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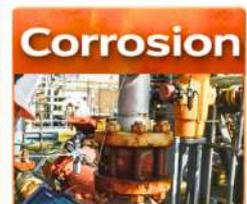
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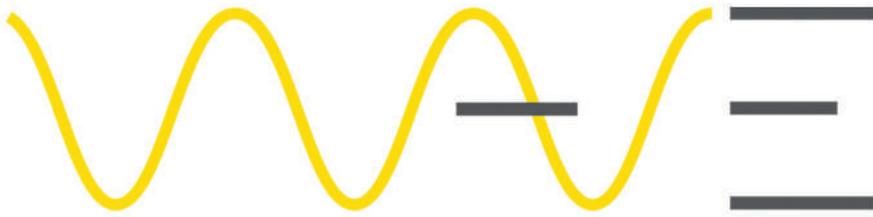
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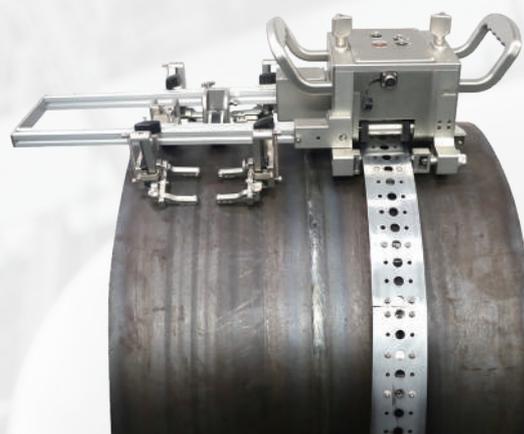


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Enabling the Future of NDT:

Open File Formats for Automation and Custom Software Integration



By Emilie Peloquin

As the **global Non-Destructive Testing (NDT) industry grapples with workforce shortages and increasing demands for efficiency**, the adoption of digital tools and standardized data frameworks is no longer optional; it is foundational. One of the most pivotal developments facilitating this transformation is the emergence of open file formats, which serve as a cornerstone for automation, software, and long-term scalability.

This article explores the demographic and workforce pressures facing the NDT industry, outlines technological responses, and highlights how open ecosystems can support a sustainable and modern NDT.

Demographic Shifts and Workforce Challenges

Long-term global demographic trends are exerting substantial pressure on skilled labor pipelines, including in the NDT sector. According to a **2025 study by the McKinsey Global Institute**¹ on depopulation and productivity,

two-thirds of the world's population now live in countries where fertility rates will drop below replacement level. This trend, coupled with a rapidly aging workforce, is projected to decrease the pool of working-age individuals in many economies. In NDT, these macro trends manifest through several well-documented challenges:

- **A shrinking talent pipeline**, particularly in advanced inspection methods such as phased array testing (PAUT) and full matrix capture (FMC)
- **Inflated labor costs and project delays** due to limited inspector availability
- **Training gaps**, where incoming personnel often lack sufficient hands-on experience or critical thinking skills, despite formal education
- **Low public awareness** of NDT as a viable career path
- **Shortages of experienced instructors** and misaligned global training standards

These issues compound the urgency for change, pushing the industry to look beyond traditional solutions and toward structural innovation.

A Technological Response: Eight Key Trends

To address the compounded challenges of labor scarcity and increasing technical complexity, the NDT industry is embracing a set of emerging strategies. One of the most impactful developments is the promotion of open ecosystems through standardized file formats and application programming interfaces (APIs), which allow for smoother integration between tools and platforms. In parallel, digital transformation is gaining momentum as organizations adopt AI-driven tools, robotics, and cloud-based workflows to optimize efficiency and reduce reliance on manual tasks.

Knowledge retention is also a growing focus, with new remote collaboration technologies enabling experienced inspectors to mentor and contribute without needing to be physically present. International certification equivalency and global recruitment efforts are expanding the talent pool and addressing regional disparities in workforce availability.

At the same time, organizations are exploring task unbundling models, where semi-skilled workers are trained for routine inspection duties under qualified supervision—reviving the use of Level I inspectors. Centralized hubs and inspection-as-a-service models are helping to pool expert resources and extend capabilities to underserved regions. Meanwhile, scalable training methods using AR, VR, and simulation are reshaping how new inspectors are prepared for the field. Finally, AI-augmented decision-making is allowing experts to focus on validating results rather than reviewing raw data, improving throughput and consistency. Collectively, these trends are helping to reshape the industry's approach to efficiency, quality, and workforce development.

While each of these trends can contribute to increased efficiency, their success is ultimately dependent on a shared foundation: accessible, standardized, and interoperable data.

The Role of Open File Formats in NDT

In today's landscape, many NDT systems generate data using proprietary formats, limiting interoperability and reducing the potential for automation or multi-tool integration. This creates challenges for service providers and end users who wish to combine data from various inspection techniques (e.g., ultrasonic, radiographic, eddy current) or integrate results into digital workflows and asset management systems.

An **open file format**, in contrast, is a publicly available specification for storing and accessing inspection data. When built on scalable, non-proprietary technologies (such as HDF5), open formats offer **several advantages**:

- **Interoperability:** Enables data exchange across different tools and platforms
- **Extensibility:** Supports new techniques such as total focusing method (TFM) or phase coherence imaging (PCI)
- **Scalability:** Accommodates large datasets and complex inspection scenarios
- **Transparency:** Enhances data traceability and auditability in regulated environments
- **Vendor Independence:** Reduces lock-in and allows for custom software development by users or third parties

For organizations pursuing **digital transformation**, open formats form the bridge between legacy systems and modern digital ecosystems. By standardizing how inspection data is structured and accessed, NDT stakeholders can enable more intelligent workflows, faster decision-making, and broader collaboration.

Use Cases: Building the Infrastructure for NDT 4.0

Open file formats open the door to several high-impact applications within NDT, including:

- **Custom Visualization Modules:** Engineers can build specialized tools to process, analyze, and visualize inspection data in novel ways—tailored to unique asset types or defect profiles.
- **AI and Machine Learning Integration:** AI algorithms require structured, labeled datasets for training. Open formats allow users to export and label data consistently across multiple inspection scenarios.

