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Official Newsletter of ISNT Chennai Chapter



Strengthening our Chapter activities.

Dear Readers,

"The objective of the Society is to promote the awareness of NDT Science and Technology through education, research and exchange of technical information within the country and internationally to its members and other professionals using NDT.

ISNT is a diverse and dynamic family of professionals representing NDT technicians, scientists, engineers, researchers, manufacturers and academicians – all dedicated to improve product safety and reliability. These specialists represent virtually every industry and discipline that may benefit from NDT technology."

I have quoted the above lines from ISNT HO's website. Chennai chapter reflects the above ideology and has been diligently following HO's footsteps. The chapter has grown as one of the premier institutions of learning and has been conducting programs as per various Guide-lines and standards right from its inception (1986) apart from in-house training & certification courses. It had also conducted National & international seminars (1996-2024 -6 times). To its credit every event that the chapter undertook to conduct had been raising the bar.

At present we have progressed to a level of owning a decent class room for around 25 participants along with audio visual equipment as well as equipment to conduct practical class. All this had been possible with active participation of several members like you as well as some magnanimous organizations who have supported our initiatives.

Now is the time to consolidate our progress and match with the new restless younger generation and progress with their aspirations. If we do not match, then there is a danger of the new generation being led towards a destructive path. Needless to say that any significant change involves human resources and financial resources. We urge more & more personnel of younger generation to come forward and participate in any manner that they deem fit in the chapter activities.

Regarding the second aspect of financial resources, the present office bearers have hit upon a novel idea of creating endowment funds for specific purposes. The amount can be above Rs.10,000/- (onetime payment) that will be put in a FD and the proceeds will be spent in the manner in which the donor desires. Presently there are 5 avenues available:

1. Best member award;
2. Best technical talk award;
3. Best course participant award;
4. Best undergraduate student award and
5. Best post-graduate student award.

The awards will be distributed during ISNT Day every year. The donor's name will be displayed during all functions of ISNT Chennai Chapter. We invite one and all to play a part in contributing to the profession that is feeding us.

Ram



*Indian Society for Non-Destructive Testing , Chennai Chapter
Module 59, 3rd floor, Readymade Garment Complex. SIDCO Industrial
Estate, Guindy, Chennai 600 032. Phone 044-45532115, 7200086075.
Email: isntchennaichapter@gmail.com; Website: www.isnt.in*

ISNT Chennai Chapter News

Addition of Members –

Newly Added Members during July 2026 to September 2026 quarter.

1. M/s. Kobelco Industrial Machinery India Private Limited, Kanchipuram – Life Corporate member
2. M/s. Sankar Polytechnic College, Tirunelveli – Life Corporate Member

MEMBERSHIP STATUS UP TO SEPTEMBER 2026

PARTICULARS	July 2026	Newly added	Sep 2026
LIFE CORPORATE MEMBER	61	2	63
CORPORATE MEMBER	4		4
LIFE FELLOW	14		14
HONORARY FELLOW	9		9
LIFE MEMBER	640		640
MEMBER	22		22
ASSOCIATE MEMBER	8		8
STUDENT MEMBER	202		202
TOTAL	960	2	962

Course Conducted

Sl.No	Course	From	To	No. of participants	Course Director
1.	MT & PT Level-II	16.07.2026	25.07.2026	22	Sri.C.Karuppasamy
2.	VT Level-II – In-house	29.07.2026	04.08.2026	21	Sri.S.R.Ravindran
3.	UT Level-II	18.08.2026	29.08.2026	19	Sri.A.R.Parthasarathy
4.	PT Level-II – In-house	16.09.2026	22.09.2026	20	Sri.S.R.Ravindran
5.	VT Level-II	21.09.2026	26.09.2026	13	Sri.S.Velumani

Advanced Training Program on Radiography Testing – Digital Interpretation as per ISO 9712:2021 - Welding / Casting / Both was held from 21st to 27th September 2026. Number of participants were 6



Courses Planned for the next 3 months

RT Level-II course from 18th Nov 2026 to 28th Nov 2026

MT & PT Level-II course from 10th Dec 2026 to 19th Dec 2026.



SANKAR POLYTECHNIC COLLEGE
A GOVERNMENT AIDED, AUTONOMOUS INSTITUTION
Approved by AICTE & Affiliated to DoTE, Chennai
SANKARNAGAR - 627357, Tirunelveli




Department of Mechanical Engineering
organizes
Faculty Development Program

NDT Certification and Industrial Practices

Resource Person

Mr. R. Balakrishnan

Chairman – ISNT, Chennai Chapter
Training & Certification

Date
28.07.2026

Venue
APJ Abdul Kalam Hall

NDT Awareness Programme was conducted at Sankar Polytechnic College, Sankar Nagar, Tirunelveli on 28th July 2026 by Mr.R.Balakrishnan, Chairman for the students of the Mechanical Engineering and Electrical & Electronics Engineering Departments, along with a Faculty Development Programme (FDP) on Non-Destructive Testing (NDT).



Annual General Body Meeting on 19th July 2026

The Annual General Body Meeting (AGM) was held on Sunday 19th July 2026 at 6.30 PM at Hotel S Conventional Centre, T.Nagar, Chennai. Total number of members attended was 52.

Chairman in his welcome address thanked everyone for the support to successfully conduct several programmes during his tenure. He emphasized that we shall continue to exhibit the same enthusiasm and team work.



Birthday celebration of EC members during August 2026



Mr. Partharati Brahma during August 2026



Mr. M.S. Viswanathan during August 2026

EC Meeting

The 3rd EC Meeting for the financial year 2026-2027 was held on 30th August 2026.





