and training hours as specified in ISO18436 to fulfil the corresponding CM Method, Category and Industry Sector.

All examinations are administered by the AINDT.
For examination dates and other pertinent information, please reach out to the federal office.

CM Training Centre Locations:

Victoria

University of Melbourne

Parkville
Victoria 3010
Phone: +61 3 9810 3348
Contact Email: claudine.evans@unimelb.edu.au

Industrial Precision Instruments

Unit 12, 634-644 Mitcham Rd Vermont
Victoria 3133
Phone: +1300781701
Email: training@ipi-inst.com.au

Wood – Asset Performance Optimisation

Level 3, 171 Collins Street
Melbourne, Victoria 3000
Phone: (08) 6314 2000 / (08) 6314 2280
Email: svt.bu.training@woodplc.com

Western Australia

SRG Training Academy

109 Bannister Road, Canning Vale
Western Australia 6155
Phone: 08 9232 0300
Email: trainingacademy@srgglobal.com

Wood – Asset Performance Optimisation

Level 1, 240 St Georges Terrace
Perth, Western Australia 6000
Phone: (08) 6314 2000 / (08) 6314 2280
Email: svt.bu.training@woodplc.com

Queensland

Advanced Infrared Resources Australia AIRA

PO Box 372 Hervey Bay
Queensland 4655
Phone: 0467 565 836
Email: jeff@irtau.com.au

SRG Training Academy

7 Brisbane Road Riverview
Queensland 4303
Phone: 07 3816 5500
Email: trainingacademy@srgglobal.net.au

Wood – Asset Performance Optimisation

Level 20, 127 Creek St
Brisbane, Queensland 4000
Phone: (08) 6314 2000 / (08) 6314 2280
Email: svt.bu.training@woodplc.com

AICIP Australian Institute for the **Certification** of Inspection Personnel

EXAMINATIONS

Information for applicants

In-service inspection and certification of boilers and pressure vessels is a requirement of the Work Health & Safety Act/ Regulations and Australian standards, and may be required by the WorkCover/Worksafe authority in your state or territory.

AICIP Certification is recognised nationally. Obtaining an AICIP certification can expand your career options or job opportunities. The examinations assess the level of knowledge, skill and capabilities of applicants to ensure integrity and safe inspections of plant and pressure equipment. AICIP Inspectors must comply with the List of Competencies and Code of Ethics.

DATES AND FEES

Exam Enrolment Deadline - 18th Aug 2023 APPLY HERE

Exam Papers	Locations	Dates
ISI Paper A & B - Theory	Nationally**	14th Sep 2023
ISI paper E - Practical*	Nationally**	15th Sep 2023
SISI Paper c & D - Theory	Nationally**	15th Sep 2023
ISI/SISI Paper F - Recertification	Nationally**	14th Sep 2023

Additional dates for the exams may be added/deleted depending upon the applicant interest.
** Nationally - Sydney, Adelaide, Brisbane, Melbourne, Perth and *Darwin.
* Darwin applicants, please note, for the exams to run, there needs to be a minimum amount of enrolments, therefore candidates may need to opt for a different region to sit their exams. Candidates will be notified accordingly.

In-Service Inspector (ISI) - Pressure Equipment: Sit Papers A, B & E	Senior In-Service Inspector (SISI) - Pressure Equipment : Sit Papers C & D
$885.00	$495.00

- All fees are to be paid and documentation finalised prior to the application cutoff date prior to applicant being allowed to sit the examination. Applicants will not receive their examination confirmation email until payment and documents are completed.
- NO application will be accepted after the application cut-off date.
- AICIP reserves the right to cancel or change the date of any exam due to insufficient applications or other reason beyond its control, and reserves the right to refuse enrolments.

03 9486 9267 www.aicip.org.au admin@aicip.org.au

NDT & CM World Event Calendar 2023/2024

After considering numerous international NDT and CM Conferences taking place worldwide, we have narrowed down our selection to a handful of events.

September 12 – 14, 2023
19th International Conference on Condition Monitoring and Asset Management CM 2023
About the conference (bindt.org)

The British Institute of Non-Destructive Testing (BINDT) is pleased to invite you to this premier event, the Nineteenth International Conference on Condition Monitoring and Asset Management (CM 2023), which will be co-located with NDT 2023 to celebrate the 60th Annual British Conference on NDT. To find out more about NDT 2023, click here. The conference is being organised by BINDT in close partnership with the International Society for Condition Monitoring (ISCM) and the US Society for Machinery Failure Prevention Technology (MFPT). This combination of the efforts of these leading organisations creates one of the largest events of its kind at a truly international level and builds on the highly successful 18 international condition monitoring (CM) conferences organised by BINDT, the First World Congress on CM in 2017 organised by BINDT and ISCM and 71 annual conferences organised by the MFPT Society.

BINDT has always recognised the importance of encouraging students to participate in this major international event. As a gesture to celebrate the nineteenth international conference, the Institute will be providing sponsorship of student registrations in 2023, resulting in a reduction of fees for student attendance.

October 23 – 26, 2023
ASNT 2023 Annual Conference
ASNT 2023 (eventsair.com)
Marriott Marquis & George R. Brown Convention Centre
Houston, Texas, USA

"EVOLUTION"

The NDT world is evolving at a rapid pace. From advances in technology, to artificial intelligence and machine learning, to an everchanging workforce, NDT continues to evolve. ASNT 2023: The Annual Conference reflects this evolution. Save the date and make plans to join us in Houston, Texas. Call for presentations is now open. Click here to present.

ASNT 2023 is the place to mingle with more than 2,000 NDT industry professionals and hear industry experts present high-quality, innovative content. The conference will feature exciting general sessions and time to connect with your peers, plus a vibrant exhibit hall with over 225 exhibitors. ASNT 2023 is the best opportunity to share your research/work, hear updates on the latest NDT advances, network with your colleagues and meet new ones.

27-31 May, 2024
The 20th World Conference on Non-Destructive Testing (20th WCNDT)
20th WCNDT
Songdo Convensia, Incheon, Korea

It is our great honour to invite you to attend the 20th World Conference on Non-Destructive Testing (20th WCNDT) hosted by the Korean Society for Non-destructive Testing (KSNT) to be held in Incheon, South Korea in May 2024 under the auspice of ICNDT.

The Organising Committee will offer a dynamic technical program that will be highly informative for every participant. The conference will be the place to interchange and integrate of professional colleagues from all around the world with an interest in this field. The venue, Songdo Convensia, Incheon, is a centre of trade and transportation built upon the advanced infrastructure of Incheon International Airport (IATA: ICN). Within an hour's distance from Seoul by public transportation, visitors will be given the opportunity to experience a mix of diverse cultures and world-class urban life.

Standards Report – Angelo Zaccari Chairperson MT007

During the last quarter, a significant milestone was reached in Australia as a number of Standards were made available for public comment. This period allowed experts and stakeholders to provide valuable insights and recommendations on the proposed standards, enabling a collaborative and inclusive approach towards their finalisation.

The voting and commenting process has now concluded, and the outcomes are as follows:

1. AS/NZS ISO 9712: Non-destructive testing — Qualification and certification of NDT personnel. Prepare for publication.
2. AS/NZS ISO 3452.2: Non-destructive testing — Penetrant testing, Part 2: Testing of penetrant materials. Prepare for publication.
3. AS/NZS ISO 3452.1: Non-destructive testing — Penetrant testing, Part 1: General principles. Prepare for publication.

The ISO Committees met in Lisboa Portugal with Standards Australia having one representative present and attending meetings where Australia has a committee seat. These included the following.

1. ISO/TC 135 – NDT General
2. ISO/TC 135/SC7 – Personnel Certification
3. ISO/TC 135/SC8 – Thermographic
4. ISO/TC 135/SC9 – Acoustic Emission

A report from the MT007 Committee Member in attendance is expected shortly but not available at the time of this Standards News.

Other ISO Committees that met and Standards being reviewed include.

1. Project: ISO/AWI 18173: Non-destructive testing — General terms and definitions
2. Project: ISO/DIS 24489: Non-destructive testing — Acoustic emission testing — Detection of corrosion at atmospheric and low-pressure metallic storage tank floors
3. Project: ISO/DIS 24489: Non-destructive testing — Acoustic emission testing — Detection of corrosion at atmospheric and low-pressure metallic storage tank floors
4. Project: ISO/DIS 18081: Non-destructive testing — Acoustic emission testing (AT) — Leak detection by means of acoustic emission
5. Project: ISO/DIS 18081: Non-destructive testing — Acoustic emission testing (AT) — Leak detection by means of acoustic emission

Standards Australia MT007 Committee Members were also notified of other Standards currently being developed / reviewed by ISO Committees which include.

1. ISO/TC 135/SC 7 – Personnel qualification – Project: ISO/TS 11774:2011: Non-destructive testing. Performance based qualification.
2. ISO/DIS 24367: Non-destructive testing — Acoustic emission testing — Metallic pressure equipment.

There are a number of ISO Standards that were also presented to MT007 for review and a number of comments were made by Committee Members that a modified adoption would possibly be best for these Standards, ISO/TS 18173:2005 General Terms & Definitions, ISO 10878:2013 Infrared Thermography Vocabulary & ISO 12716:2001 Acoustic Emission Inspection Vocabulary, however discussions were to continue and further information provided within the next Standards News.

Please contact me using the details below if you have any questions or require further information and I will reply at the first opportunity.

Angelo Zaccari, MT007 Standards Chairperson
azaccari@aben-tech.com.au

Sometimes you get really (un)lucky…

From time to time, every installer has had a job that goes sideways through no fault of their own. If you're very unlucky, it results in catastrophic equipment failure. If you're very lucky, you might just manage to catch the issue before this happens. Fortunately for all involved, this is a story of the latter.