- **Digital Twins:** When data from multiple modalities is stored in a unified structure, it can be used to build digital twins—virtual representations of physical assets that evolve over time with each inspection.
- **Remote Supervision and Review:** Experts can access open-format data remotely for review, second opinions, or audits, without requiring access to proprietary software or licenses.
- **Training Simulators:** Training institutions can develop simulation environments based on real-world inspection data, enhancing trainee exposure to flaw morphology, signal interpretation, and defect recognition.

These use cases are critical as the industry attempts to do more with fewer inspectors, and as the skill level required to interpret increasingly complex data continues to rise.

Aligning with Industry Trends

The NDT industry is not alone in its pursuit of open data standards. In the **medical imaging sector**, for instance, the Digital Imaging and Communications in Medicine (DICOM) standard allows radiographs, ultrasounds, and MRIs to be shared across systems and institutions seamlessly. Similarly, **the European Data Act**, coming into effect in 2025, mandates that users must be able to access and port data from any connected device, reinforcing the principle that **data belongs to the user**.

These policies and market pressures are likely to influence global industries, including NDT, over the coming years. Early adoption of open formats will not only align NDT organizations with future regulatory expectations but also unlock greater long-term value from their data.

CONCLUSION

A Foundation for Innovation

The NDT industry stands at the crossroads of significant workforce and technological transformation. With fewer inspectors entering the field and increasing complexity in inspection methods, embracing **automation, scalable training, and AI** will be essential.

At the heart of these transformations lies the need for **data standardization**. Open file formats provide the infrastructure needed to enable multi-vendor interoperability, support custom software development, and facilitate next-generation workflows.

By adopting open ecosystems and committing to shared standards, the NDT community can improve not only efficiency and scalability but also transparency, quality, and long-term sustainability.

Ref.

1

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NDT Jobs will Never Be the Same:

How Technology is Changing Inspections



By Mohamed Abufour

Non-Destructive Testing (NDT) professionals have always been the unsung heroes of safety. Their work ensures that people, equipment, and the environment are protected by detecting defects before they escalate into serious problems. Traditionally, inspections relied on hands-on expertise, deep technical knowledge, and rigorous certification processes. However, the **NDT landscape** is **changing rapidly**.

Emerging technologies such as Artificial Intelligence (AI), robotics, automation, and digital inspection platforms are transforming how inspections are performed.

As assets in industries like energy, aviation, and infrastructure grow more complex, safety standards are also becoming stricter.

Companies now expect inspections to be faster, more accurate, digitally traceable, and auditable. These demands make it clear that traditional NDT skills alone are no longer enough. To succeed, technicians must combine manual expertise with digital capabilities, creating a new breed of NDT professional who can meet the challenges of today and tomorrow.

The NDT professional of tomorrow is someone who builds on strong conventional NDT foundations while also mastering the digital intelligence of NDT 4.0.

This evolution requires more than just learning new tools, it demands a shift in mindset. Modern NDT professionals must embrace continuous learning and adaptability, understanding that a single certification or a narrow skill set is no longer sufficient. In this digital era, inspectors must be capable of integrating traditional methods with advanced technologies to deliver safe, reliable, and efficient inspections.

Continuous learning is now at the heart of the NDT career path. While technical proficiency remains critical, modern inspectors must also develop digital literacy and analytical skills. This ensures they can work with AI assisted detection systems, robotics, and automated scanners while maintaining their core inspection expertise.

Some of the most essential skills for today's NDT professionals include:

- Operating automated scanning systems for advanced inspections

- Interpreting AI assisted flaw detection and analysis results
- Utilizing robotic tools for inspections in hazardous or hard-to-reach areas
- Navigating digital workflows and reporting systems for clear, traceable documentation
- Analyzing large datasets to make informed predictions and recommendations

By combining traditional hands-on skills with these digital capabilities, professionals position themselves not just as inspectors but as strategic problem solvers. Adaptability is the most valuable certification an NDT professional can hold today.

The need for multi-disciplined NDT professionals stems from the increasing complexity of modern assets. Industries like oil & gas, aviation, nuclear, and renewable energy require inspectors who can work across multiple methods and technologies. An inspector who knows only one method or tool may struggle to keep up with evolving industry needs.

The skills of a modern NDT technician can be grouped into three interconnected areas:

1. Traditional Methods

- Ultrasonic Testing (UT)
- Magnetic Particle Testing (MT)
- Penetrant Testing (PT)
- Radiographic Testing (RT)
- Visual Testing (VT)

2. Digital Skills

- Data interpretation and analysis
- Digital reporting and workflow management
- Using digital twins to monitor and simulate asset behavior



3. AI and Automation

- Understanding AI and basic machine learning concepts
- Operating robotic inspection systems
- Integrating automated scanning and analysis tools into daily workflows

The combination of these skill sets ensures that inspectors are prepared for the challenges of today while staying ahead of industry trends. Professionals who can bridge the gap between traditional and digital skills will naturally become leaders in the field.

Alongside these new skills, the approach to inspection itself is evolving. Historically, inspections were reactive or scheduled, often performed after signs of wear or according to fixed timelines.

Today, companies are increasingly adopting predictive maintenance, digital twins, and risk-based inspection programs. These approaches use data to anticipate potential issues before they become critical, improving safety and efficiency.

Modern NDT data has moved beyond simple record-keeping. It is now a strategic resource, helping organizations make informed decisions about asset management. By analyzing inspection data with AI and advanced analytics, professionals can detect subtle trends, prioritize maintenance activities, and prevent failures before they happen. This shift connects NDT directly to business outcomes, highlighting the growing importance of skilled inspectors in strategic decision-making.

The concept of NDT 4.0 describes the integration of traditional inspection techniques with smart technologies. Automated scanners, smart sensors, cloud-based reporting platforms, and AI driven analytics are now working together to enhance inspection reliability and speed.

The benefits are significant:

- Higher accuracy and consistency reducing human error
- Faster inspections – accelerating data collection and reporting
- Better decision-making – AI highlights potential issues for focused attention

Imagine inspecting a complex asset like a pipeline or aircraft component using multiple layers: a technician performs manual checks, automated scanners collect data, drones capture images, and AI analyzes the results in real-time. This combination of human skill and technology defines NDT 4.0, empowering inspectors rather than replacing them.