REVOLUTIONIZING DYE PENETRANT TESTING: AUTOMATING INDUSTRIAL PIPE INSPECTION WITH MACHINE VISION, IMAGE PROCESSING, AND LEARNING-BASED ANALYTICS

By Mr. Shyamsunder Baskaran¹, and Prof. Helmut Wolf²
¹IQC Advanced Inspection Solutions | ²QNET Quality Network

Abstract

Dye Penetrant Testing (DPT) remains a cornerstone of Non-Destructive Testing (NDT), yet its application to internal pipe surfaces has historically been constrained by manual execution, subjectivity, and high labor costs. This paper reviews the foundational mechanics of DPT and introduces a cutting-edge case study on full-lifecycle automation deployed for petroleum line pipes complying with API 5L-D standards. By utilizing a high-speed, precision-indexed camera head operating in cylindrical coordinates, the system acquires overlapping video streams and stitches them into an error-corrected, high-resolution C-scan image of the developed inner pipe surface. Incorporating specialized machine vision optics, polarizing filters, and hue-based color manipulation heuristics, the software automatically isolates penetrant indications from background developer coatings. Extracted features are statistically evaluated to drive Automated Defect Reporting (ADR) based on standardized size and shape criteria. Finally, the article outlines the system's ongoing architectural migration toward deep learning image segmentation models and information-preserving data resampling for standard-compliant archiving. This synthesis of mechanical automation and intelligent vision defines a benchmark for NDE 4.0 implementation in high-volume pipeline manufacturing.

1. Introduction: NDE 4.0 and the Digital Evolution of DPT

Non-Destructive Testing (NDT) is undergoing a paradigm shift driven by the principles of Industry 4.0, a movement commonly designated as NDE 4.0 (Non-Destructive Evaluation 4.0). Traditional inspection modalities—including Visual Testing (VT), Magnetic Particle Testing (MT), Radiographic Testing (RT), and Penetrant Testing (PT)—are rapidly transitioning from qualitative, human-dependent methodologies into fully integrated, quantitative digital ecosystems. Historically, Liquid or Dye Penetrant Testing (DPT) has been viewed as one of the least susceptible to complete automation due to its reliance on chemical dwell times, manual washing, white developer application, and the subjective visual interpretation of an inspector working under ambient or ultraviolet illumination.

The consequences of manual DPT are well-documented across heavy manufacturing industries: operator fatigue, standard interpretation variances, lack of a permanent digital data record, and significant operational bottlenecks. When applied to long, narrow geometries such as the inner walls of industrial pipes, manual inspection becomes an ergonomic and logistical nightmare. Inspectors must rely on primitive borescopes or crawling video cameras, which provide only localized, uncalibrated views without spatial indexing or standardized report generation capabilities.

2. The Industrial Imperative: Corrosion-Resistant Clad Pipes and API 5L-D

In the oil, gas, and petrochemical sectors, subsea and high-pressure transmission line pipes are routinely subjected to aggressive fluid environments containing hydrogen sulfide (H₂S), carbon dioxide (CO₂), and high chloride concentrations. To withstand these corrosive environments without incurring the prohibitive cost of solid high-alloy components, manufacturers utilize carbon steel line pipes lined or clad internally with a thin, highly corrosion-resistant alloy (CRA) layer, such as austenitic stainless steel or nickel-base alloys. The technical execution and quality control of these specialized components are strictly governed by international industrial standards, most notably the American Petroleum Institute (API) Specification 5L-D (Specification for Clad or Lined Steel Pipe).

3. Case Study: The AutoDPT Mechanical and Motion Architecture

Developed by IQC Advanced Inspection Solutions, the AutoDPT system is a complete commercial automation solution built to replace manual penetrant testing of petroleum line pipes.

3.1 The C3I Multi-Station Configuration

A major challenge in automating liquid penetrant testing is the unavoidable chemical dwell times (often ranging from 10 to 20 minutes for dye penetration and developer action). If a single machine handled all operations sequentially on one pipe at a time, the overall production cycle time would be unacceptably slow for modern high-volume pipe manufacturing mills.

To overcome this bottleneck, the AutoDPT platform introduces a proprietary 'C3I Multi-Station' architecture. This layout features three completely independent mechanical Motion Control System (MCS) processing beds running in parallel, all managed by a centralized, high-speed Image Acquisition System (IAS). This allows multiple pipes to be handled concurrently. For example, while an operator is managing the pre-cleaning or dye application on pipe one at MCS station 1, pipe two can undergo developer application at MCS station 2, and pipe three can be actively scanned by the high-speed camera assembly at MCS station 3.

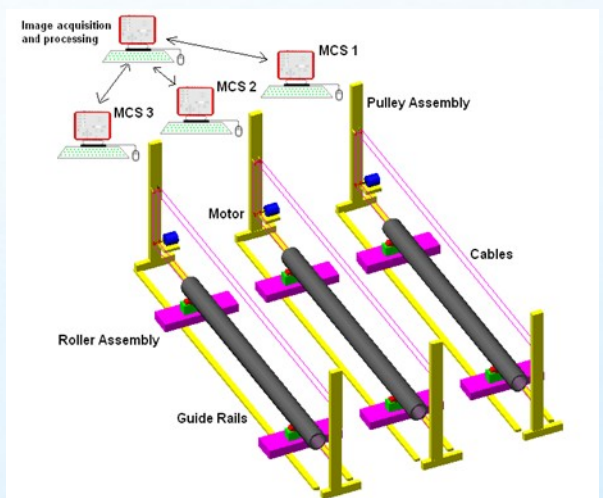


Figure 1: Schematic of the proprietary C3I Multi-Station Architecture designed to decouple static chemical dwell times from active imaging hardware utilization.

