In-service inspection; training and certification aspects

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In-service inspection significance

- Flaw detection
- Failure analysis
- Fracture mechanics
- Fitness for service assessments (FSA)
- Risk based inspections (RBI)
- Plant integrity
- Maintenance decisions
- Life extensions or decommissioning

Quantification and sizing accuracy is vital for all In-service inspection applications

The training and certification challenge

ISO 9712:2012 specifies ***pre and In-service inspection*** as one of the main certification sectors

Inspectors certified in this sector are assumed competent to carry out the inspections

In-service inspection effectiveness is often debatable by industry

Questions arising

- What makes In-service inspection different?
- What competencies are required for those types of inspections?
- Is the training model one of the reasons for the ineffectiveness identified?
- Are all industrial sectors facing the same problem?

Questions arising

- How certain industries tackle the problem described?
- How the required competencies for in-service inspections differ from the ones provided by the standard ISO 9712 certification route?
- How these competencies can be mandated through the qualification process?

Service induced flaws

Main service induced flaws categories:
(UK HSE Plant ageing, 2006)

- Wall thinning
- Stress-driven damage, cracking and fracture
- Physical deformation
- Metallurgical / environmental damage

In-service inspection characteristics

- Flaws significantly different than manufacturing flaws
- Product and flaw awareness is vital for detection and quantification
- Methods and techniques are different

Differences: Inspection techniques, equipment, procedures, sensitivity levels, sizing techniques, reporting levels, acceptance criteria

In-service inspection examples

- Corrosion mapping (conventional and phased array ultrasonics
- Ultrasonic critical sizing
- Special UT applications
- Tangential radiography
- Pulsed eddy current testing (PECT)
- Acoustic emission
- Condition monitoring

Training and certification models

- Training and certification is among the main factors affecting NDT reliability
- Two certification models currently available:
  - Employer based schemes
  - Third party schemes

Third party schemes

Benefits (ICNDT, 2012)

- Internationally agreed ISO standard
- Internationally developed training syllabus
- Examinations (theory and practical) are provided directly by certification bodies
- It provides a harmonised standard for training, qualification and certification

ISO 9712:2012 certification sectors

- Product sectors

Castings, forgings, welds, tubes and pipes, wrought products, composite materials

- Industrial sectors

Manufacturing, *pre and In-service testing*, railway maintenance, aerospace

Industrial sectors are combining a number of product sectors

ISO 9712:2012 Examination requirements per sector

<table>
<tr><th colspan="3">Certification sectors</th><th colspan="3">Minimum no. of exam samples for Level 2 certification</th><th colspan="3">Type of exam specimens</th></tr>
<tr><th>Product sectors</th><th colspan="2">Industrial sectors</th><th>Product sectors</th><th colspan="2">Industrial sectors</th><th>Product sectors</th><th colspan="2">Industrial sectors</th></tr>
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Castings or forgings and welds</td></tr>
<tr><td>Forgings (f)</td><td>2</td></tr>
<tr><td>Welds (w)</td><td>2</td></tr>
<tr><td>Tubes and pipes (t)</td><td>2</td></tr>
<tr><td>Wrought products (wp)</td><td>2</td></tr>
<tr><td>Composite materials (p)</td><td colspan="2"></td><td colspan="6">To be specified by the certification body</td></tr>
<tr><td rowspan="2"></td><td colspan="2">Railway maintenance</td><td rowspan="2"></td><td colspan="2">2</td><td colspan="3" rowspan="2">Specimens from different product sectors or character</td></tr>
<tr><td colspan="2">Aerospace</td><td colspan="2">2 or 3</td></tr>
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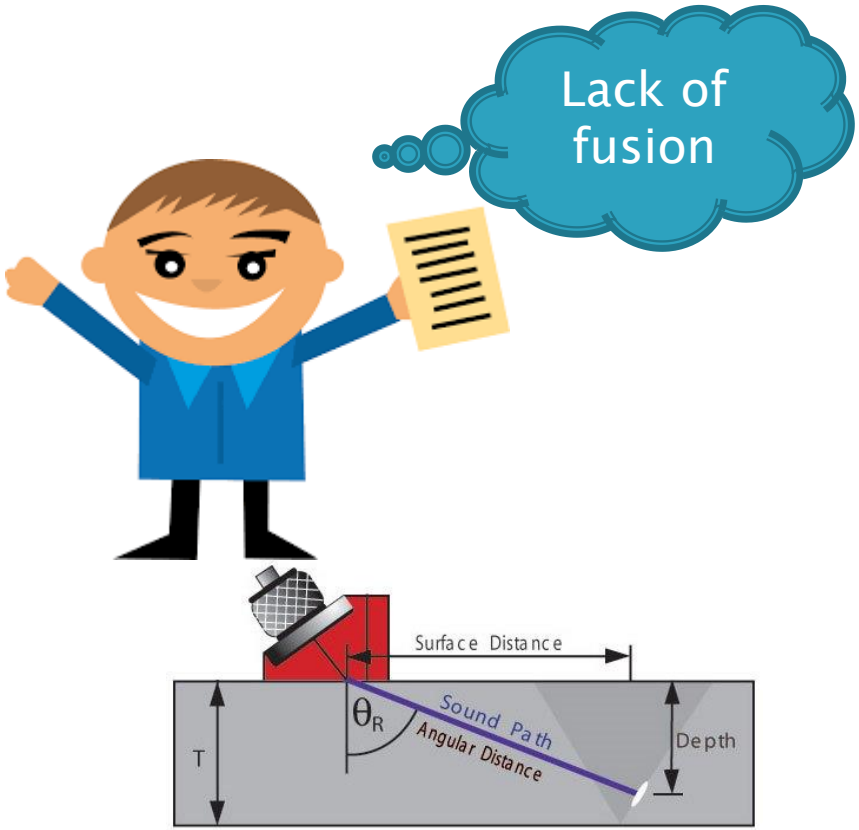
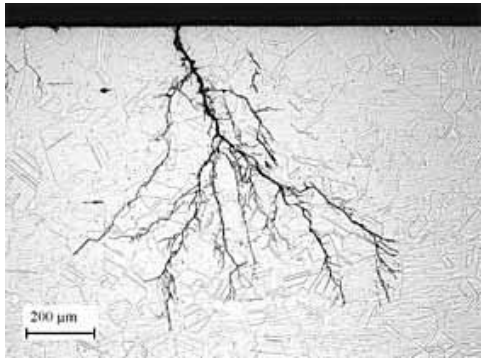
ISO 9712:2012 In-service inspection qualification challenges