For professionals, this evolution opens exciting opportunities in fields such as digital inspection, asset integrity, robotics, and data analytics. The modern NDT career path is now broader and more impactful than ever.

NDT 4.0 is not replacing inspectors; it is empowering them.

The skills needed for modern NDT are highly transferable across industries. Professionals trained in both traditional and Advanced NDT as well as digital methods, can pursue career opportunities across a wide range of industries sectors, including but not limited:

- Oil & Gas
- Aviation & Aerospace
- Renewable Energy
- Infrastructure
- Manufacturing

Emerging career roles include:

- Integrity Engineer
- Digital NDT Specialist
- Advanced Robotics Operator
- Inspection Planner
- Asset Integrity Manager

By embracing new technologies and continuous learning, NDT professionals can expand their career options globally, taking on roles that were not available a decade ago.

While these changes bring exciting opportunities, the transformation of NDT also comes with challenges that cannot be ignored. First, there is a skill gap, as many experienced technicians may not have experience with AI, robotics, or data analytics. Second, existing certification programs were developed for traditional methods and need updates to include digital and AI competencies.

Managing large datasets securely and ensuring compliance with regulations is another challenge. Some professionals may also be hesitant to adopt new technologies, preferring familiar manual methods. Finally, integrating AI, robotics, and automation into established workflows requires careful planning and validation to ensure safety and accuracy.

Addressing these challenges requires training, collaboration, and updated certification pathways to prepare both current and future inspectors for the digital age.

Education is the foundation for preparing the modern NDT professional. Beyond mastering traditional inspection methods, **training programs** must include:

- Basic AI and digital literacy
- Robotics and automated systems
- Data analysis and interpretation
- Digital reporting and cloud-based tools

Certifications should evolve to reflect the digital transformation. Modern inspectors should pursue **multi-tiered credentials** covering:

- Advanced NDT techniques and the core of conventional NDT methods (UT, MT, PT, RT, VT)
- Digital inspections and data analysis
- AI and robotics applications
- Predictive and risk-based inspection strategies



By combining hands on expertise with digital knowledge, certified inspectors can analyze data, make informed decisions, and enhance asset integrity, rather than just performing inspections. The NDT profession is changing faster than ever, and the opportunities are immense. Today's inspectors can:

- Expand their technical skills across multiple methods
- Learn and apply AI, robotics, and digital inspection tools
- Participate in predictive maintenance and strategic planning
- Lead multi-disciplinary inspection teams

Future NDT professionals must embrace continuous learning, adaptability, and curiosity. Those who develop both manual and digital skills will become leaders in the field, setting new standards for safety and reliability.

The future belongs to those who innovate, adapt, and lead. Start now to achieve your goals and make an impact.

By combining human expertise with AI and digital technologies, NDT becomes a high-impact profession that protects people, assets, and the environment worldwide.

NDT jobs will never be the same. The integration of manual skills and digital intelligence is transforming inspections and careers.

The path forward is clear:

- Keep learning and updating your skills
- Earn training/certifications in traditional, advanced NDT and digital NDT methods
- Embrace technology as a tool for better inspections
- Stay adaptable, curious, and innovative

Those who start today will shape the industry tomorrow. By combining expertise, AI, and digital mastery, NDT professionals can make a lasting difference, inspire future generations, and lead the profession into a new era.

The time is now. The NDT profession is evolving embrace it, lead it, and empower yourself and the next generation.

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By Kuldeep Sharma
Vineet Yadav
Ashok Kumar

Non-destructive testing (NDT) is essential to maintaining the integrity of critical components and systems. It allows defects to be detected and assessed without impairing the function of the part, which is fundamental wherever safety & reliability are priorities.

Traditional inspection regimes, however, often follow fixed time intervals that do not reflect actual degradation or risk. Risk-Based Inspection (RBI) offers a different approach, and NDT is at the heart of making it work.

From Time-Based to Risk-Based

In many organizations, inspection planning has historically been calendar driven. Components are examined at fixed intervals—three years, five years, or some other prescribed period—regardless of their condition or operating history. This approach is simple to manage, but it can lead to unnecessary inspections on low-risk items and insufficient attention on items that are more likely to fail.

RBI changes the focus from schedule to risk. It does this by explicitly considering two key elements:

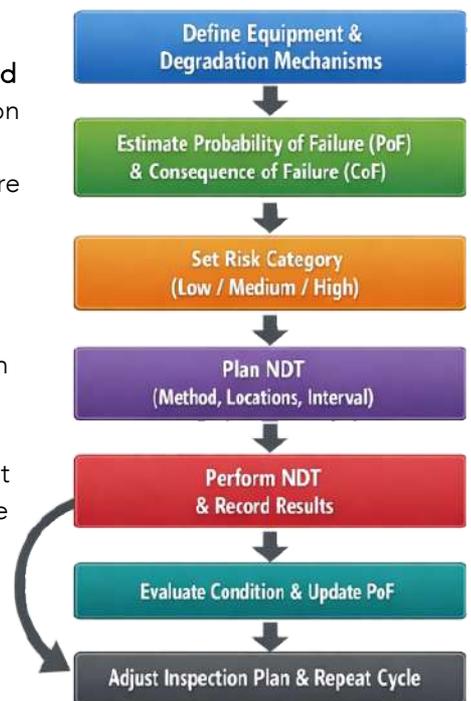


Figure 1: NDT in a Risk-Based Inspection Loop

- Probability of Failure (PoF): The likelihood that a component will fail, given its design, materials, environment, loading, degradation mechanisms and past performance.
- Consequence of Failure (CoF): The impact that failure would have on safety, environment, operations and cost.

By combining PoF and CoF, RBI methods classify items into risk categories and then tailor inspection strategies accordingly. High-risk items receive more frequent and more detailed examination, while lower-risk items may justify extended intervals or simplified inspection.