3.2 Heavy-Duty Mechanical Engineering and Spatial Indexing

The mechanical core of each MCS station is engineered to safely support and precisely manipulate pipes weighing up to 10 gross tons. The structural layout features dual-sided structural steel roller assemblies coated with a heavy vulcanized rubber layer. This rubber lining absorbs heavy structural impacts and prevents any metal-on-metal friction that could scratch or damage the external surface of the premium carbon steel pipes. A high-torque rotary drive system turns one of the main rollers, rotating the massive pipe smoothly during operation.

To monitor this rotation, a precision angular encoder is mechanically coupled to the pipe axis, delivering position feedback accurate to 1/10th of a degree. Simultaneously, a precision sliding carriage system moves along continuous structural guide rails to handle linear travel down the pipe length. This carriage carries the camera head and multiple aerosol canister holders for the cleaner, dye, and developer. The combination of precision linear travel tracking and 1/10th-degree angular encoding creates a stable cylindrical coordinate framework (X, Y, Z, Θ, ϕ), ensuring sub-pixel spatial indexing for every frame captured during inspection.

4. Machine Vision Foundations: Sensors and Image Acquisition

For the AutoDPT system, a high-resolution full-field camera head is configured to stream data via a high-speed link at 24 frames per second (fps). To handle the challenge of high-speed inspection while ensuring no part of the surface is missed, the acquisition parameters are locked into a 400% surface overlap requirement. This means every physical point on the internal clad surface is captured across four sequential video frames.

5. Digital Image Processing: Frame Stitching and C-Scan Generation

Reviewing a raw, 12-meter uncompressed video file frame-by-frame would be incredibly tedious and introduce human subjectivity. The AutoDPT software suite solves this by processing the raw video data into a single, cohesive, high-resolution digital master image known as a C-scan, which represents the completely unrolled, developed internal surface of the pipe. Using the embedded cylindrical encoder coordinates, adjacent frames are accurately aligned and combined. Overlapping pixel regions are blended using image registration metrics that match surface features across frames. This process compresses hours of raw video into a single high-resolution C-scan image with a sub-pixel resolution of under 0.3 mm per pixel, preserving the fine structural details needed for accurate defect sizing.

6. The Physics of Contrast: Optics, Illumination, and Color Theory

A critical rule of color analysis in machine vision is that like colors reflect light (brightening the surface), whereas opposing colors absorb light (darkening the surface). By utilizing a standard color wheel of warm versus cool colors, developers can design high-contrast images without complex software filtering. For example, illuminating a surface with a narrow-wavelength red light source (660 nm) lightens red and yellow features while heavily darkening blue features. In a standard visible DPT process, the defect indications appear as bright magenta or deep red marks against a matte white developer background. Additionally, internal clad surfaces often create harsh specular reflections and glare that can blind camera sensors. To resolve this, the AutoDPT system uses cross-polarizing filters mounted on both the light source and the camera lens. These filters block glare and scattered reflections, allowing only the cross-polarized light from the defect indications to reach the sensor, resulting in clean, reliable images.

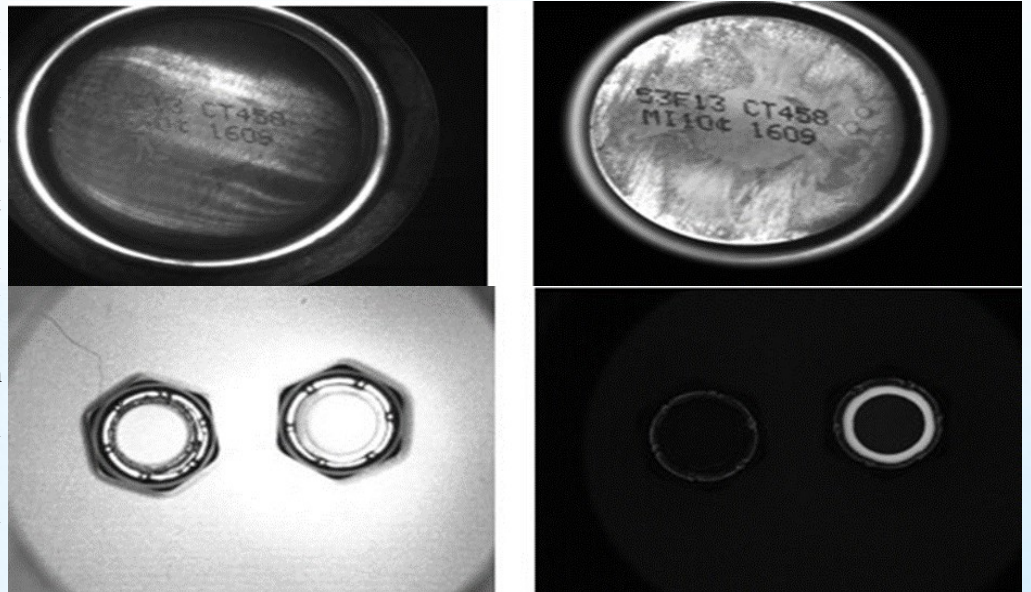


Figure 3: Optimization of optical contrast using structured illumination wavelengths and polarizing filters to eliminate specular glare from wet or metallic clad walls. Top, using diffuse light for better contrast, bottom using UV lighting to create fluorescent imaging to highlight a plastic washer.

(From: "A Practical Guide to Machine Vision Lighting." National Instruments, www.ni.com/en/shop/choosing-the-right-hardware-for-your-vision-applications/a-practical-guide-to-machine-vision-lighting.html.)