AUTHOR: MR LIAM MITCHELL – AUSPTA

In addition to thermographic inspections, our organisation regularly carries out maintenance and upgrades of high-current/energy electrical switchgear. We were engaged by a facility manager to carry out the upgrade/replacement of an obsolete air circuit breaker ("ACB") at a mid-size suburban shopping centre. The ACB in question was the service protective device ("SPD") for the entire site, and so the work required a network operator isolation and complete power outage to the site. As the site included a major supermarket, keeping down-time to an absolute minimum was a necessity to reduce cost and inconvenience, and eliminate the requirement for the provision of temporary power (which can easily double or treble the overall cost). Rear access to the switchboard was also impossible, rendering any changes to the bolted bus bar arrangements very difficult. With all of this in mind we utilised a "plug in" type ACB retrofit kit, rather than a "bolt in" type ACB installation kit.

For the uninitiated, there are generally three ways to upgrade/replace an obsolete or faulty ACB:

1. Cut and bend to size bus bars while on site to adapt the bus stab orientation on the existing ACB to the new ACB. This has the advantage of ensuring that you can almost always achieve a successful outcome, as it's possible to adapt to site conditions on the fly, but the disadvantage of increasing the time required on site by anywhere up to 20x (depending on the installation conditions).
2. Engage a third-party specialist to prefabricate the bus bars off site based on manufacturer shop drawings (or if not available, site measurements) showing the stab orientations and spacing for the existing ACB and the new ACB. This can result in increased cost due to the engineering required (although often you make back the difference due to reduced time/effort on site), but dramatically reduces the installation/shutdown time compared to option 1.
3. Utilise OEM supplied retrofit kits. This often reduces the installation/shutdown time even further compared to option 2, but comes with dramatically increased cost, and reduced flexibility as not all OEMs support all potential combinations of ACBs. In addition, most OEMs in Australia will not sell their kits to a third party as a stand-alone item; you also need to engage them to complete the installation, and of course they charge accordingly (pricing in the order of 4-5x what you might charge to complete the same work yourself is not uncommon).

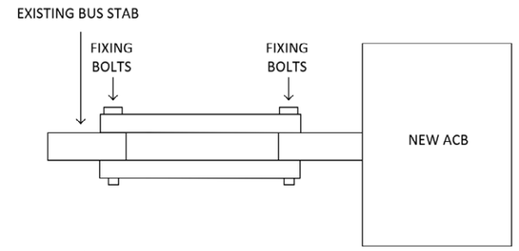


Figure 1 Side view.

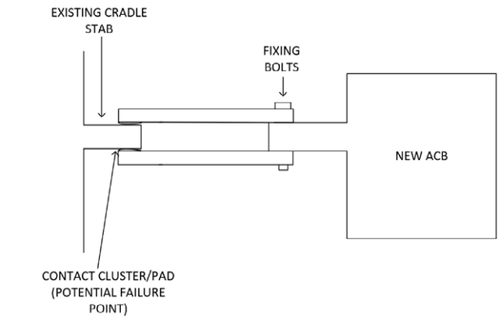


Figure 2 Side view.

For most, option 2 is usually the way to go. Within option 2, there are two further possibilities:

a) A "bolt in" type installation kit. This means the existing ACB cradle/sub-chassis is completely removed, and the new cradle/sub-chassis installed in its place with the new/adapted bus work bolted in place. The advantage here is more reliable electrical contact, as everything is bolted together and torqued, however due to the need to remove and reinstall bolts and fixings it results in a longer shutdown time. Also, if no rear access is available, it may be completely impossible. (figure 1)

b) A "plug in" type installation kit. In this case the existing ACB cradle/sub-chassis is left in place and the new cradle/sub-chassis is "plugged in" using bus work to adapt the cradle to the existing stabs/contact clusters. The advantage is dramatically reduced shutdown time, but there is always a risk of poor electrical contact (and thus high resistance connections) due to small differences in manufacturing tolerances either on the existing ACB/chassis, or the new pre-fabricated bus work. Almost everybody involved in this sort of work has at least heard of a related horror story, if not witnessed one first-hand. (figure 2)

Due to time and budget constraints levied by the client, and perhaps against our better judgement, we elected to go with option 2b (in this case option 3 was not available to us). The changeover was completed with less than 60 minutes of down time, and the client was very happy.

As the potential risks involved with a “plug in” type kit (poor electrical connections) were already well known to us, we were sure to test the ACB utilising a “ductor” micro-ohmmeter at 200amps to confirm good electrical connection. Once the site was re-energised, we also returned during a period of normal load conditions and carried out a thermographic inspection out of an abundance of caution. And all was well, right up until it wasn’t. At the next routine thermographic inspection, approximately 12 months later, imagine our surprise when we returned to find this (figure 3).

Whilst the thermal image shows a fairly significant delta T (approx. 20.2deg C at ~50% rated load), this still belies the significance of the issue. The visible light image shows that at some point this component had become very hot. The nickel plating on the top W phase “plug in” bus bar was significantly discoloured, the “bakelite” brace was scorched, and the W phase load side bus bar within the switchboard was also discoloured and scorched. Through the application of Joule’s Law, the maximum temperature was calculated at approximately 165deg C. Needless to say, this was a big problem (and also a great example of a situation where delta T was not telling the whole story).

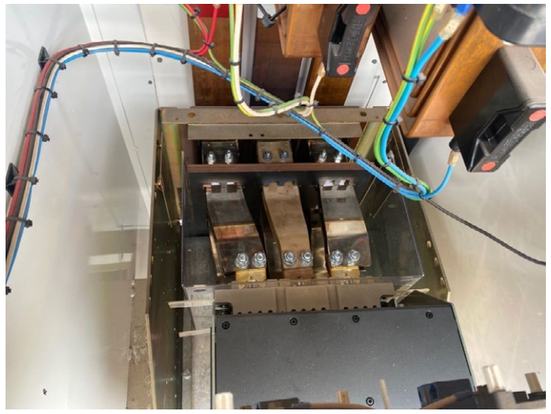
What did we do about it? There was no other choice, the site had to be shutdown under emergency conditions, the offending components removed and replaced, and this time of course we had to use a “bolt in” type installation kit to completely eliminate any potential points of failure.

Fortunately we had the equipment and expertise to do this on very short notice, and the facility manager was experienced enough to understand the urgency, recognise that we had done everything reasonable practical to ensure a correct installation in the first instance, and not waste time trying to point fingers or assign blame. We all just needed to work together to resolve the issue. With a little (or a lot) of blood and sweat the repair was completed within 72 hours, and "the risk of potentially catastrophic failure was alleviated.

So, what went wrong? Unfortunately, we’ll never really know for certain. One of two things had to be the case. Either the width on the bus stabs in the existing cradle was slightly smaller than the original manufacturer’s specifications indicated, causing the contact clusters on the “plug-in” kit to make poor contact on the W and B phases.

Or, the width on the bus stabs on the existing cradle was exactly as it should have been and a fabrication error resulted in slightly undersized pads on the “plug-in” contact clusters which, again, resulted in poor electrical contact.

Whatever the reason the result was the same - once the component had been under significant load for a longer period of time, the poor connection hit the classic “thermal runaway” failure cycle that all experienced thermographers have seen before. The poor connection became hot, as it got hotter the components expanded and the poor connection became worse, it got hotter, the connection became worse still, and so on and so forth. Eventually the contacts partially welded themselves in place, stabilising at the temperatures we saw in the thermogram.



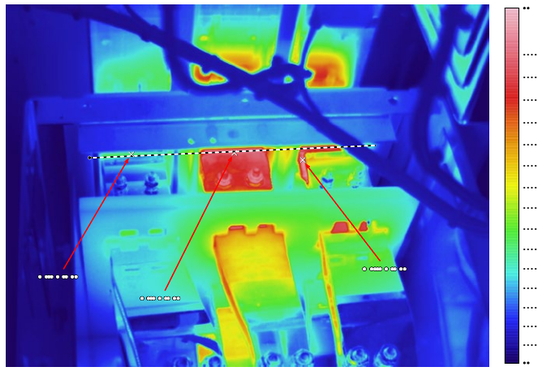


Figure 3: Line side bus stabs showing poor W and B phase contact clusters

And what can we learn from this? Firstly, for installers, these “plug in” type kits should be used as a last resort only (but to be fair we already knew that). Secondly, no matter how much pressure they apply, never let your client override your better judgement and hard-won experience. And thirdly, sometimes no amount of on-site testing or condition monitoring is enough. Components just fail, and when they do everybody needs to be ready (and willing) to respond accordingly. If you’re both the installer and the subsequent inspector there will always be a temptation to try and down-play or minimise an issue like this to avoid being blamed. If you’re the client or site manager, there will always be a temptation to put off disruptive work and kick that can down the road. But ultimately those chickens will always come home to roost. Issues like this never go away, sooner or later they go bang.

International Issues: Troubles with ISO and their application

When the Australian Standards Committee decided to discontinue some of the major test standards for NDT it caused unease in the industry with clients, weld supervisors, engineers and test personnel alike.

AUTHOR: CHRIS HOWSON

For those on the periphery of NDT (engineers, plant managers etc.) it prompted a knee-jerk reaction. Those who acted early were requesting inspections to be carried out to ISO well in advance of the Australian Standards being withdrawn with no consideration for the implication – product standards that referenced specific test standards for example provided NDT suppliers with little leeway.

For NDT Level 3s and senior staff it became a time-critical matter to produce new procedures to what seemed like at face value, sets of somewhat confusing test standards. For managers and business owners it created financial challenges who had to purchase new suites of test standards as one method could span many documents.

For technicians, it was confusing. A common question: Were the Australian Standards withdrawn or not? The application of these standards led to further confusion.

Where previously, one document covered most test method parameters (AS), the ISOs generally contain several parts. A costly exercise and a mine field to navigate.

Here I will present an interpretation of how the International Test Standards fit together, starting with ISO5817 and its relationship to the test standards referenced within.

Keywords: International Standards Organisation (ISO)

Introduction

ISO 5817 is an International Standard that specifies the classification of the surface conditions of newly fabricated welded joints with thickness greater than 0.5mm. The standard is used to evaluate the quality of a welded joint and assign a rating based on the appearance and amount of imperfections present on the welded joint surface. The standard is used to ensure that welded joints meet certain quality standards and can be used in various industries including construction and manufacturing.