Risk-Based Inspection and NDT:

Moving from Compliance to Predictive Integrity

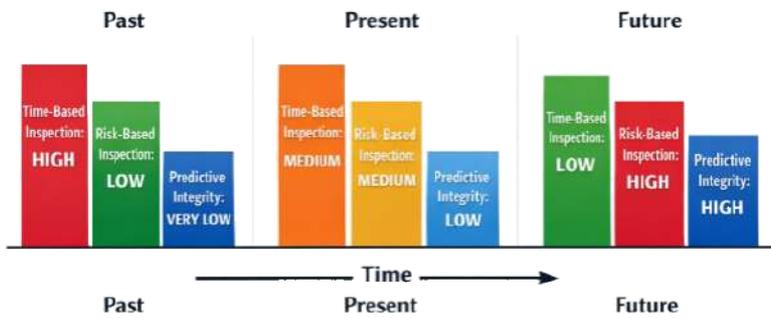


Figure 2: Shift in Inspection Approach Over Time

The Central Role of NDT in RBI

RBI is only as good as the information that feeds it, and this is where NDT is critical. NDT provides the condition data needed to quantify and update PoF in a meaningful way. For example:

- Thickness measurements supply information on material loss, enabling estimates of corrosion or wear rate.
- Flaw detection and sizing results describe crack length, depth, orientation and morphology, supporting assessments of remaining strength and remaining life.
- Repeated NDT over time reveals degradation trends, rather than just single snapshots of condition.

This information reduces uncertainty in the risk model. Instead of relying solely on age, generic degradation assumptions or conservative worst-case estimates, decision-makers can base PoF on measured condition. As new NDT data becomes available, PoF is updated, and the risk classification can change. In this way, inspection becomes part of a continuous feedback loop: inspect, reassess, adapt.

Typical NDT–RBI Workflow

- Identify damage mechanisms and affected components
- Select suitable NDT methods based on required sensitivity and sizing
- Collect baseline inspection data
- Evaluate PoF using measured condition data
- Combine PoF with CoF to determine risk ranking
- Adjust inspection scope and interval based on risk
- Repeat inspections to confirm trends and update predictions

Moving Toward Predictive Integrity

Risk-based thinking naturally supports predictive and condition-based maintenance philosophies. When NDT data is collected consistently and managed well, it can be used not only to describe current condition but also to forecast future condition. The progression looks like this:

1. **Descriptive:** NDT tells you what damage exists now.
2. **Trending:** Repeated measurements show how fast damage is changing.
3. **Predictive:** Models use the trend to estimate when a critical limit will be reached.

For example, if wall thickness is measured periodically in the same locations, the resulting time series can be used to calculate a material loss rate. This rate can be extrapolated to predict when the component will reach a minimum allowable thickness. Similarly, repeated crack-sizing measurements can support estimates of crack growth rates and remaining life, using fracture mechanics or other suitable methods.

Modern data analysis techniques, including machine learning, can enhance this predictive capability by detecting patterns, correlations and anomalies in large NDT datasets. The key point is that NDT, when integrated into an RBI framework, supports a shift from reacting to detected defects toward anticipating when and where defects are likely to become critical.

Illustrative Example: Corrosion Monitoring in a Pipeline Segment

Consider a pipeline section exposed to internal corrosion. Initial ultrasonic thickness measurements show localized wall loss but still above minimum allowable thickness. Under a traditional time-based inspection plan, the next inspection might be scheduled several years later based solely on code requirements.

In an RBI-driven approach, these thickness measurements are used to calculate a corrosion rate. When the consequence of failure is high (for example, due to product release or environmental impact), the calculated probability of failure increases even if the component is not yet near failure. By repeating thickness measurements at the same locations, the corrosion rate can be confirmed or refined. This allows inspection intervals to be adjusted and supports prediction of when minimum thickness will be reached, enabling proactive repair or replacement before integrity is compromised.

NDE 4.0: The Role of Artificial Intelligence and Machine Learning in Risk-Based Inspection

The evolution of Non-Destructive Evaluation (NDE) toward what is often referred to as **NDE 4.0** reflects the broader digital transformation occurring across industrial sectors. NDE 4.0 emphasizes the integration of advanced sensors, automation, data analytics, and connectivity to transform inspection from a largely manual, experience-driven activity into a data-centric and predictive discipline. Within this framework, **Artificial Intelligence (AI) and Machine Learning (ML)** play a central role in enhancing the effectiveness of Risk-Based Inspection (RBI).

Traditionally, NDT results have been interpreted by inspectors using visual assessment, threshold-based alarms, or simple trend analysis. While effective, these approaches are limited when large volumes of inspection data are generated or when degradation mechanisms are complex.

AI-Assisted Data Interpretation

One of the most immediate applications of AI in NDT is automated data interpretation. Machine learning models can be trained using historical inspection data, including ultrasonic signals, radiographic images, acoustic emission records, or thermographic data. Once trained, these models can assist in:

- Distinguishing relevant defect signals from noise
- Improving repeatability and consistency of flaw detection
- Reducing dependence on individual operator judgment
- Supporting faster screening of large inspection datasets

For example, in ultrasonic testing, ML algorithms can analyze A-scan, B-scan, or phased-array data to identify characteristic patterns associated with cracks, lack of fusion, or corrosion. This supports more reliable input into Probability of Failure (PoF) calculations within an RBI framework.

From Monitoring to Prediction

The true value of AI and ML emerges when repeated NDT data over time is combined with operating and environmental information. Machine learning models can be used to estimate degradation rates, identify non-linear trends, and predict future based on historical behavior. This enables a transition from descriptive inspection to predictive integrity. In an RBI context, this predictive capability directly strengthens PoF assessment. Instead of assuming conservative degradation rates or relying solely on generic models, PoF can be continuously updated using data-driven predictions. As inspection data accumulates, model accuracy improves, reducing uncertainty and supporting more confident decision-making.

Enhancing RBI Decision Making

AI-enabled NDT does not replace RBI principles; rather, it enhances them. The integration of ML outputs into RBI systems allows risk rankings to be updated dynamically as new data becomes available. Components previously classified as low risk may move into higher-risk categories if degradation accelerates, while stable components may justify extended inspection intervals.

This dynamic risk updating supports more efficient allocation of inspection resources. High-risk components can be monitored more closely, while unnecessary inspections on stable, low-risk assets can be reduced without compromising safety or integrity.

Practical Considerations and Limitations

While AI and ML offer significant potential, their application in NDE must be approached carefully. Models are only as good as the data used to train them. Poor quality, inconsistent, or biased datasets can lead to unreliable predictions. Transparency and validation are therefore essential, especially in safety-critical industries.