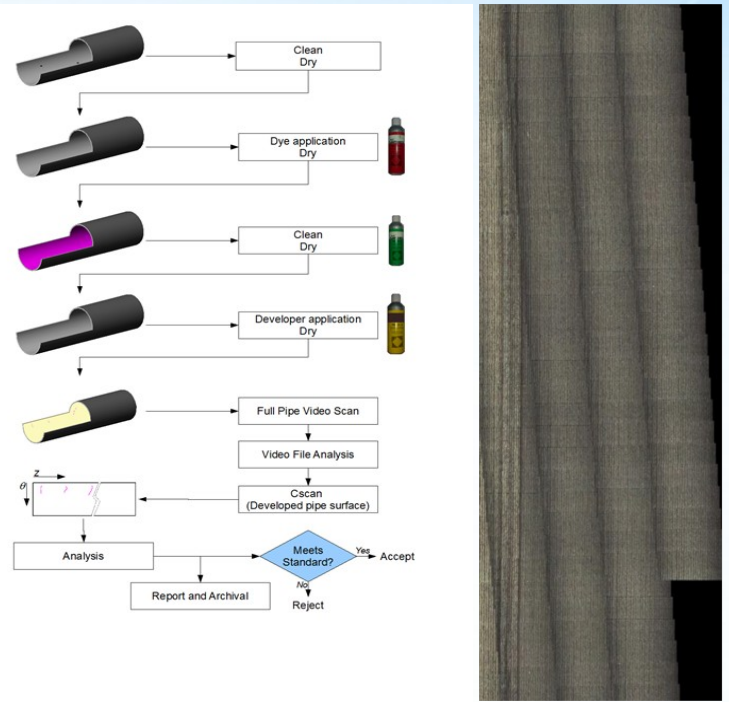


Figure 2: Conceptual workflow for sub-pixel accurate frame registration and continuous panoramic C-scan generation in cylindrical coordinates. (LHS also includes DPT process steps)

7. Automated Defect Reporting (ADR) and Report Generation

Once a high-contrast, error-corrected C-scan image is generated, it is passed to the system's Automated Defect Reporting (ADR) module. Instead of relying on manual visual checks, the software uses standard machine vision libraries to run rules-based parametric and hue-based feature extraction. This isolates the precise boundaries of the dye penetrant marks from the white developer background.

The software automatically evaluates these geometric metrics against the pass/fail limits defined by the API 5L-D standard. If an indication exceeds the allowable limits for linear cracks or total accumulated area, it is automatically flagged as a defect, and the pipe is marked for rejection or repair. A built-in reporting tool then instantly generates an inspection document containing the pipe metadata, time stamps, exact flaw locations, and the unrolled C-scan images.

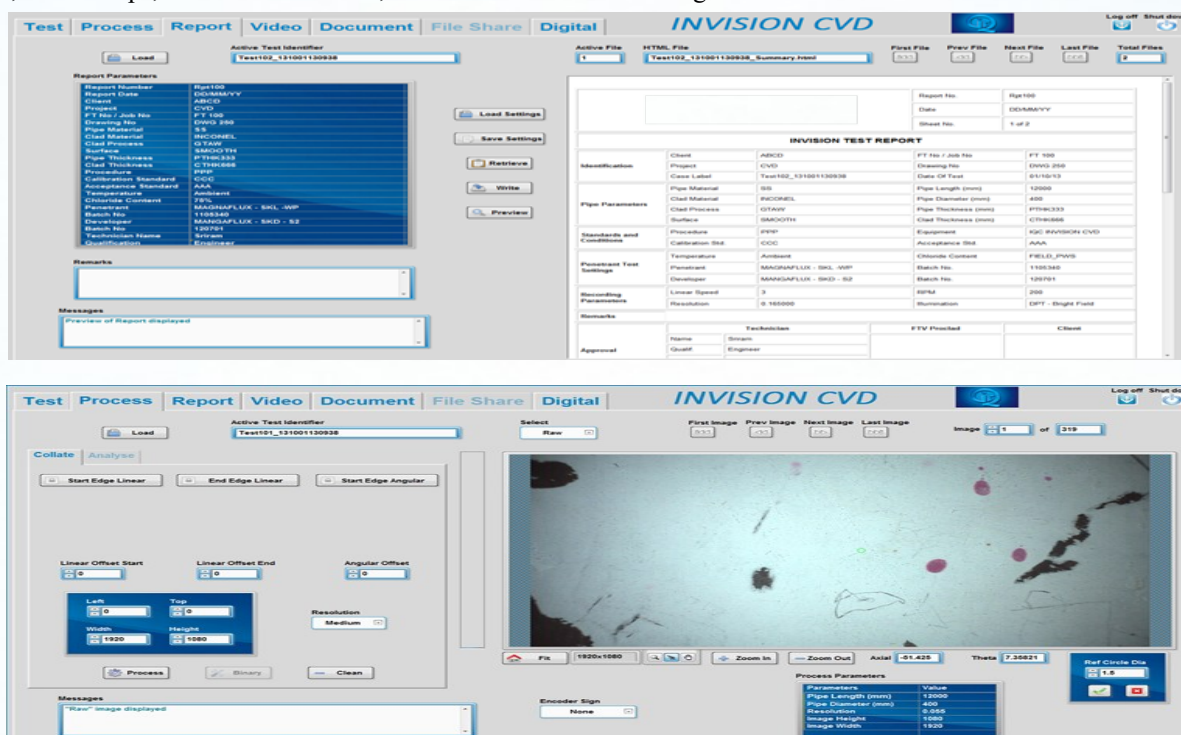


Figure 4: Interface example of the Automated Defect Reporting (ADR) system logging flaw locations, aspect ratios, and standard compliance verification metrics.