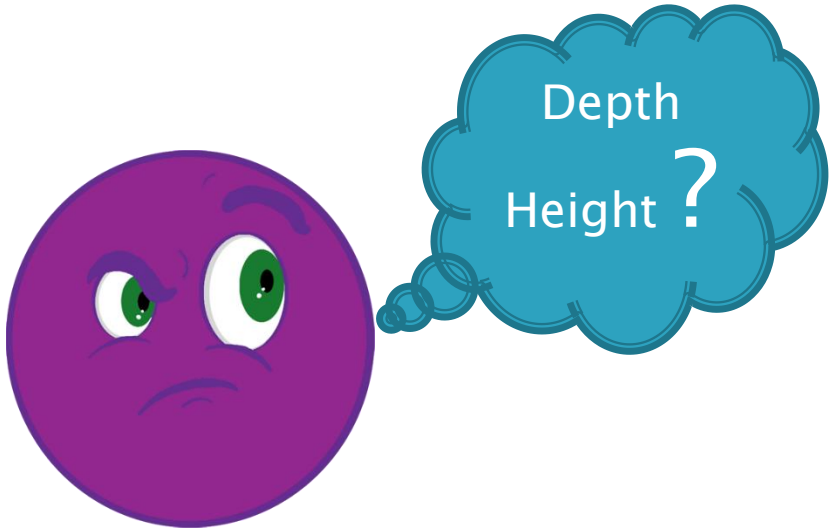
- Limited training time for In-service flaw awareness in the harmonised training syllabus according to ISO/TR 25107
- In-service induced flaw detection and sizing not mandated in the examination
- Practical training usually limited to manufacturing flaws

BINDT Code of conduct: Certification schemes, including PCN, are modelled on the detection of manufacturing defects and the defects in the test samples are artificially induced and normally represent those brought about by the manufacturing process. (HSE: PANI3, Annex10, 2008).

ISO 9712:2012 In-service inspection qualification challenges







Response of different industrial sectors

Nuclear industry: ***a different approach***

- Leader in research in NDT inspection reliability
- Significant investment on additional training of inspectors
- Additional training of contractors
- Procedure driven training
- Competency checks

D'Agostino A., Morrow S., Franklin C. and Hughes N. Review of human factors research in non-destructive examination. Washington, DC: U.S NRC, 2017.

Response of different industrial sectors

Aerospace:

- Mainly employer based certification schemes
- NAS 410 or EN 4179
- Procedure driven training

Both Nuclear and Aerospace are quality driven industries

Response of different industrial sectors

Other, cost driven industries

- Limited research (UK HSE PANI projects)
- Lagging behind in tackling the issue
- Relying on generic courses
- Reluctant to invest on training when not mandated by manufacturing or In-service inspection specifications

Training organisations and certification bodies response

- Endorsement courses

(e.g. UT and PAUT Critical sizing, PAUT Corrosion mapping, Tangential Radiography, PECT)

- Advantages: Hands on equipment used specifically for these inspections, specific flaw awareness, exams on In-service testing applications

- Disadvantages: Total training duration increased, not procedure driven training, certification not mandated by codes and standards

Training organisations and certification bodies response

- Performance based qualification according to ISO TS 11774

  - Description: Based upon the candidate's ability to demonstrate capability in detecting and sizing critical discontinuities equivalent to those to be detected and sized only after the NDT procedure has been qualified (ICNDT, 2012).

  - Disadvantages: overlap in scope with ISO 9712 and difficulties for recognition and mutual agreement between sector's committees (EFNDT, 2014)

Proposed solution: The third party employer specific scheme

- Different certification model
- Third party certification governed by accredited certification bodies
- ISO 9712 compliant
- Involvement of industry
- Procedure driven
- Qualification requirements specified by the employer
- Reduced overall training duration

The employer specific scheme

SNT-TC-1A

- Flexibility
- Involvement of industry
- Procedure driven
- Written practice
- Additional requirements

ISO 9712:2012

- Independent third party certification
- Internationally recognised
- Assured level of competency

The employer specific scheme

Combining

SNT-TC-1A **ISO 9712:2012**

To achieve

Best of Both Worlds

through joint efforts by industry, training organisations and certification bodies

The employer specific scheme challenges

Industry

- Active involvement
- Access to materials
- Samples
- Procedures
- Equipment
- Facilities
- Realistic written practice

The employer specific scheme challenges

Training organisations and certification bodies

- Flexibility
- Follow new technologies and techniques
- Use of alternative training and examination processes
- Introduce e-learning elements and simulation

The employer specific scheme

Not limited to In-service inspections

- Applicable to any other product or industrial sector
- Ideal for new technologies and techniques
- Applicable to screening techniques

?

Questions & Answers