AI tools should be viewed as **decision-support systems**, not replacements for qualified NDT personnel. Human expertise remains essential for defining inspection strategy, validating results, and making final integrity decisions.

Successful implementation of NDE 4.0 requires not only digital tools but also appropriate training, governance, and integration with existing inspection and RBI processes.

NDE 4.0 as an Enabler of Predictive Integrity

When effectively integrated, AI-driven NDT supports the broader goal of predictive integrity management. It strengthens the link between inspection data and risk assessment, reduces uncertainty in PoF estimates, and enables earlier intervention before failure becomes imminent. In this sense, NDE 4.0 represents a natural evolution of NDT within a risk-based philosophy—moving from compliance-focused inspection toward continuously updated, data-driven integrity assurance.

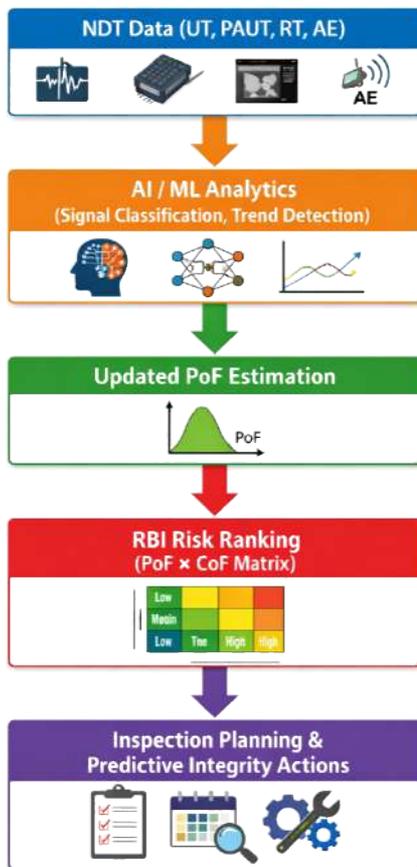


Figure 3: Role of NDE 4.0 in Risk-Based Inspection and Predictive Integrity.

Benefits of Integrating NDT & RBI

Combining RBI with robust NDT practices offers several important benefits:

- **Focused use of inspection resources:** Time and effort are directed to components that contribute most to overall risk, rather than spread across all items.
- **Improved understanding of uncertainty:** Measured data reduces reliance on conservative assumptions, which can either overestimate or underestimate.
- **Optimized inspection intervals:** Inspection frequency is based on degradation behavior and consequence, not just calendar dates.
- **Enhanced decision-making:** Condition data, risk assessments and predictive models together support more transparent and defensible integrity decisions.

These benefits depend on the quality of the NDT applied. Techniques must have adequate sensitivity and sizing capability for the damage mechanisms of concern, and procedures and personnel must be qualified appropriately.

Why This Matters for Owners and Operators:

For asset owners and operators, the shift from time-based inspection to risk-based inspection is not only about safety but also about smarter use of resources. Inspections, shutdowns, and repairs are costly. By focusing attention on components that truly drive risk, organizations can avoid unnecessary inspections while still maintaining confidence in asset integrity. Over time, this approach supports safer operation, fewer unplanned failures, and better alignment between inspection effort and business priorities.

Practical Considerations for Implementation

For practitioners looking to align NDT with RBI and move toward predictive integrity, several aspects deserve attention:

- **Data consistency and traceability:** NDT results should be recorded in a structured, repeatable way so that they can be compared over time and linked to specific locations and components.
- **Method selection:** Inspection techniques should be selected with the relevant damage mechanisms and required detection and sizing performance in mind.
- **Integration with analysis tools:** NDT data should feed directly into risk assessments, remaining-life calculations and, where used, digital twins or integrity software.
- **Competence and training:** Personnel need understanding not only of NDT but also of how their results influence PoF, CoF and risk.
- **Feedback and continuous improvement:** As risk models and predictions are tested against real outcomes, both the RBI approach and the NDT program should be refined.

A Direction of Travel for NDT

Risk-Based Inspection provides a structured way to move beyond purely compliance-driven, time-based inspections. When NDT is integrated into RBI and used to quantify and update risk, inspection becomes more targeted, more informative and more closely connected to actual integrity needs. The longer-term direction is clear: NDT is evolving from a set of isolated tests into a core data source for predictive, risk-informed asset management.



APEX-FI Certifications

-1 ISO 2015: 9001

The International standard requirements for quality management system (QMS).

-2 ISO 2018: 45001

Occupational Health and safety management system.

-3 ISO 2012: 17024 – Certification of personnel

ISO9712 Scheme-testing- Qualification and certification of NDT personnel .

-4 ISO 17020:2012 Conformity assessment for inspection body

UT, Thickness Measurement, PT, MT, VT, PAUT, Corrosion Mapping, TOFD — Storage

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TANK CALIBRATION AND MEASUREMENTS



THIRD PARTY INSPECTION



NDT PRODUCT INNOVATION



The Future NDT Workforce:

Skills, Certification, and Digital Readiness

AUTHOR:

Srijan Tiwari

Co-founder & Director of **TIQ World Pvt. Ltd.**, an integrated digital ecosystem focused on Training, Inspection, and Quality in the NDT and manufacturing quality domain. Incubated at **IIT Madras Research Park**, India, TIQ World operates at the intersection of NDE 4.0, digitalization, and workforce readiness.

He has delivered several Keynote Industry sessions in India, Singapore, Germany.

He is also an Entrepreneurial Research Scholar at the Centre for Non-Destructive Evaluation (CNDE), IIT Madras with a focus on bridging inspection technologies, certification systems, and human digital collaboration. With a background in Mechanical Engineering and an MS in Entrepreneurship from IIT Madras, he actively engages with industry, academia, and global manufacturing ecosystems across India, Africa, and the Middle East on skills development, certification evolution, and the future of the NDT workforce.

The Non-Destructive Testing and Evaluation industry

has always been built on one fundamental idea, trust. Trust in data, trust in process, and most importantly, trust in people. As we move toward 2026, the very meaning of that trust is evolving.

NDT is no longer just about inspection or compliance. It is about intelligence, interpretation, and the ability to see beyond the visible.