8. Conclusion

The integration of mechanical automation, machine vision, and intelligent image processing within the IQC AutoDPT system completely modernizes traditional liquid penetrant testing. As the NDT industry continues to adopt NDE 4.0 practices, combining robust mechanical automation with advanced analytics and emerging deep learning models will be essential for manufacturers looking to maximize both production throughput and product reliability.





PRESSURE TESTING

By Shri.R Balakrishnan, Manager-CQ-BHEL (Retd)

Pressure testing, leak testing, and acoustic leak testing are three important integrity assessment methods used in industry. Although they are related, each serves a different purpose in ensuring the safety, reliability, and performance of pressure-retaining equipment.

1. Pressure Test

Purpose—Pressure testing confirms that the component can safely withstand the specified pressure without permanent deformation, rupture, or excessive pressure loss.

Industrial Applications—Pressure vessels, Boilers, Heat exchangers, Steam pipelines, Oil and gas pipelines, LPG storage vessels, Cryogenic tanks, Nuclear reactor piping, Hydraulic systems, Chemical process equipment

Significance- Verifies mechanical strength, Demonstrates pressure-retaining capability, Detects gross defects, Required before commissioning. Mandatory under many construction codes. Ensures public and personnel safety

2. Leak Test

Purpose- Leak testing determines whether the equipment is leak-tight. It focuses on **leakage** rather than structural strength.

Industrial Applications -Oil & Gas pipelines, Chemical Industry –Storage Tanks, Reactors, Aerospace Fuel Tanks, Medical- Oxygen Cylinders. Automotive- Fuel systems & Air-conditioning systems

Significance—Prevents product loss, Prevents environmental pollution, Prevents explosion hazards, Ensures regulatory compliance

3. Acoustic Leak Test (Acoustic Emission Leak Detection)

Principle—When pressurized gas escapes through a leak, it creates turbulent flow that generates ultrasonic sound (typically 20–100 kHz). Acoustic sensors detect these high-frequency sound waves to locate the leak.

Industrial Applications -Oil & Gas-Natural gas pipelines, LNG plants, Gas storage terminals, Petrochemical Plants, Power Plants-Steam Lines. Aerospace- Aircraft fuel tanks, Oxygen systems Nuclear Industry-Reactor coolant systems, HVAC & Refrigeration

Significance of Acoustic Leak Testing—Early Leak Detection, Non-contact Inspection, Fast Inspection, Safe Testing, Cost Saving, Preventive Maintenance Industries Benefiting from Acoustic Leak Testing

Oil & Gas, Petrochemical, Refineries, Power Plants, LNG Plants, Nuclear Power, Aerospace, Defence, HVAC Industry

The entire aspects of the three tests are detailed in the comparison Table

Description	PRESSURE TEST	LEAK TEST	ACOUSTIC LEAK TEST
Significance	Verifies strength and pressure-retaining capability	Verifies leak-tightness and can quantify leakage.	Quickly detects and pinpoints gas leaks , especially in operating systems, but does not verify structural integrity.
Principle	Equipment is pressurized to a specified pressure to confirm it can safely withstand the load.	Leakage is detected by soap bubbles, pressure decay, vacuum, helium, or other methods.	Escaping gas through a leak produces high-frequency ultrasonic sound detected by acoustic sensors.
Objective of the Test	Confirm pressure-retaining capability and structural strength.	Determine whether leakage exists and quantify leakage.	Locate the leak.
Test Medium	Water (hydrostatic), oil, or gas (pneumatic).	Air, nitrogen, helium, hydrogen, refrigerant, water, etc.	Air, nitrogen, helium, natural gas, steam, or other gases.
Test Pressure	Usually 1.25 to 1.5 times design pressure (per applicable code).	Operating pressure or specified leak-test pressure.	Normally operating pressure or slightly above.
Detection Method	Pressure gauges, visual inspection, deformation measurement.	Soap solution, helium mass spectrometer, pressure decay, vacuum box, halogen detector, etc.	Ultrasonic detector, acoustic emission sensor, electronic receiver.
Sensitivity	Low for detecting small leaks; mainly identifies gross leakage or failure.	Very high (especially helium leak testing).	High for gas leaks; capable of locating small leaks.
Leak Location	No ; does not accurately locate leaks.	Yes (depending on method).	Yes , precisely identifies leak location.
Acceptance Criteria	No rupture, cracking, excessive deformation, or pressure loss during the specified holding time.	Leakage must be within specified allowable limits or zero visible leakage.	Does not have a universal acceptance criterion. The acceptance criteria depend on the applicable code, standard, customer specification, and the sensitivity of the acoustic instrumentation. ☐ No acoustic signal corresponding to a leak is detected above the specified threshold. ☐ All detected acoustic events are evaluated and confirmed to be non-leak sources (background noise, valve operation, vibration, etc.).
Safety	Hydrostatic testing is relatively safe; pneumatic testing has higher stored-energy hazards.	Depends on the test medium used.	Safe when using inert gases.
Typical Applications	Boilers, pressure vessels, piping systems, storage tanks, cylinders.	Pressure vessels, heat exchangers, refrigeration systems, aerospace components, valves	Pipelines, compressed air systems, pressure vessels, vacuum systems, valves, steam traps, cryogenic systems.
Applicable Standards	ASME Section VIII Div. 1 (UG-99, UG-100), ASME B31.3, API 650, API 620.	ASME Section V Article 10, ASTM E515, ASTM E499, ASTM E1003, ISO 20485.	ASME Section V Article 11 (Acoustic Emission, where applicable), ISO 12716, ASTM E1002 (Acoustic Emission), plant-specific procedures.