At first glance – the documents system 'hierarchy' can appear confusing, but they are conveniently organised in an order that is logical with the weld quality standards placed at the top.

The NDT test method standards (or test techniques) make up the bulk of the documents, where each test standard has its own associated specific standard for acceptance criteria. The documents are arrangement as follows:

Figure 1 – Overview of document suite hierarchy

ISO 5817 deals specifically with welded alloys of Steel, Nickel and Titanium whereas its 'sister' standard – ISO 10042 defines weld quality in alloys of Aluminium. We will deal with ISO 5817 alone here.

The 'Quality Levels' defined in ISO 5817 are linked to the overall quality of the produced batch of welds. The standard is to used in conjunction with other welding product standards, such as ISO 9606 (Welder Qualification), which provides more specific guidance on welding processes and briefly summarises specific ISO NDT test method standards to be used for inspection of the welds produced. The acceptance levels with regard to specific non-destructive test cannot be applied until we know which NDT test method is to be used.

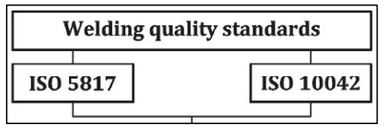


Figure 2 – Document Hierarchy – Shows weld quality standards

With parallels to Australian Standards such as AS 1554 or AS 4037, ISO 5817 introduces an alphabetic classification system for classifying imperfections and consists of 3 tiers. These tiers range from Class B (best quality) to Class D (worst quality).

This class System can be used to evaluate the surface condition of a weld and assign ratings based on the level of imperfections present in terms of a basic visual inspection. Figure 3 below shows an excerpt of ISO 5817 'Table 1' and outlines acceptance criteria for each type of defect based on the part thickness (t) and the type of welding process used.

The following bullet points provide an overview of these classification levels:

- D: Defects in this category are considered to be acceptable under certain circumstances but only if they are within certain limits in size and quantity.

- C: Defects are considered to be less severe than Category D and are not acceptable in certain circumstances.
- B: Defects in this category are considered to be the most severe and are not acceptable in most circumstances.

Table 1 — Limits for imperfections

No.	Reference to ISO 6520-1	Imperfection designation	Remarks	t mm	Limits for imperfections: for quality levels: D	C	B
1 Surface imperfections:							
1.1	100	Crack		≥ 0.5	Not permitted	Not permitted	Not permitted
1.2	104	Crater crack		≥ 0.5	Not permitted	Not permitted	Not permitted
1.3	2017	Surface pore	Maximum dimension of a single pore for — butt welds — fillet welds	0.5 to 3	$d \leq 0.3\,s$ $d \leq 0.3\,a$	Not permitted	Not permitted
			Maximum dimension of a single pore for — butt welds — fillet welds	> 3	$d \leq 0.3\,s$, but max. 3 mm $d \leq 0.3\,a$, but max. 3 mm	$d \leq 0.2\,s$, but max. 2 mm $d \leq 0.2\,a$, but max. 2 mm	Not permitted

Figure 3 – ISO 5817 Table 1 – Limits of imperfections by joint type and thickness (t)

NDT Method Application

It is important to differentiate here that these test method standards relate to weld testing only. For example – ISO 9934 is not specific to magnetic particle testing of welds but provides the overall guidance for magnetic particle testing outlining 'general principles' for magnetic techniques, equipment and detection media. Likewise – ISO 16810 contains 'general principles' for ultrasonic testing.

ISO 5817 can be used as a 'standalone' document for conducting basic Visual Assessments of newly fabricated welds without further application of any NDT methods. However, the standard is often used in conjunction with other NDT test methods to assess the weld quality level proper by using combinations of surface and sub-surface tests. See paragraph below;

'This International Standard is directly applicable to visual testing of welds and does not include details of recommended methods of detection or sizing by non-destructive means. Is should be considered that there are difficulties in using these limits to establish appropriate criteria applicable to non-destructive testing methods such as ultrasonic, radiographic, eddy current, penetrant, magnetic particle testing and may need to be supplemented by requirements for inspection, examining and testing.' – ISO 5817 Excerpt.

Unlike the Australian Standards, many of which are written as NDT test method standalone documents and in themselves, procedure-like – the international standards may span several documents. This will assuredly require interpretation by Level 3 personnel to collate and consolidate the information to construct a fully comprehensive NDT procedure.

Somewhat confusingly – The ultrasonic test method standard contains 'Levels for Detection' that are also categorised alphabetically. In addition, each test method has its own separate acceptance criteria. Fortunately – these levels are numbered and ascend by 'Levels of Severity'. The number associated with severity level is prefixed with the letters 'AL' (Acceptance Limit)

Each test technique standard incorporates a table which correlates with the weld quality levels stated in ISO 5817.

Method Selection

Many clients issue NDT requests and specify "Test to ISO 5817". This is common and also somewhat incorrect.

Where Non-destructive testing is required to be carried out in addition to the basic Visual Inspection as per the standard then ISO 17635 shall be applied. This document specifies appropriate methods of test to be selected to implement an inspection regime.

3.1 ISO 17635 – General Rules for Metallic Materials

Once the ISO Welding Quality Standards are specified for use with newly fabricating products, then one must determine what type of NDT is to be applied. The document to be considered is ISO 17635 which provides guidance and recommendations for test method selection.

Tables '2' and '3' from this document (see Figure 5 and Figure 6) specify the NDT test method suitable for a surface or sub-surface test by material type, joint type and material thickness (t)

Provided the NDT request contains this minimum information, an inspection plan can be formulated.

Table 2 — Generally accepted methods for detection of accessible surface discontinuities for all types of welds, including fillet welds

Materials	Testing methods
Ferritic steel	VT VT and MT VT and PT VT and (ET)
Austenitic steel Aluminium and nickel Copper and titanium	VT VT and PT VT and (ET)
NOTE Methods in parentheses are only applicable with limitations.	

Figure 5 – ISO 17635 Table 2 – Recommended Surface Method Tests

Table 3 — Generally accepted methods for detection of internal discontinuities for butt- and T-joints with full penetration

Materials and type of joint	Nominal thickness of the parent material to be welded t mm		
	$t \leq 8$	$8 < t \leq 40$	$t > 40$
Ferritic butt-joints	RT or (UT)	RT or UT	UT or (RT)
Ferritic T-joints	(UT) or (RT)	UT or (RT)	UT or (RT)
Austenitic butt-joints	RT	RT or (UT)	(RT) or (UT)

Figure 6 ISO 17635 Table 3 – Recommended Sub-Surface Method Tests

3.2 Method transfer

With the job now specified and inspection techniques agreed upon we can use the NDT 'Method Transfer Function' to choose the appropriate and applicable standard for the test.

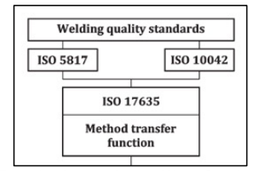


Figure 7 – Method Transfer in relation to Weld Quality Standards

The method transfer function shows the applicable NDT test methods, their associated test standards and acceptance standards as required.

- Note here that within the Ultrasonic document suite there are additional guidelines for determining defect type based on pattern recognition – see section 5.2.1

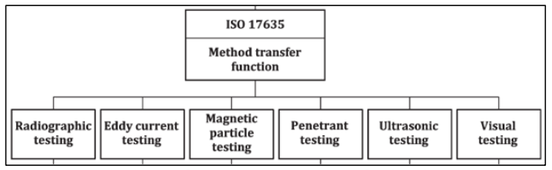


Figure 8 – Method Transfer Function: Overview of Related NDT Methods

Conducting NDT Activities

The test method standards provide consistent means of assessing weld quality to ensure the reliability of a test result. By using ISO 5817 in conjunction with ISO 17635, we can now determine which non-destructive test method(s) are most suitable and furthermore, provide an evaluation of the weld quality both at the surface and within its volume to ensure it is fit for purpose.

When a test method is selected using the method transfer function, the following tables labelled "A. ##' show correlations linked with overall quality of welds produced to ISO 5817.

As stated earlier – ISO 5817 only outlines some of the basic requirements for surface tests. For further and more thorough Visual Testing, the application of ISO 17637 – Visual testing of fusion-welded joints may be necessary.

4.1 Visual Inspection – ISO17637

Table A.1 – shows the acceptance level required to meet the quality level set out in ISO 5817. Note there are no 'test techniques' or 'levels' here as there are with other methods such as see UT. The acceptance criteria is stated in ISO 5817, there is no additional acceptance criteria document associated with this standard.

Table A.1 — Visual testing (VT)

Quality levels in accordance with ISO 5817 or ISO 10042	Testing techniques and levels in accordance with ISO 17637	Acceptance levels[a]
B	Quality level not defined	B
C	Quality level not defined	C
D	Quality level not defined	D

[a] The acceptance levels for visual testing are equal to the quality levels of ISO 5817 or ISO 10042.

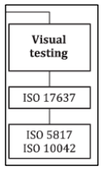


Figure 9 – Shows VT Standards and acceptance levels

4.2 ISO 17638 – Magnetic Particle Inspection

Excluding VT for now – Surface NDT methods are an easy place to start. MT and PT in this regard can be treated quite the same as their routes through the documentation and application of are very similar.

Outlined below is a typical testing regime that's starts out with magnetic particle inspection. (Note that a Liquid penetrant inspection would be much the same) Lets follow through on a surface and sub-surface inspection scenario to see how they work together.

Table A.3 — Magnetic particle testing (MT)

Quality levels in accordance with ISO 5817	Testing techniques and levels in accordance with ISO 17638	Acceptance levels in accordance with ISO 23278
B	Quality level not defined	2 X
C	Quality level not defined	2 X
D	Quality level not defined	3 X

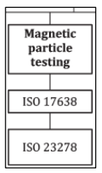


Figure 10 – Shows MT Standards and acceptance levels (suffix #'X' denotes linear indications to be asses to AL1)

Similar to VT, ISO 17635 Table A.3 states there are no testing techniques or levels defined, but this time we do have a separated acceptance standard to work with – ISO 23278.