The future of this industry will not be defined only by better tools or faster inspections. It will be shaped by how we build skills, evolve certification, and prepare people to work confidently in a digital yet responsibility driven environment.

Behind the Technology

The NDT and evaluation industry has always been built on one quiet but powerful foundation. Trust in measurements, procedures, and the people who stand behind inspection decisions. As we move to 2026, tech. is evolving rapidly, the responsibility carried by the NDT workforce has only become more critical.

Across **Africa, the Middle East, and industrial regions worldwide**, infrastructure growth is accelerating. Energy assets, refineries, pipelines, transport systems, pressure equipment, and large-scale manufacturing facilities are expanding in both complexity and scale. In this environment, NDT is no longer a background activity that follows construction. It is now a central function that directly influences safety, uptime, sustainability, & public confidence.

The Four Pillars of Excellence



Skills Are Becoming Multidimensional

For many years, the journey into NDT followed a familiar path. Learn the fundamentals, accumulate field hours, pass certification examinations, and grow through experience. That foundation remains essential, but the nature of work has changed.

Today's inspectors operate in environments filled with digital radiography systems, automated scanners, advanced ultrasonics, remote inspection tools, and increasingly, AI assisted interpretation. This does not reduce the value of traditional knowledge. In fact, it increases it. Without strong fundamentals, advanced tools can introduce risk instead of reliability.

What is changing is the skill profile expected of professionals. Inspectors now need to understand data quality, traceability, digital reporting, and system level thinking, alongside classical inspection expertise. The most capable professionals are those who can move seamlessly between hands-on inspection and digital systems while retaining confidence in judgment.

This shift is visible across global projects. It is no longer enough to know how to scan. Inspectors must understand why a signal matters, how data flows across systems, and how decisions made on screen translate into real world consequences.



Certification Must Reflect Real Capability

Certification continues to be the backbone of trust in NDT. Asset owners, regulators, and employers rely on certification systems to ensure competence. However, certification frameworks must evolve in step with industry realities.

Digital learning, remote training, and simulation-based education have expanded access globally, especially in regions where traditional infrastructure is limited. This is a positive development. Yet accessibility must never dilute credibility.

The future of certification lies in deeper alignment between theory, practice, and validation. Certifications must increasingly reflect demonstrated capability, not just completed hours or passed examinations. Practical assessment, traceable skill verification, and periodic competency review will become more important than one time qualification.

There is also a growing need for international alignment. Professionals move across borders more frequently as projects become global.

Certification systems must support mobility while maintaining consistency in quality, ensuring that trust does not weaken across regions.

Technology Changes Workflows, Not Accountability

Artificial intelligence and automation are already influencing inspection workflows. Automated defect recognition, assisted interpretation, predictive analytics, and digital asset histories are no longer concepts of the future. They are entering live projects today.

In some manufacturing sectors globally, facilities now operate with minimal human presence. While this may work for controlled and repetitive processes, NDT operates under very different conditions. Inspection decisions often involve uncertainty, complex geometry, material variability, and high consequence outcomes.

A machine can highlight patterns, but it cannot carry responsibility. That accountability remains human.

This is why the idea of Artificial Intelligence working alongside Human Intervention is so important. AI can improve consistency, reduce fatigue, and support inspectors with insights drawn from large datasets. But final decisions must remain with qualified professionals who understand context, risk, and consequence.

The future NDT workforce will not be replaced by machines. It will be reshaped. Inspectors will increasingly act as decision makers supported by intelligent systems rather than operators buried in raw data.

Training the Next Generation Requires Rethinking Structure

One of the most pressing challenges globally is preparing the next generation of NDT professionals. Younger engineers and technicians approach careers differently. They seek clarity, relevance, and growth pathways. If NDT appears fragmented, outdated, or disconnected from modern tech., it risks losing talent. Training models must respond to this reality. The future is not fully traditional and not fully digital. It is hybrid. Online learning provides reach and flexibility, while hands-on training builds judgment and confidence. Both are necessary.

However, hybrid learning must be designed with discipline. Watching content does not create inspectors. Simulation alone cannot replace field exposure. What matters is structured progress, supervised practice, and assessment. This belief has strongly influenced how we are building TIQ World. The idea behind TIQ, which stands for Training and Quality, came from observing how fragmented the ecosystem had become. Training existed in one place, inspection in another, quality records elsewhere, and workforce development disconnected from all of it.

We realized that if quality truly matters, these elements must evolve together. Learning should connect to inspection practice. Outcomes should feed quality intelligence. Skills should translate clearly into employability and trust. TIQ World is being built as a digital ecosystem that respects human expertise while using technology to remove friction, improve traceability, and support growth. Not to replace institutions or professionals, but to connect them.

Critical Questions for Our Industry

As hybrid learning becomes the standard, three key stakeholder perspectives demand our attention.

 Professionals Does E-Learning translate to real expertise? 1. Can online training adequately prepare candidates for rigorous certifications like ASNT/ISNT?	 Recruiters How are online certifications perceived? 1. Do digital credentials carry the same weight as traditional qualifications?	 Trainers Quality of Content Delivery? 1. Are instructors finding digital platforms adaptive enough for complex technical subjects?
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HYBRID Learning

The New Norm?

As we navigate these questions, one thing becomes clear: Hybrid learning offers the best of both worlds, combining online flexibility with essential hands-on experience.

The question isn't whether to adopt hybrid methods, but "how" to implement them effectively to ensure genuine expertise and industry readiness?

Employment Is Shifting Toward Verified Skills

Hiring in NDT has traditionally been inefficient. Employers struggle to assess real capability from resumes alone, while professionals struggle to demonstrate skills beyond experience listings. This is beginning to change. The future employment model will rely more on verified competencies, digital skill records, and transparent validation. Recruiters will increasingly look for evidence of capability. Professionals will gain recognition based on what they can do, not only where they have worked. This shift benefits both sides. It improves safety, reduces hiring risk, and creates fairer access to opportunity across regions. It also encourages continuous learning, as growth becomes visible and measurable.

Building Systems Around People

One of the greatest risks facing the industry is fragmentation. When training, inspection data, certification records, devices, and hiring exist in silos, trust weakens. The future demands integrated systems built around people, not software alone. People, processes, devices, & systems must work together.