**PRACTICAL APPROACHES TO OVERCOME IDENTIFIED CHALLENGES IN NDT
FROM CHALLENGES TO EFFECTIVE SOLUTIONS
BY Mr.S.PONNAPPAN, HEAD QA, L & T CONSTRUCTION, KUDANKULAM,**



Introduction

Despite significant advances in NDT technology, many inspection failures continue to originate from planning and execution issues rather than limitations of the inspection methods themselves. In many projects, inspection challenges can be traced back to decisions made months earlier during design, fabrication planning, resource allocation, or personnel deployment.

The previous articles in this series examined the common factors affecting NDT reliability and highlighted how inadequate coordination, poor planning, and limited integration between disciplines can compromise inspection effectiveness. Identifying these challenges is only the beginning.

Sustainable improvement requires practical solutions that can be embedded throughout the project lifecycle. By strengthening competency, improving planning, fostering collaboration, capturing organizational knowledge, and adopting technology strategically, organizations can significantly enhance inspection reliability while reducing rework and project delays.

This article presents practical approaches that help transform NDT from a final verification activity into an integrated element of quality assurance and asset reliability.

Developing Competency Beyond Certification Requirements

Every experienced Level III can recall situations where a certified inspector struggled to interpret an unusual indication or apply a code requirement in the field.

Certification is an important milestone because it confirms that an individual has completed training and successfully demonstrated fundamental knowledge. However, real-world inspections rarely resemble examination scenarios. Field conditions introduce complex geometries, varying materials, equipment limitations, restricted access, and project-specific requirements.

Practical experience, understanding of codes and standards, familiarity with manufacturing processes, and engineering judgment transform knowledge into capability. Certification establishes the foundation; experience develops competence.

Practical Example

A Level II ultrasonic technician may be fully certified but may never have inspected dissimilar metal welds or complex nozzle configurations. Without exposure to such applications, interpretation challenges can arise despite possessing the required certification.

2. Building a Culture of Continuous Learning

Technology evolves faster than most certification cycles.

New techniques, revised standards, and changing customer expectations require continuous professional development. Organizations that excel in quality invest in refresher training, lessons-learned workshops, updates on revised codes, and practical proficiency assessments.

Continuous learning also addresses human factors that affect inspection reliability. Fatigue, production pressure, and communication gaps can influence decision-making. Regular training helps personnel recognize and manage these challenges while maintaining professional integrity.

3. Preserving Expertise Through Mentorship

Some of the most valuable lessons in NDT never appear in textbooks or certification examinations.

Organizations often spend decades developing technical expertise through project experience. Unless that knowledge is transferred systematically, it may be lost when experienced personnel retire or move to other assignments.

Practical Example

Several organizations have encountered situations where specialized inspection knowledge disappeared after the retirement of a senior Level III, forcing younger teams to spend years relearning solutions to previously solved problems.

4. Authorization: The Missing Link

A certificate confirms training. Authorization confirms readiness.

Employer authorization bridges the gap between certification and assignment-specific competence. Before personnel are assigned to critical inspections, organizations should verify relevant experience, code knowledge, project familiarity, and demonstrated capability.

This approach aligns certification with actual project requirements and strengthens inspection reliability.

5. Institutionalizing Organizational Learning

One of the industry's costliest inefficiencies is repeatedly solving the same technical problem.

Organizations benefit most when lessons learned are converted into organizational knowledge. Procedures, qualification records, technical interpretations, defect characterization examples, and project case studies should be systematically captured and maintained.

Digital Records Enhancement

Modern digital knowledge systems make this process significantly more effective. Electronic inspection records, digital radiographs, PAUT data files, lessons learned databases, and technical libraries enable faster retrieval of information and support consistent decision-making across projects.

6. Incorporating Inspectability During Design Development

When inspection problems appear during fabrication, their root cause often lies in design decisions made months earlier.

Inspection accessibility should be considered during design rather than after fabrication begins. Early involvement of NDT specialists helps ensure examination methods remain practical throughout fabrication and service life.

Practical Example

In some projects, nozzle configurations or structural attachments have prevented full ultrasonic coverage of critical weld zones. Correcting such issues after fabrication can be expensive and time-consuming.

7. Promoting Inspection-Conscious Fabrication Practices

Excellent workmanship does not always guarantee inspectability.

Fabrication activities should be planned to support both production and examination requirements. Welding sequences, temporary attachments, inspection openings, and access arrangements can significantly influence inspection effectiveness.

Practical Example

Some projects have experienced delays in radiographic testing because weld sequencing restricted access for film placement and source positioning. These challenges could have been avoided through early planning.

Similarly, UT examinations have occasionally been limited because support structures or permanent attachments reduced scanner access to the required scanning surface.

8. Strengthening Technical Review of Procedures

Many field challenges can be traced back to assumptions embedded in approved procedures.

Procedure reviews should verify technical suitability, compliance with governing standards, equipment capability, personnel qualifications, and implementation feasibility.

Multidisciplinary reviews involving NDT specialists, welding engineers, project personnel, and QA/QC teams frequently identify practical issues before they affect schedules.

9. Implementing Advanced Technologies Strategically

Technology creates value only when it solves a genuine inspection challenge.

Modern NDT technologies such as PAUT, TOFD, digital radiography, robotics, and AI-assisted evaluation provide significant advantages in coverage, characterization, and efficiency.