The weld is tested by conventional magnetic particle testing (AC yoke, for instance) and then the weld is assessed in accordance with the acceptance criteria to AL2 or AL3 and finally – classed in accordance with its quality level in relation to ISO 5817.

4.3 Ultrasonic Inspection Standards

With multiple test standards to deal with subsurface inspection – Ultrasonic and Radiographic Testing, the situation becomes slightly more complicated.

In the next section we will deal with Manual (Pulse Echo) Ultrasonic inspection only but assume similar route for radiography whether that's standard RT or CR / DR.

- Note that ToFD and Phased array take a similar route in terms of inspection.

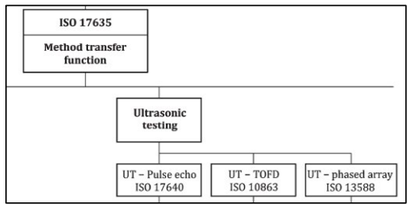


Figure 11 – Shows all UT Standards in respect to method transfer

4.3.1 ISO 17640 – Ultrasonic Inspection (Pulse Echo)

Unlike the previous two examples (VT and MT) – ISO 17635 Table A7 also states 'Testing Techniques'

These tables correlate with ISO 5817 as shown in Figure 12 below. As stated earlier – they are also alphabetically structured.

The associated acceptance criteria for pulse echo ultrasonic testing is ISO 11666.

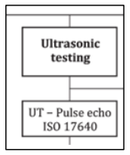


Figure 12 – Pulse Echo Standard

As an example – ISO 5817 Quality Level 'B' might be the target for the Quality of a specific weld, then at least ISO 17640 – 'Test Level B' is to be employed with an Acceptance Level (AL) of 2 (most stringent)

- Note: Where requested – ISO 23279 is to be used to characterise flaws (more on that later)

Table A.7 — Ultrasonic pulse-echo technique (UT)

Quality levels in accordance with ISO 5817	Testing techniques and levels in accordance with ISO 17640[a]	Acceptance levels in accordance with ISO 11666
B	At least B	2
C	At least A	3
D	Not defined	Not required[b]

[a] When characterization of indications is required, ISO 23279 shall apply.

[b] UT is not recommended but can be defined in a specification (with the same requirements as quality level C).

Figure 13 – Shows UT Standards and acceptance levels, include testing technique and reference to indication categorisation

4.3.2 Test Levels

Table 5 — Recommended testing levels

Testing level	Quality level in ISO 5817
A	C, D
B	B
C	By agreement
D	Special application

Figure 14 – ISO 17640 (UT welds)

ISO 17640 – Table 5 makes recommendations for ultrasonic 'Test Levels' which are split down by weld joint thickness.

Using the example from above, Quality Level 'B' equates to ultrasonic test level 'B'

As stated earlier, Quality Level is not to be confused with Test Level. The test level in an ultrasonic inspection relates to the 'Probability of Detection'

The table to the below, Figure 15 shows an excerpt of minimum expected scanning requirements for weld inspection by its test level (A, B, C), by part thickness for a particular configuration to welded joint.

Testing level	Thickness of the parent material	Longitudinal discontinuities						Transverse discontinuities			
		Required number of						Required number of			
		Beam angles	Probe positions	Scanning zone width	Probe positions	Total number scans	Notes	Beam angles	Probe positions	Total number scans	Notes
	mm	L-scans			N-scans			T-scans			
A	$0 \le t < 15$	1	A or B	$1{,}25\,p$	—	2	a	1	(X and Y) or (W and Z)	4	e
	$15 \le t < 40$	1	A or B	$1{,}25\,p$	—	2	a	1	(X and Y) or (W and Z)	4	e
B	$8 \le t < 15$	1	A or B	$1{,}25\,p$	—	2	a	1	(X and Y) or (W and Z)	4	e
	$15 \le t < 40$	2[c]	A or B	$1{,}25\,p$	—	4	b,a	1	(X and Y) or (W and Z)	4	e
	$40 \le t < 60$	2	A or B	$1{,}25\,p$	—	4	b	2	(X and Y) or (W and Z)	8	e
	$60 \le t < 100$	2	A or B	$1{,}25\,p$	—	4	b	2	(X and D) or (E and F)	4	e,d
C	$8 \le t < 15$	1	A or B	$1{,}25\,p$	G or H	3	d	1	(C and D) or (F and F)	2	d
	$15 \le t \le 40$	2	A or B	$1{,}25\,p$	G or H	b	b,d	2	(C and D) or (E and F)	4	d
	>40	2	A or B	$1{,}25\,p$	G or H	5	b,d	2	(C and D) or (E and F)	4	d

Figure 15 – ISO 17640 (UT Welds) Test Levels

Typical of the Australian Standard – AS2207 – UM-B type joint for a welded plate, not that the scanning positions a represented by alpha and note numeric.

The joint thickness and test level dictate probe selection and position etc to ensure best coverage. Sticking with

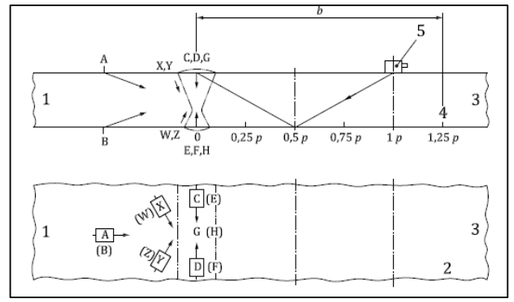
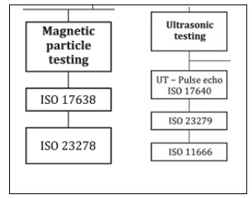


Figure 16 – ISO 17640 (UT Welds) Scanning Positions

Test Lebel B, the method of scanning, probe selection and positions for testing are shown in Figure 15 and scanning position in Figure 16.

4.4 Evaluation of indications

Evaluation of indications and acceptance levels are specified in sperate documents.



Continuing with the magnetic particle and ultrasonic example – ISO 23278 & ISO 11666 are specified.

The documents are specific to each method and provide guidelines on how to evaluate indications located by the test method.

4.4.1 Testing Technique – Reference Levels

For ultrasonic testing, we require some means of evaluating an ultrasonic signal against a known reflector.

The test techniques below describe methods in which a calibration can be established for the equipment being used, using reference reflectors. According to ISO 17640, these reference reflectors can be any of the following four:

- Technique 1 – Distance Amplitude Correction Curve (DAC) using 3mm Side Drilled Holes (SDH)
- Technique 2 – Distance Gain Sizing (DGS) using Diameters of Disk-Shaped Reflectors (DDSR)
- Technique 3 – Rectangular notch (Specifies notch & product dimensions and beam angles)
- Technique 4 – Tandem Technique

Acceptance Levels

Acceptance limits for all methods are defined for various types of discontinuities such as cracks, lack of penetration, undercut, lack of fusion, porosity, incomplete penetration, and many more.

The acceptance criteria are referred to as Acceptance Limits (AL), which are defined as the maximum size and / or quantity of a specific type of imperfection that is acceptable for a given class of weld. The AL designation is numeric – AL2 (most stringent) and AL3, less stringent.

Acceptance levels are not a direct interpretation of the quality levels defined in ISO 5817 (or ISO 10042)

5.1 Acceptance Levels (AL) for Magnetic Particle Inspection

The acceptance criteria for magnetic particle testing was touched on earlier (Figure 10).

The table below shows acceptance levels and does not require much explanation.

Table 1 — Acceptance levels for indications from imperfections

Dimensions in millimetres

Type of indication	Acceptance level[a]		
	1	2	3
Linear indication l = length of indication	$l \leqslant 1{,}5$	$l \leqslant 3$	$l \leqslant 6$
Non-linear indication d = major axis dimension	$d \leqslant 2$	$d \leqslant 3$	$d \leqslant 4$

[a] Acceptance levels 2 and 3 may be specified with a suffix "X", which denotes that all linear indications detected shall be assessed to level 1. However, the probability of detection of indications smaller than those denoted by the original acceptance level can be low.

Figure 17 – Table shows limits of imperfections for Magnetic Particle Inspection

5.2 Acceptance Levels (AL) for Ultrasonic Inspection

Acceptance levels for Ultrasonic Inspection covers both single indications and groups of indications. To avoid further confusion, we shall look at single indications only.

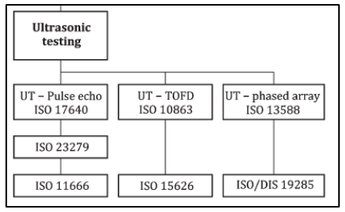


Figure 18 – Shows all ultrasonic test standards and acceptance standards

The following table (referred to as table 1 in ISO 11666) presents a third column indicating the level of acceptance pertaining to the testing levels specified in the test standard, and establishes a correlation between the test standard and ISO 5817.

For the example we have chosen already, we can see that Quality Level 'B' requires an 'at least level B' test level.

This gives us an Acceptance Level of AL 2.

Table 1 — Ultrasonic pulse-echo technique (UT)

Quality level in accordance with ISO 5817:2014	Testing level in accordance with ISO 17640[a]	Acceptance level in accordance with this document
B	At least B	2
C	At least A	3
D	At least A	3[b]

[a] When characterization of discontinuities is required, ISO 23279 shall be applied.

[b] UT is not recommended but may be defined in a specification (with the same requirements as quality level C).

The acceptance levels in this document are valid for all testing levels and for all techniques as defined in ISO 17640, including tests with straight-beam probes.