When they do, quality becomes a natural outcome rather than forced.

This philosophy sits at the core of how we think about the future of NDT and why platforms like TIQ World are emerging globally. Not as marketplaces or dashboards alone, but as connective infrastructure that supports trust, learning, and accountability.

Humans Will Always Remain Central

As we look ahead, one truth remains unchanged. Technology can enhance capability, but it cannot replace responsibility. Data can inform decisions, but it cannot own consequences. Certification can validate knowledge, but it cannot guarantee judgment. The future of the NDT workforce belongs to those who understand this balance. To organizations that invest in people as much as tools. To training systems that value depth over speed. To professionals who embrace technology without surrendering accountability. NDT has never been just about detecting flaws. It has always been about protecting lives, assets, and environments. That responsibility will only grow as systems become more complex and interconnected. The future of NDT is global, digital, and intelligent. But at its core, it will remain deeply human.



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Quality Control Process

LPG Cylinder Production



By Onur ÖZUTKU

LPG

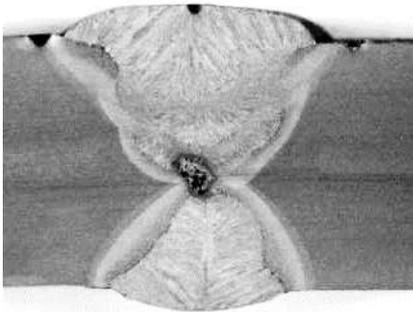
cylinders are critical equipment that store flammable gas under pressure and directly affect human life. Therefore, quality control mechanisms applied in production processes directly determine not only product quality but also public and consumer safety. In this article, the quality control chain in LPG cylinder production, from raw material acceptance to final product certification, is addressed with a holistic approach. Within the scope of the article, the effects of critical parameters such as metallurgical suitability, welding quality, non-destructive testing methods, pressure tests, and corrosion resistance on safety performance are discussed. The results of the study reveal that effective quality control systems are indispensable in reducing accident risks, extending product life, and ensuring regulatory compliance.

1. INTRODUCTION

LPG cylinders are portable pressure vessels used in millions of households and businesses worldwide. This widespread use makes product safety a critical issue not only for manufacturers but also for public safety. A microcrack, welding defect, or material weakness in the cylinder body can lead to chain reactions resulting in fire, explosion, and serious loss of life. Therefore, quality control processes should go beyond classical production verification and be approached with a preventive risk management perspective. In modern industry, the understanding that quality is built in the process, not in the final product, prevails. LPG cylinder production is one of the most concrete application areas of this approach. This article emphasizes that quality control is not only a legal requirement but also an integral part of corporate responsibility and engineering ethics.

2. STANDARDS AND REGULATORY FRAMEWORK

The production of LPG cylinders is subject to numerous technical regulations and standards at national and international levels. These standards provide a safety framework covering the entire process cycle of the product, from design and manufacturing to testing and market release. For example, the EN 1442 and ISO 22991 standard defines the structural requirements for portable LPG cylinders. In welded fabrications, the EN ISO 9606 and ISO 15614 standards regulate both welder qualifications and the validity of welding procedures. In addition, ISO 9712 ensures the competence of non-destructive testing personnel.



Macro Examination of Welding

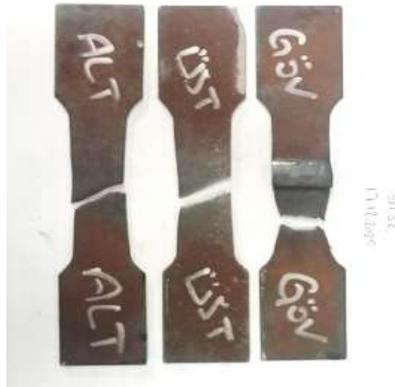
This regulatory framework serves not only as a technical guide for manufacturers but also as a binding system defining their legal responsibilities. Compliance with standards is strategically important for safety, as well as for brand reputation and access to international markets.

3. RAW MATERIAL AND INPUT QUALITY CONTROL

One of the most critical stages of the quality control process is verifying the suitability of the raw materials entering the production line. The chemical composition of the steel sheets used for LPG cylinders is meticulously analyzed in terms of the amounts of carbon, manganese, phosphorus and Sulphur present.

An uncontrolled ratio of these elements can increase the risk of cracks forming or the material becoming brittle during welding.

Mechanical tests measure tensile strength, yield strength and elongation values to confirm compliance with pressure vessel standards. Impact tests are also Important for evaluating toughness performance at low temperatures.



Tensile test

Furthermore, the certifications of auxiliary equipment such as valves, welding wire, and consumables are meticulously reviewed, ensuring batch-based traceability. It is imperative to exercise due diligence at this stage in order to avoid the occurrence of structural weaknesses that may prove to be irremediable in subsequent production processes. It is therefore evident that a reliable and effective input quality control system is a fundamental element in ensuring the reliability of the entire production chain.

4. QUALITY CONTROL IN THE PRODUCTION PROCESS

4.1 Forming and Body Manufacturing

In the context of LPG cylinder production, the fabrication of the body element is accomplished through the implementation of a multifaceted manufacturing process that encompasses, punching spinning, deep drawing, trimming and pressing. In this process, the homogeneous shaping of the sheet metal plays a decisive role in terms of the mechanical strength of the final product. This is verified through the utilization of measuring devices. It has been established that irregular thickness distribution can result in localized stress increase under pressure and premature fatigue. Furthermore, the measurement of ovality and axial misalignment is undertaken to ensure that the cylinder geometry remains within the prescribed design tolerances. The presence of microcracks, layering, and scratches on the surface is determined through a process of visual inspection. Such discontinuities have the potential to engender a predisposition to accelerated corrosion or crack propagation in later stages. quality control measures implemented during the forming phase ensure long-term structural integrity.





4.2 Welding Quality

Welding is one of the most critical stages in LPG cylinder production in terms of safety. This is because the weld seam is the area subjected to the highest stresses under internal pressure. Therefore, welding operations must only be performed by certified personnel and in accordance with approved welding procedures. WPS (Welding Procedure Specification) and PQR (Procedure Qualification Record) documents define all parameters, from the current values used to the type of filler metal.