Practical Example

For example, PAUT can provide improved coverage and defect characterization compared with conventional manual ultrasonic testing when examining complex weld geometries.

Digital radiography can significantly reduce image processing time while improving data storage and retrieval capabilities for future reference.

Technology adoption should follow a structured implementation plan that includes pilot applications, validation activities, personnel training, and stakeholder engagement.

10. Addressing Field Challenges Through Proactive Planning

Field inspections rarely occur under ideal conditions.

Restricted access, adverse weather, concurrent construction activities, and compressed schedules can all affect inspection effectiveness.

Human Factor Enhancement

Production pressure can sometimes encourage shortcuts, while long working hours may contribute to fatigue-related errors. Effective planning, clear communication, and appropriate supervision help reduce these risks.

Organizations that conduct early site surveys, ensure resource readiness, and plan inspection activities in advance consistently achieve better results.

11. Aligning Inspection Scope with Service Criticality

Not all components present the same level of risk.

A risk-based inspection strategy allocates inspection effort according to safety significance, operating conditions, regulatory requirements, and potential consequences of failure.

This approach improves reliability while optimizing inspection resources.

12. Creating a Culture of Shared Ownership

Inspection reliability is rarely achieved by the NDT team alone.

Designers, fabricators, engineers, QA/QC personnel, inspectors, clients, and regulators all influence final inspection outcomes. Clear communication and alignment of objectives reduce misunderstandings and improve project execution.

Many quality issues originate from communication gaps between departments rather than technical shortcomings. Early engagement and clear responsibilities significantly improve outcomes.

13. Conclusion: Reliability is Built Through Integration

Successful NDT programs are built on much more than inspection techniques. They depend on competent personnel, effective planning, sound engineering decisions, organizational learning, and collaboration across multiple disciplines.

Organizations that integrate inspection considerations from design through fabrication, construction, and operation consistently achieve higher levels of quality and reliability. Advanced technologies can enhance inspection capability, but technology alone cannot guarantee success.

Inspection reliability is not achieved through technology alone. It is the outcome of informed decisions made throughout the project lifecycle.

Next Article in the Series

The next article, "Overview of NDE Personnel Certification Guidelines, Codes, and Standards," will provide a practical perspective on personnel certification, qualification, authorization, and employer responsibilities. It will explore the major certification frameworks, the roles of Levels I, II, and III personnel, and the key standards governing NDT qualification, helping organizations align certification requirements with project-specific competency needs for reliable and compliant inspection performance.



QUALITY MANUAL OF ISNT CHENNAI CHAPTER

By Mr. Dwarakanathan S (SDN), Ramakrishna Titagarh Railwheels Limited

ORGANIZATIONAL KNOWLEDGE

Organizational Knowledge — ISO 9001:2015

Clause 7.1.6 – Organizational Knowledge.

Organizational knowledge means the knowledge an organization needs to **operate its processes, achieve conformity of products and services, and ensure the effectiveness of its Quality Management System (QMS).**

In simple terms:

It is the knowledge that an organization has learned, developed, or acquired and needs to keep and make available so that people can perform their jobs correctly and consistently.

What does organizational knowledge include?

It can include both **internal and external knowledge.**

Internal knowledge:

- Work instructions and procedures
- Lessons learned from previous projects
- Experience of employees
- Knowledge of manufacturing or service processes
- Design and engineering knowledge
- Troubleshooting methods
- Previous nonconformities and corrective actions
- Customer-specific knowledge
- Knowledge gained from audits and improvement activities

Know-how developed through experience

External knowledge:

- Standards and regulations
- Customer requirements
- Supplier information
- Technical publications
- Industry best practices
- Training and professional knowledge
- Information from consultants or specialists
- New technology and market developments

2. Why does ISO 9001 require it?

Organizations can become dependent on the knowledge of a few experienced employees. If those employees leave, retire, or change jobs, important knowledge can be lost.

ISO 9001 therefore expects the organization to:

Determine → Maintain → Make available → Update knowledge when necessary

The objective is to ensure that people have the knowledge necessary to perform processes effectively and consistently.

3. Example

Imagine a company has one technician who knows how to adjust a particular machine to achieve the required product quality.

If that knowledge exists **only in the technician's experience**, there is a risk to the organization.

The company could capture the knowledge through:

- A work instruction
- Machine-setting parameters
- Training
- Troubleshooting guidance

Lessons learned

Now the knowledge is available to other competent personnel.

4. Organizational knowledge is not necessarily a document

This is important.

ISO 9001 does **not** say that all organizational knowledge must be documented.

Knowledge can exist as:

- **Documented information** — procedures, drawings, specifications, instructions
- **Human knowledge** — experience, skills and know-how
- **Practical knowledge** — lessons learned and proven methods
- **Digital knowledge** — databases, software, technical records
- **Shared knowledge** — training, mentoring and team-work

The organization should determine **what knowledge is necessary and how it will be maintained and made available.**

5. When should knowledge be updated?

ISO 9001 also expects the organization to consider **changing needs and trends.**

For example, knowledge may need to be updated when:

- A new product or process is introduced
- Technology changes
- Customer requirements change
- Regulations change
- New equipment is installed
- A major nonconformity occurs
- An experienced employee leaves

Lessons are learned from a project or failure

One-line interpretation for an auditor

Organizational knowledge is the knowledge necessary for the organization to operate its processes and achieve conformity of products and services, which the organization determines, maintains, makes available, and updates as necessary.