Figure 19 – Table shows limit of imperfections for Inspection

Table A.1 — Acceptance levels 2 (AL 2) and 3 (AL 3) for techniques 1, 2, 3 and 4

Technique (according to ISO 17640)	Evaluation level		Acceptance level 2 (AL 2)		Acceptance level 3 (AL 3)	
	for AL 2	for AL 3	8 mm ≤ t < 15 mm	15 mm ≤ t < 100 mm	8 mm ≤ t < 15 mm	15 mm ≤ t < 100 mm
1 (side-drilled holes)	H_0 – 14 dB	H_0 – 10 dB	For $l \leq t$: H_0 – 4 dB For $l > t$: H_0 – 10 dB	For $l \leq 0{,}5\ t$: H_0 For $0{,}5\ t < l \leq t$: H_0 – 6 dB For $l > t$: H_0 – 10 dB	For $l \leq t$: H_0 For $l > t$: H_0 – 6 dB	For $l \leq 0{,}5\ t$: H_0 + 4 dB For $0{,}5\ t < l \leq t$: H_0 – 2 dB For $l > t$: H_0 – 6 dB

NOTE 1 Recording levels are 4 dB below the corresponding acceptance levels.
NOTE 2 H_0 is the reference level.

Figure 20 – Table shows limits of imperfections for Ultrasonic Inspection

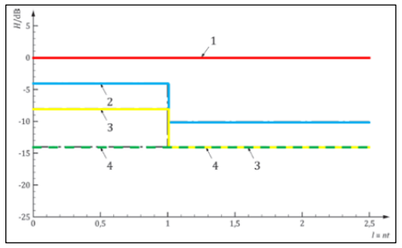
Summarised above in Table A.1 (Figure 20) – we can see acceptance criteria for all levels by part thickness for technique 1 (SDH)

Any indication evaluated is to be at the reference echo height minus the specified dB figure Ho.

Recording level is set 4dB below the acceptance level.

In addition to the table above – each scenario has a graphical representation similar to Figure 21 below.

There are graphs representing each test technique, 1, 2, 3 or 4 (SDH, Notch etc) by part thickness and by Acceptance Level.



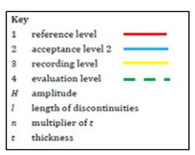
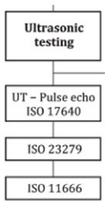


Figure 21 – Graph shows reference levels for imperfections for Ultrasonic Inspection

5.2.1 Characterisation of Flaws – ISO 23279



It may not, under all circumstances be a requirement to characterise flaws, only locate and size in terms of length and amplitude.

Where clients request additional information about indications and their echo dynamic characteristics then ISO 23279 shall be applied.

When an indication is identified, it important to note how the echo behaves. Classification of discontinuities depends on the specific patterns observed.

In summary – the echo dynamic character of ultrasonic indication can be categorised into distinct 'Patterns'. The patterns are numerically labeled P1 through to P5.

The patterns which are often seen are shown below:

- Pattern 1: single, point-like
- Pattern 2: smooth reflector
- Pattern 3: rough reflector at 90 degrees to the sound beam
- Pattern 4: rough reflector at oblique to the sound beam
- Pattern 5: cluster of non-planar discontinuities

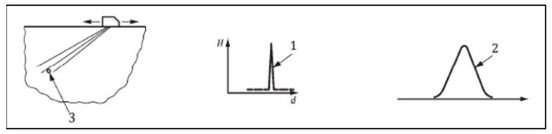


Figure 22 – Pattern 1 style indication (point-like)

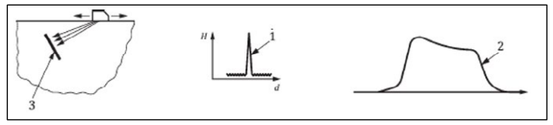


Figure 23 – Pattern 2 style indication (smooth)

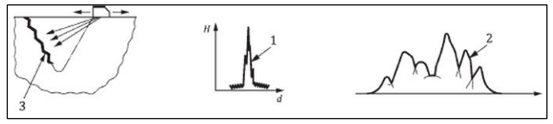


Figure 24 – Pattern 3 style indication (rough at 90°)

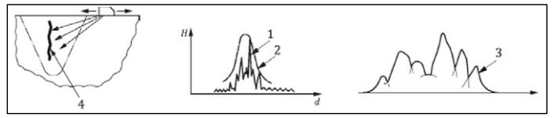


Figure 25 – Pattern 4 style indication (rough, oblique)

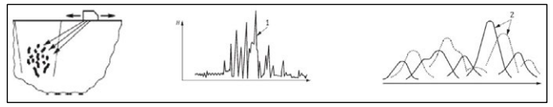


Figure 26 – Pattern 5 style indication (cluster)

CONCLUSIONS

6.1.1 FAT levels (AS/NZ)

It is important to note here that the acceptance limits specified within these international standards are not the only criteria for determining the acceptability of a weld, other factors such as location of the imperfection, stress concentration, and material properties are also considered before declaring a weld acceptable or non-acceptable.

There are additional notes on fatigue levels set out in the Australian adopted version of ISO 5817 – named AS/NZ ISO 5817. These designations are categorised by a FAT (fatigue) Level number 'FAT##' – and are outlined in Annex C.

In summary, these suites of documents can seem confusing but they do fit together in a very logical order and read very well. They are quite easy to follow and provide a fully comprehensive and consistent means of inspection for weldments for all major methods of test. Even though the Australian Standards that were withdrawn have been reinstated, the genie is out of the bottle and it looks like the ISO's are here in Australia to stay, and once they are understood – they are quite user friendly.

Acknowledgments

NA

References

Reference to all International Standards used include:

- ISO 5817 & 10042 (Welding quality)
- ISO 17635 – General Rules for Metallic Materials
- ISO 17638 – Visual Inspection Test Standard
- ISO 9934 / 17638 / 23278 – Magnetic Particle Inspection Test Method Application Standards
- ISO 16810 / 17640 / 11666 / 23279 – Ultrasonic Inspection Test Method Application Standards
- Australian Standards – AS 1554 / 4037

Author Details

C. Howson is the SRG Region Lead for NDT in NSW and Victoria.

Current position held since 2017, working for SRG / ALS from 2012.

Responsible for Laboratory NDT accreditations, Level 3 service and maintenance of quality systems, trainer and mentor.

Practical NDE and QC applications of time domain terahertz technology

This is an introductory talk, which will briefly discuss the principles of the generation and measurement of terahertz energy, look at its interaction with different materials and show how these principles can be employed to perform inspections of a wide variety of non-conductive materials, including single or multi-layer plastic structures and coatings on both conductive and nonconductive substrates.

JOSEPH MCLEAN BUCKLEY1, IRL DULING2
[1]BAUGH & WEEDON, HEREFORD, ENGLAND
[2]LUNA INNOVATIONS, ANN ARBOR, MICHIGAN, USA

Terahertz technology, using electromagnetic waves situated between microwaves and the far infra-red, is another 'tool in the box' enabling accurate measurement of layer thickness, location of metallic inserts, and detection of discontinuities in materials and configurations that are unsuited for 'conventional' inspection approaches.

Terahertz investigations are non-harmful, non-contact and normally can be applied from one side of a part.

This talk will discuss the applicability of this technology to several practical applications in the aerospace, manufacturing, energy, construction and oil and gas industries. This includes applications where the technology has been implemented into production, and others where it has been investigated, shown to be feasible, but not yet implemented due to external factors.

We will also mention its application in several 'cultural heritage' investigations.

Brief details of equipment used will be discussed and an outline case study showing development of a technique and the accuracy which can be obtained will be presented.

KEYWORDS: Terahertz, Coatings, Films. Composites, Heritage, Aerospace

1. Introduction

Terahertz radiation is in the part of the electromagnetic spectrum which lies between microwaves and the far infrared,

1.1. Terahertz for NDT applications

For NDT applications we typically use frequencies around 100 GHz up to about three TeraHertz, this represents frequencies that give a wavelength in free space from around 3mm down to 100 microns, i.e., comparable to the wavelengths that we are used to dealing with for ultrasound.

Terahertz waves will propagate through homogeneous non-conductive materials at a velocity

$vp=c/\sqrt{\varepsilon r}$

where εr is the relative permittivity or dielectric constant.

When terahertz waves pass through an interface between materials having different dielectric constants some of the energy is reflected. The strength of this reflection will depend primarily on how different the dielectric constants are. With a conductive material none of the energy is transmitted. We can measure the strength and timing of these reflections and we can then calculate the thickness of the material layers and assess whether they are intimately bonded.

Figure 1 Reflections from Layers

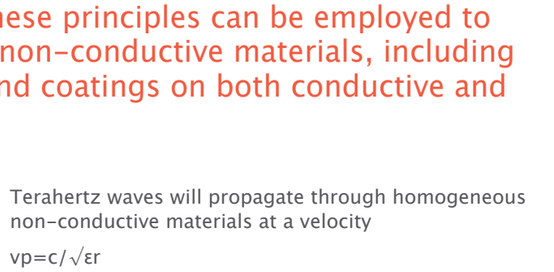


Figure 2 Terahertz waveform

There are many analogies between Terahertz and ultrasound (although we must be careful not to push them too far) in particular:

- We can display A, B and C-scan images, and derivatives thereof, which are very similar to ultrasound.
- Attenuation with distance is analogous.
- The signal phase shows the transition from high to low permittivity or vice versa.

This presentation illustrates principles and applications using Terametrix equipment from Luna Innovations Inc, however the general principles of terahertz inspection are not, in general, equipment specific.

1.2. Generation and measurement of terahertz energy

We generate the terahertz radiation by putting an electrical bias across a specialized photoconductive antenna, when we hit this with a very short (around 100 femtosecond) laser light pulse it will conduct, giving a short (200-300 fs) burst of electromagnetic radiation. This transmitter can be packaged like a standard telecom component to make the equipment reliable and robust which of course is important in practical NDT applications.

To detect the reflected or transmitted terahertz energy we use a similar device which becomes conductive when hit with a laser pulse - the resultant current is the product of the laser on off parameter and the energy of the incoming terahertz wave at that instant.

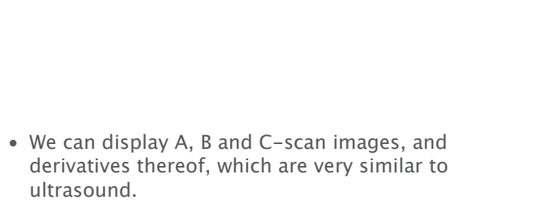


Figure 3: Terahertz transmitter

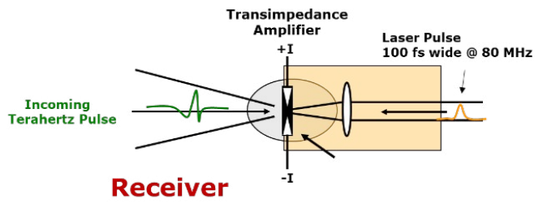


Figure 4: Terahertz receiver

By setting the delay between the transmit and receive laser pulses we can measure a specific point on the waveform, by changing this delay while firing the laser at a high repetition rate of around 80MHz we can produce a digitized waveform.

In the Terametrix equipment this is done by a rotating multi-faceted mirror array which can scan through a time range of several hundred picoseconds at a rate

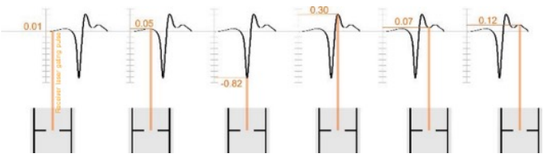


Figure 5: Reconstructing a terahertz signal by moving the measurement point.

of up to 1000 times a second. This repeating scan is combined with a longer adjustable delay (multiple reflections) allowing the scanning range to be accurately positioned so that the delay between transmit and receive pulses corresponds to the distance of the path between the transmit and receive sensors and the desired measurement range.

The terahertz laser system is connected to the transducer elements using an umbilical cable containing high quality polarisation preserving fibre optics. To maintain the laser pulse fidelity a compensation system, providing a wavelength dependent delay, is required to balance the dispersion within the fibre optic cable. Without this the pulse would spread to several times its original width, especially when a long umbilical cable (the system can accommodate cables over 30m) is used.

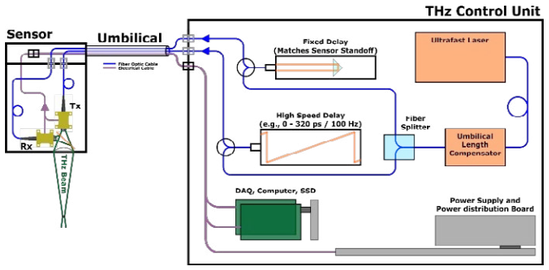


Figure 6: Block diagram of Terahertz system.

Figure 7: Terahertz control unit, Online sensor head

1.3. Interaction of Terahertz energy with material

Some of the energy is reflected (and possibly refracted) when going through a boundary between materials having different permittivity. In non-homogeneous materials there will be loss due to energy reflected at boundaries, as with ultrasound, and, as with ultrasound, the resultant attenuation will be frequency / structure dependant.

At a conductive surface 100% of the energy will be reflected.

Terahertz energy can thus be used to measure the thickness of layers, and to identify discontinuities such as voids, cracks, and density variations.

A key advantage of terahertz NDE is that it is non-ionizing and completely safe. The human body is a much more powerful source of terahertz radiation than is normally used for NDE applications, although obviously the peak energy (for less than a picosecond with a duty cycle typically more than 10000:1) is greater.

There are many analogies between Terahertz and ultrasound (although we must be careful not to push them too far) in particular:

1.4. Terahertz Signal processing

To improve resolution and signal clarity of the received signal it can be digitally processed in several ways.

The transmitter device produces energy over a wide spectrum, this can only be altered by changing its physical design (several transmitter head options are possible to optimise penetration or resolution), but the digitized signal can be filtered. Generally, the 'low bandwidth' filtering gives lower noise results, since the higher frequencies are subject to greater scattering, but increasing the bandwidth and possibly suppressing lower frequencies may be required for adequate resolution on very thin layers.

Averaging multiple waveforms can significantly improve the signal to noise ratio and thus increase the usable bandwidth, although obviously this will proportionately reduce the maximum speed when scanning.

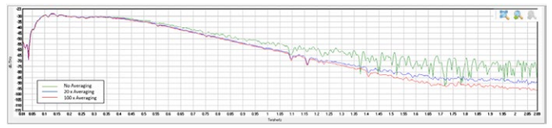


Figure 8: Typical TeraHertz energy spectrum showing effect of averaging on bandwidth

To improve resolution a deconvolution algorithm processes the signal based on a known reference waveform from a smooth metal surface. Using this deconvolution process maximises resolution and generally gives signals which are easier to interpret and gate.

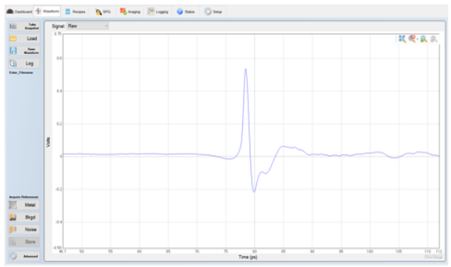


Figure 9: Reference signal from metal surface

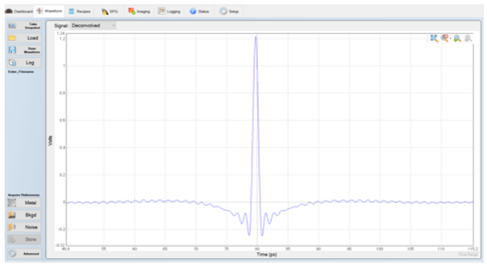


Figure 10: Deconvolved signal from metal surface

2. Application of terahertz on measurement of non-conductive films, sheets, and coatings

2.1.Measurement of Films and Sheets

Figure 11 and Figure 12 show reflections from a thin plastic shim, normally we will get a positive reflection when passing from air to a material with higher dielectric constant, a negative one when passing back to air.

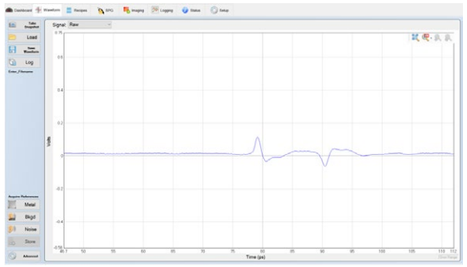


Figure 11: Raw signal from a thin (approx. 1mm) plastic shim

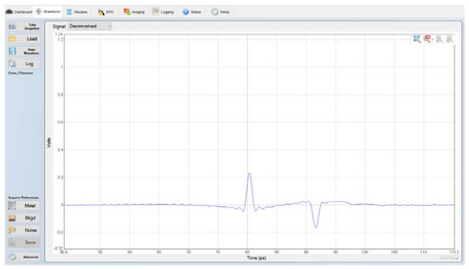


Figure 12: Deconvolved signal from a thin (approx. 1mm) plastic shim

Suitable measurement gates can be applied to this signal, allowing accurate timing, and thus thickness, assessments. We can measure structures having multiple layers. The waveform in Figure 13 shows a three-layer plastic sheet.

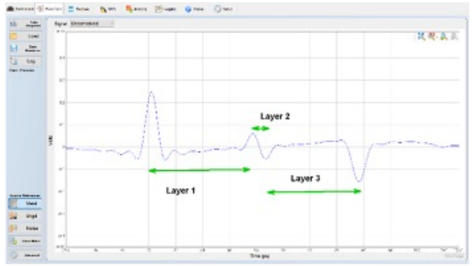


Figure 13: Reflections from three-layer sheet

Figure 14: Display on single point gauge

Thicker and less homogeneous materials, such as Glass Fibre composites, can show significant attenuation and internal noise (as with ultrasound), and in extreme cases it may be useful to test with a metal target behind a sample to confirm that there is adequate penetration and that the reflection we are measuring is in fact from the back wall.

2.2. Measurement of coatings

The reflections from coatings on conductive surfaces are similar, the relative strength and polarity of the reflections will depend on the thickness and dielectric constants on the materials involved, examples are shown below.

- Paint on metal, (Figure 15) in this example a high bandwidth filter is used for maximum resolution, the paint layer is around 100 um, combined with the low dielectric constant this gives a short transit time, making the reflections relatively hard to distinguish.
- Plastic coating on metal (Figure 16) again a low dielectric constant, but thicker, so easier to measure. Note the second reflection showing energy reflected twice through the coating.
- Ceramic coating (Figure 17) The coating has a high dielectric constant, so much more of the energy is reflected at the surface of the coating, and the fraction of energy penetrating to the metal substrate is much less. The initial signal is larger than the reflection from the ceramic-metal interface. Again, multiple reflections are visible.
- Paint on Carbon fibre composite (Figure 18) in this situation some of the energy is interface is transmitted into the composite and absorbed,

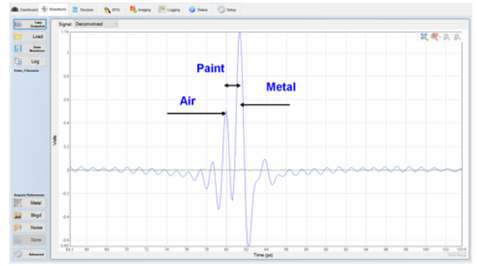


Figure 15: Terahertz signals from paint on metal

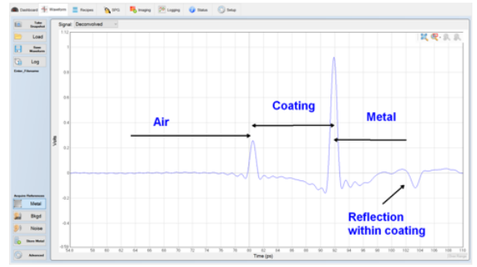


Figure 16: Terahertz signals from thick plastic coating on metal

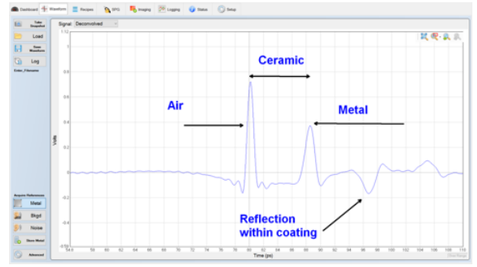


Figure 17: Terahertz signals from ceramic coating on metal

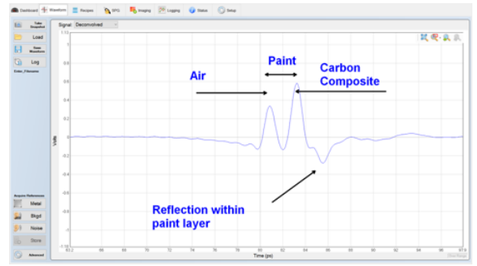


Figure 18: Terahertz signals from paint on carbon composite

3. Key applications of terahertz NDE

Terahertz NDE has several key features as an inspection method.