In practical terms: ISO 9001 wants the organization to make sure that **“the knowledge needed to do the job correctly does not get lost and is available to the right people when they need it.”**

To be continued

STANDARD- ESSENCE OF EXPERIENCE
DISTINGUISH THE STANDARDS
STANDARDS FOR EDDY CURRENT TESTING

By Mr.M.Manimohan, Manager (Retired), NDTL, BHEL, Trichy



ASTM

- E 215 Standard Practice for Standardizing Equipment and Electromagnetic Examination of Seamless Aluminum-Alloy Tube
- E 243 Standard Practice for Electromagnetic (Eddy Current) Examination of Copper and Copper-Alloy Tubes
- E 309 Standard Practice for Eddy Current Examination of Steel Tubular Products
- E 376 Standard Practice for Measuring Coating Thickness by Magnetic-Field or Eddy Current (Electromagnetic) Testing Methods
- E 426 Standard Practice for Electromagnetic (Eddy Current) Examination of Seamless and Welded Tubular Products, Titanium, Austenitic Stainless Steel and Similar Alloys
- E 566 Standard Practice for Electromagnetic (Eddy Current/Magnetic Induction) Sorting of Ferrous Metals
- E 571 Standard Practice for Electromagnetic (Eddy-Current) Examination of Nickel and Nickel Alloy Tubular Products
- E 690 Standard Practice for In Situ Electromagnetic (Eddy Current) Examination of Nonmagnetic Heat Exchanger Tubes
- E 703 Standard Practice for Electromagnetic (Eddy Current) Sorting of Nonferrous Metals
- E 1004 Standard Test Method for Determining Electrical Conductivity Using the Electromagnetic (Eddy Current) Method
- E 1312 Standard Practice for Electromagnetic (Eddy Current) Examination of Ferromagnetic Cylindrical Bar Product Above the Curie Temperature
- E 1606 Standard Practice for Electromagnetic (Eddy Current) Examination of Copper and Aluminum Redraw Rod for Electrical Purposes
- E 1629 Standard Practice for Determining the Impedance of Absolute Eddy-Current Probes
- E 2338 Standard Practice for Characterization of Coatings Using Conformable Eddy Current Sensors without Coating Reference Standards
- E 2884 Standard Guide for Eddy Current Testing of Electrically Conducting Materials Using Conformable Sensor Arrays
- E 3052 Standard Practice for Examination of Carbon Steel Welds Using An Eddy Current Array

ASME-Section V

- Article 8 Eddy current Examination

ISO

- ISO 2360 Non-conductive coatings on non-magnetic electrically conductive base metals — Measurement of coating thickness — Amplitude-sensitive eddy-current method
- ISO 10893-1 Automated electromagnetic testing of seamless and welded (except submerged arc-welded) steel tubes for the verification of hydraulic leak tightness
- ISO 10893-2 Automated eddy current testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of imperfections
- ISO 10893-1 Non-destructive testing of steel tubes
- ISO 10893-2 Automated eddy current testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of
- ISO 12718 Non-destructive testing — Eddy current testing — Vocabulary
- ISO 14691 Petroleum, petrochemical and natural gas industries — Flexible couplings for mechanical power transmission — General-purpose applications
- ISO 15548-1 Non-destructive testing — Equipment for eddy current examination. Instrument characteristics and verification
- ISO 15548-2 Non-destructive testing — Equipment for eddy current examination. Probe characteristics and verification
- ISO 15548-3 Non-destructive testing — Equipment for eddy current examination. System characteristics and verification
- ISO 15549 Non-destructive testing — Eddy current testing — General principles

ISO 17643	Non-destructive testing of welds — Eddy current testing of welds by complex-plane
ISO 20339	Non-destructive testing — Equipment for eddy current examination — Array probe characteristics and verification
ISO 20669	Non-destructive testing — Pulsed eddy current testing of ferromagnetic metallic components
ISO 20890-5	Eddy current testing of steam generator heating tubes
ISO 21968	Non-magnetic metallic coatings on metallic and non-metallic basis materials — Measurement of coating thickness — Phase-sensitive eddy-current method
ISO 25902-1	Titanium pipes and tubes- Eddy-current examination

INDIAN STANDARDS

IS 6398-2	Automated Eddy Current Testing of Seamless and Welded (Except Submerged Arc-Welded) Steel Tubes for the Detection of imperfections
IS 11612	Code of practice for eddy current testing of non-ferrous seamless pipes and tubes
IS 12965	Glossary of terms used in electromagnetic (Eddy Current) testing
IS 15540	Recommended practice for eddy current testing of installed non-ferromagnetic heat exchanger tubing using dual frequency method
IS 17181	Remote Field Eddy Current Testing of Steam Generator and Heat Exchanger Tubes
IS 19362	Non-destructive testing Eddy Current Testing- Determination of Electrical Conductivity of Non-magnetic Metal

BRITISH STANDARDS

BS 3683-5	Eddy current flaw detection glossary
BS 3889-2A	Automatic eddy current testing of wrought steel tubes
BS 3889	Eddy current testing of nonferrous tubes

DIN EN Standard

DIN EN 1971-1	Copper and copper alloys – Eddy current test for measuring defects on seamless round copper and copper alloy tubes MIL U.S Military and Government specification
NPFC-MIL-STD-1537	Electrical Conductivity test for verification of heat treatment of Aluminum alloys Eddy current method

AUSTRALIAN STD

AS ISO 15549	Eddy current testing — General principles
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BS EN

BS EN 2360	Eddy current methods for measurement of coating thickness of nonconductive coatings on nonmagnetic base material.
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SAE (Society of Automotive Engineers)

(standards used for the aerospace, automotive and commercial-vehicle)

ARP4402A	Eddy Current Inspection of Open Fastener Holes in Aluminum Aircraft Structures
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