- Non-Contact: can work at a distance from part of 25-100mm or greater.

- Can be used in through transmission or single sided configuration.
- Scanning rate up to approx. 1000 points per second.
- Can resolve indications 1-2mm in diameter or better.
- Distance resolution to a few microns
- Can penetrate low density materials which do not transmit ultrasound well.
- WILL NOT penetrate conductive materials, including Carbon.

Some of the applications where it is particularly useful are detailed below.

3.1. Terahertz measurement of Films and sheets

As we have seen Terahertz measurement is very effective for non-contact examination of thickness. It is therefore very suitable for sample and in-line measurement of plastic materials. This includes.

- Blow moulded Plastic or glass containers – Terahertz measurements can be used for automated multipoint measurement, for example with a robot, or can be installed on a production line to make single measurements of parts as they come through.
- Film and sheets being produced continuously. The Terahertz measurement can be used purely for QC or can be fed back to roll pressure control to ensure correct and consistent thickness across the width of material as it is produced. Terahertz measurement of coatings

Terahertz is one of very few viable non-contact methods for measuring the thickness of paint and similar non-conductive coatings. This means it can be used for both wet and dry measurement. Typically, the Terahertz system can measure coatings greater than around 50 microns, with a typical accuracy of around +/- 5 microns (*).

The explosion proof test head option is designed to be mounted with a spray gun, and allows continuous measurement of thickness as a coating is built up.

Terahertz measurement has also been used for assessment of heat resistant coatings on turbine engine parts.

3.2. NDT of Non-conductive composites structures

Among the many successful applications for Terahertz inspection are:

- Radomes. These are inherently non-conductive to achieve their function, so terahertz inspection is a suitable method for detecting disbonding and confirming repair integrity. Terahertz inspection at specific frequency lines is also good for detecting water intrusion.
- Car Trim parts inspection. This is mostly used during development to ensure correct thickness and absence of internal defects such as bubbles.
- Slush moulded parts – These are made when control of external finish is critical (Car dashboards are a common example) by filling a heated metal mould with polymer powder. After a suitable time, the excess powder is tipped out and the mould cooled. Because of irregular or textured surfaces, they are often difficult to inspect by other methods. Terahertz inspection allows measurement of thickness and allows moulding time to be optimised.
- Sprayed on foam insulation (SOFI) and insulating tiles on space vehicles [1]. Terahertz has been used to inspect the underlying structure and confirm bonding.

Examples are shown below.

Figure 19: Photo and Terahertz Images of Radome repair

Figure 20: Terahertz scan of C-130 Radome showing layers

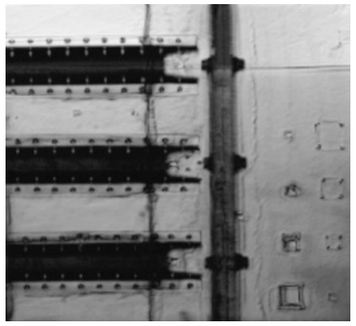


Figure 21: Scan of structure under SOFI (Shuttle Fuel Tank)

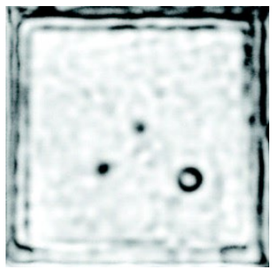


Figure 22: Scan of heat resistant tile bonding (ARTEMIS)

3.3. Assessment of bonded seams

Terahertz inspection works well for single sided assessment of overlap bonding between polymer sheets. Typical examples include.

- Waterproofing membranes for flat roofs. This is typically installed under an asphalt layer. Once the roof is completed and in service it can be difficult or impossible to find the location of any leaks, so inspection immediately after installation to eliminate these can save significant risk and reduced insurance costs.
- Fuel bladders for aviation and motorsport, these are normally pressure tested, terahertz inspection provides a method of assessing bonding during manufacture.
- Balloons – Large passenger balloons are often made using heat bonded strips of a fibre reinforced polymer – again bond integrity is critical.

Figure 23:Flat roof – finding a leak could be difficult!

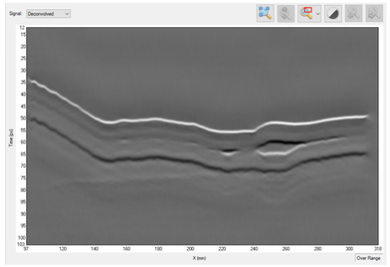


Figure 24:B-scan of Bond

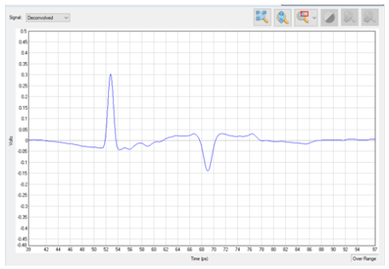


Figure 25: Waveform of well bonded area

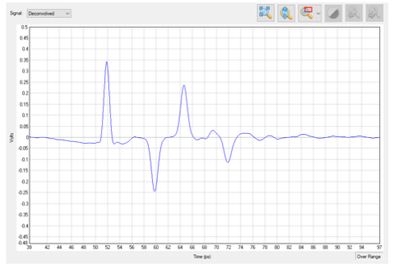


Figure 26:Waveform at defect.

3.4. Checking for correct assembly

Terahertz scanning can be used to verify the location and depth of metallic inserts within non-conductive assemblies. One example is verifying correct position of framework, heating elements and other wiring within car or aircraft seat assemblies.

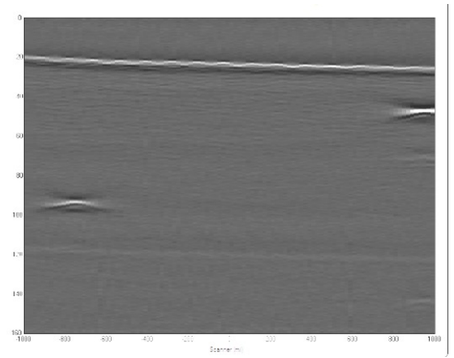


Figure 27: Location of wires within non-conductive foam structure

3.5. Cultural Heritage Applications

Murals and panel paintings often have a multi-layer structure, typically consisting of plaster and fabric over the substrate to create a surface suitable for paint. In conservation work it can be critical to assess the thickness and integrity of these layers. [2] Terahertz inspection, being non-contact is a very suitable method for this.

- Terahertz NDE can detect the presence and location of metallic layers (such as gold leaf) used within paintings.
- Terahertz NDE provides another tool for distinguishing pigments which look identical in visible or infra-red light. [3]
- Terahertz NDE can identify previous conservation work.
- Terahertz NDE is useful in dendrochronology – assessing the grain structure in wood to confirm dating. With terahertz the analysis of this can be done without removing paint.

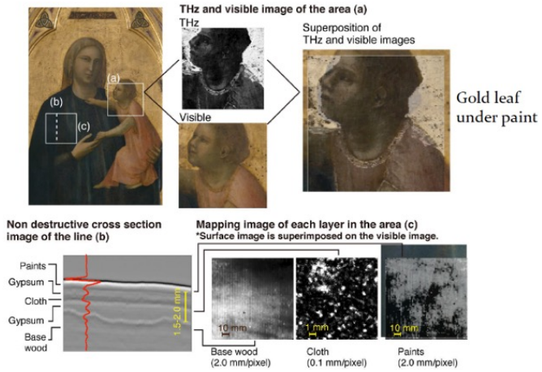


Figure 28: Investigation of internal structure of the Badia polyptych (Giotto c1300) [4]

Figure 29: Arrangement to carry out Terahertz Scan of Da Vinci's 'Last Supper' [5]

Figure 30:Terahertz Scan of Da Vinci's 'Last Supper'- Detail.

4. Conclusions

Terahertz measurement and imaging is a powerful method which should be considered part of our NDT toolbox. While the cost is relatively high compared to some other methods it can find answers where no other method can.

Acknowledgements

This presentation draws heavily on work done by colleagues at Luna Innovations and elsewhere. In the cultural heritage area, the work of Kaori Fukunaga, from the National Institute of Information and Communications Technology in Tokyo is particularly significant.

References

[1] Zimdars et al. "Technology and Applications of Terahertz Imaging Non-Destructive Examination: Inspection of Space Shuttle Sprayed On Foam Insulation, AIP Conference Proceedings 760, 570-577 (2005)

[2] Jackson, J. Bianca et al. "Terahertz Pulse Imaging of Stratified Architectural Materials for Cultural Heritage Studies" O3A: Optics for Arts, Architecture, and Archaeology III (2011):

[3] K Fukunaga, M Picollo, "Terahertz spectroscopy applied to the analysis of artists' materials", Appl Phys A (2010) 100: 591-597

[4] Picollo et al, "Obtaining noninvasive stratigraphic details of panel paintings using terahertz time domain spectroscopy imaging system"

[5] K. Fukunaga et al., "Terahertz time-domain imaging of "The Last Supper"," 2020 45th International Conference on Infrared, Millimeter, and Terahertz Waves (IRMMW-THz), Buffalo, NY, USA, 2020, pp. 1-2, doi: 10.1109/IRMMW-THz46771.2020.9370630.

NewSpec

NewSpec is the exclusive Australasian local distributor of Hitachi Analytical and other key suppliers providing equipment and solutions for non-destructive testing (NDT).

We specialise in the sales, installation, and service of a broad range of scientific and industrial equipment in Australia and New Zealand. Our product range includes handheld and benchtop XRF, LIBS, OES for metal analysis, electron microscopes, micro-XRF, spectrometers, surface metrology interferometer, lasers and laser safety, gas analysers and process control equipment.

The NewSpec team of sales and service engineers are based in most major capital cities of Australia and will be happy to help and support you in any project you may have that require NDT equipment.

One of our main partners, Hitachi, specialise in high-tech analysis solutions, designed to meet the tough challenges of a rapidly evolving industrial sector and helping businesses streamline their costs, minimize risk, and increase production efficiency.

The Hitachi range of laboratory-based and robust high-performance in-field testing instruments deliver essential materials analysis which adds value and throughout to the production lifecycle, from raw material exploration to inspection of incoming material, to production and quality control to recycling.

Working in close collaboration with our customers, we can recommend the most suitable and cost-effective analysis solution for your industrial applications, delivering simplicity of operation for even the most demanding workflows.

Contact us at any time to discuss your project or to ask for a demonstration!

Web: **www.newspec.com.au**

Total Asset Solutions

Thermographic and UAV Inspections

With more than two decades of experience in managing the health, integrity, and reliability of assets across various industrial sectors, we collaborate with you to fulfill your compliance requirements. Our expertise extends to thermography and drone (UAV) services, encompassing a wide range of applications:

Thermography:

- Assessment of electrical motors pumps and mechanical systems
- Inspection of conveyors and systems
- Examination of HV and LV Main Supply and distribution panels
- Analysis of cold storage
- Evaluation of solar panels and wind turbines

Drone (UAV):

- Thermal inspections
- Exploration of confined spaces
- Assessment of solar panels, fields, and wind turbines
- Inspection of overhead powerlines
- 3D mapping
- Evaluation of high voltage terminals and sub-stations

By conducting thermal and drone (UAV) inspections, we have demonstrated a significant reduction in downtime, risk of property loss, breakdowns, and associated revenue losses resulting from asset failures.

Our qualifications and affiliations include:

- CASA - RPA Operators License (ReOC 7737)
- AINDT - IRT Certification (ISO18436)
- AINDT & AUSPTA Member

Phone: 03 9747 1996

Email: Info@totalassetsolitions

Web: **www.totalassetsolutions.com.au**

TechRentals Australia

Your Trusted Test & Measurement Rental Solution

TechRentals Australia is largest rental provider of Test and Measurement instruments, offering innovative solutions to meet diverse business needs. In addition to our comprehensive range of survey and spatial, radio frequency, environmental monitoring, and general industrial equipment, we also specialise in providing non-destructive testing (NDT) equipment.

We offer a wide selection of reliable and high-quality NDT equipment, including videoscopes, thickness and coating thickness gauges, scanners and probes, flaw detectors, and more. Our NDT equipment enables you to assess the integrity and quality of materials and components without causing damage.

TechRentals has grown to become the largest rental provider of Test and Measurement instruments in the southern hemisphere. We have developed an extensive international fleet and established convenient facilities throughout Australia, Malaysia, New Zealand, and Singapore.

With our flexible rental options, you can choose the duration that best suits your project's needs. Whether it's a short-term rental or a managed service solution, our rental options eliminate the need for significant upfront investments, making cutting-edge NDT technology accessible to businesses of all sizes.

TechRentals Australia is the reliable and trusted partner for all your Test and Measurement rental requirements. Our extensive inventory, flexible rental options, and outstanding customer support are designed to cater to your unique technology needs. Discover the convenience and value of partnering with a dependable technology rental provider by selecting TechRentals today.

Phone: 1800 632 652

Web: **www.techrentals.com.au**

ARI

ARI delivers professional services in pressure equipment inspection, weld inspection, and non-destructive testing. Our team of experienced professionals are committed to providing high-quality, reliable inspection services to ensure the safety and compliance of our client's assets. We use state-of-the-art equipment and adhere to industry standards and regulations to deliver accurate, actionable results.

ARI has recently added to our Advanced NDT capability with 2 new services:

1. PA-CAT™ inspection technique for Contact Point Corrosion (CPC) and Corrosion Under Pipe Supports (CUPS). ARI is the first company to introduce this capability into Australia.

2. Long Range Guided Wave Screening for corrosion in pipes.

Our goal is to help clients reduce downtime and improve the reliability of their assets while maintaining the highest safety standards. ARI has a proven track record of supporting planned shutdown services, new construction projects, and delivering routine in-service inspections of the highest quality. When your operations cannot stop our team will execute 24 hours a day, 7 days a week to meet your inspection needs.

With offices in Bunbury, Perth, and Adelaide, we are on hand to partner with asset owners and operators to ensure Safety and Efficiency.

Email: info@ari.com.au Phone: 08 9725 7550
www.ari.com.au

We believe RESULTS MATTER!

Simplifi NII

We help customers find more cracks!

We do this by delivering a high performance MR Chemie MPI and DP solution.

Not only will you meet the local and international standards you will also be able to identify more cracks. Not just tell your customers and NATA that you comply with the standards.

The MR Chemie solutions are sprayable in a 360 deg position and customers have confidence that all the product will be dispensed.

Simplifi NII are able to deliver on our commitments to customers because we hold a significant stock and procurement and operations managers are able to find the batch certificates at any hour of the shift.

Simplifi NII is consistently delivering world class solutions that bring more value and more service every day.

MR Chemie is a medium-sized family company based near Dortmund in Germany. Over the last 50 years we formed our identity from a local supplier of industrial aerosol cleaner to a global player. Today, are one of the market leaders for high-quality NDT testing materials and equipment (MR® NDT Materials) as well as 3D scanning spray (REFLECON®) and products from the hygiene sector (MR® Smart & Clean). Our passion for success jointly with our customers made this sustainable journey possible. We believe in new opportunities and better product solutions for our customers today and in the future. Continuous improvement, application development and supply with a clear focus on the needs of our customers and the market is our key to success.

www.simplifi-nii.com.au

Vertech Group

At Vertech Group, with operations in Australia, New Zealand, and the USA, we offer a comprehensive suite of inspection, Non-Destructive Testing (NDT), and maintenance solutions, all backed by state-of-the-art specialist access systems. Our NDT capabilities stand out in the industry, ensuring the integrity and reliability of assets while minimising downtime and maximising safety.

Our group comprises a network of complementary and specialist service providers collaborating to drive innovation in project delivery across diverse market sectors. Among these providers are Geo Oceans, a Mini-ROV and subsea inspection services leader, and Sonomatic, a globally recognised expert in specialised NDT. These partners bring unparalleled expertise in NDT techniques such as ultrasonic testing, radiography, magnetic particle inspection, and more, allowing us to detect and evaluate potential flaws in materials and structures accurately.

Additionally, we benefit from the expertise of AUAV, a specialist in UAV, drone, and data analytics, which enables us to conduct remote inspections and gather essential information with minimal risk to personnel. APS Industrial Services, which offers construction, access, and engineering services, and Abseil Access, a New Zealand-based infrastructure, engineering, and geotechnical specialist, contribute to our ability to provide end-to-end asset management solutions.

Our innovative access systems enhance our non-destructive testing capabilities, allowing for safe and efficient inspections in even the most challenging environments. These systems include rope access, confined space entry, and custom-engineered platforms, ensuring seamless integration with various inspection techniques.

For more information, visit **vertechgroup.com.au**

TRAINING SCHEDULE

Product Technology multisector	**14 Aug – 18 Aug**
Magnetic Particle Level 2 multisector, ISO 9712	**21 Aug – 25 Aug**
Dye Penetrant Level 2 multisector, ISO 9712	**28 Aug – 1 Sept**
Ultrasonics Level 1 general engineering, ISO 9712	**4 Sept – 13 Sept**
Ultrasonics Level 2 welds, ISO 9712	**18 Sept – 29 Sept**
Phased Array UT Level 2 multisector, ISO 9712	**2 Oct – 13 Oct**
Time Of Flight Diffraction Level 2 welds, ISO 9712	**16 Oct – 27 Oct**
Radiographic Testing Level 2 welds, ISO 9712	**30 Oct – 10 Nov**
Visual Testing Level 2 multi-sector, ISO 9712	**13 Nov – 17 Nov**
Radiation Safety X, Gamma & XRF	**Self paced, online**

• Enjoy the comfort of 4.5-star accommodation, conveniently located just next door!

• Special rates at La Loft Hotel for students.

• Unwind each day with a complimentary "knock-off" beverage at La Loft Bar.

• Benefit from our early bird course pricing options.

• We're proudly AINDT accredited for quality and excellence.

Scheduled courses delivered in person at our facility in Adelaide, South Australia.

Courses available Australia wide, contact us today to book.

1300 199 086
www.kuzer.com
info@kuzer.com

Kuzer TECHNICAL

EVIDENT

OLYMPUS

Power You Can Carry

OmniScan™ X3 64 Phased Array and TFM Flaw Detector

Improved Agility and Mobility

Compact and easy to transport, the OmniScan™ X3 64 flaw detector offers true portability, providing increased convenience and flexibility for jobs where space is limited.

Accomplish More in Less Time

Capable of storing large amounts of inspection data, the 1 TB internal SSD enables you to perform bigger scanning jobs and stay on site longer without needing to transfer your files.

Perform Faster TFM

The optimized acquisition speed and efficiency of TFM using a full 64-element aperture and the system's sparse firing algorithm make it easier to incorporate as a regular part of your inspection process.

Scan here for more information