Post-weld non-destructive testing

enables early detection of internal defects. Radiographic tests reveal internal voids and slag deposits, while ultrasonic tests are effective in identifying discontinuities in the weld root zone.

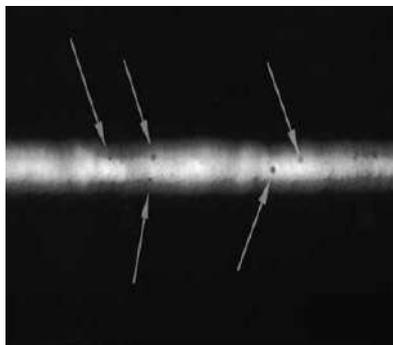
Magnetic particle and penetrant tests help detect surface cracks. This multi-layered inspection system significantly reduces the risk of sudden rupture and leakage that may occur during use.



Visual Inspection



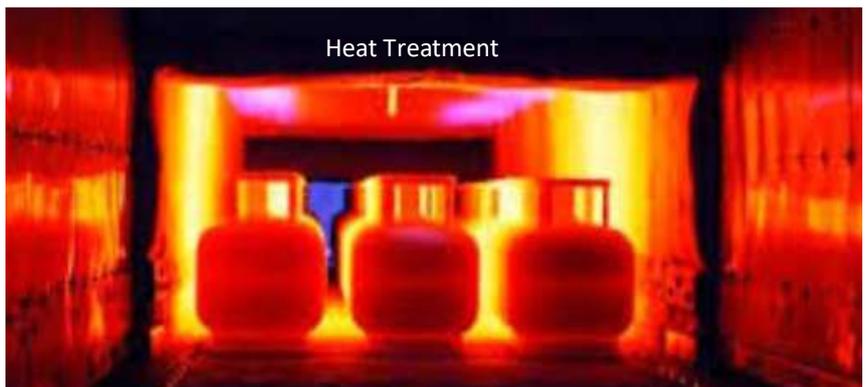
MT Testing



RT Testing

5. HEAT TREATMENT AND METALLURGICAL CONTROLS

Post-weld heat treatment (PWHT) processes applied to LPG cylinders are of critical importance from a metallurgical and structural integrity perspective. During welding, the material in the heat-affected zone (HAZ) is exposed to steep thermal gradients, causing localized microstructural transformations, hardness variations, and the formation of tensile residual stresses. In addition, manufacturing steps such as deep drawing, cold forming, and dishing introduce plastic deformation, which further contributes to residual stress fields locked within the cylinder wall. These combined thermal and mechanical effects result in a non-uniform stress distribution through the thickness of the material. Tensile residual stresses are particularly dangerous because they add to operational stresses generated by internal pressure, cyclic filling and emptying, handling loads, and temperature fluctuations. From a fracture mechanics standpoint, these stresses reduce the effective margin between operating stress and the material's critical stress intensity factor.



If not adequately relieved through appropriate stress-relief heat treatment, residual stresses can accelerate several degradation mechanisms. These include fatigue crack initiation under cyclic pressure loading, stress corrosion cracking in aggressive environments, and brittle fracture risk at low temperatures where toughness is reduced. Over time, microcracks formed at weld toes, HAZ regions, or areas of geometric discontinuity may propagate in a stable manner before transitioning into sudden, unstable fracture.



Burst Test

6. PRESSURE AND LEAKAGE TESTS

6.1 Hydrostatic Test

The hydrostatic test constitutes the most elementary safety test applied to verify the structural integrity of LPG cylinders. In this test, the cylinder is pressurized by filling it with water, usually up to 1.5 times the design pressure. The utilization of water serves to minimize energy release in the event of a potential explosion, thereby ensuring a safe testing environment. During the test, the volumetric deformation of the cylinder is measured and evaluated to ascertain whether it remains within elastic limits.



Hydrotest (Failure)

6.2 Leak Tightness Control

Leak tightness tests represent the final and most critical inspection stage for user safety. In these tests, the cylinder is filled with compressed air and submerged in a water bath, and bubble formation is observed at valve connections and body surfaces. In more sensitive applications, helium or nitrogen is used with leak detection systems. Detecting micro-leaks is especially important to prevent long-term gas accumulation and explosion risks.

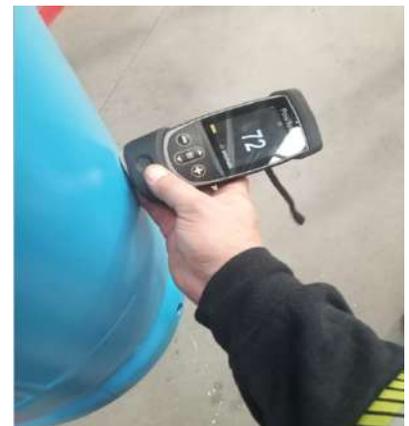
These inspections prevent even the smallest discontinuities overlooked during production from reaching the field. Therefore, leak testing can be considered the final safety link in the quality control chain extending to the end user.

7. SURFACE COATING AND CORROSION RESISTANCE

Throughout their service life, LPG cylinders are exposed to outdoor conditions, humid environments, and mechanical impacts. Consequently, corrosion is one of the most significant environmental factors threatening cylinder safety. Post-production surface preparation processes directly affect coating performance. Shot blasting removes oxide layers and provides suitable adhesion for coating. Subsequently applied zinc coating and paint systems are measured within specific thickness ranges to verify compliance with standards.



Surface control after sandblasting



Paint thickness measure

8. FINAL INSPECTION, TRACEABILITY

The final inspection stage is the point at which all production and control processes are evaluated holistically. At this stage, each LPG cylinder is marked with a serial number, tare weight and linked to its production batch, test results, and operator information.



In the contemporary context, digital quality management systems are undergoing a process of evolution, attaining the capacity to electronically store test reports and to monitor process performance through data analytics. Furthermore, QR code-based "cylinder passport" applications offer significant advantages in maintenance and periodic inspection processes. This digital transformation engenders greater transparency, traceability and sustainability in the quality control process, whilst concomitantly minimizing human error.



IN CONCLUSION, safety in LPG cylinders is built not only during use but also at the design desk, on the production line, and in the quality laboratory. Every safe use in the field is the natural result of correct quality decisions made at the factory.

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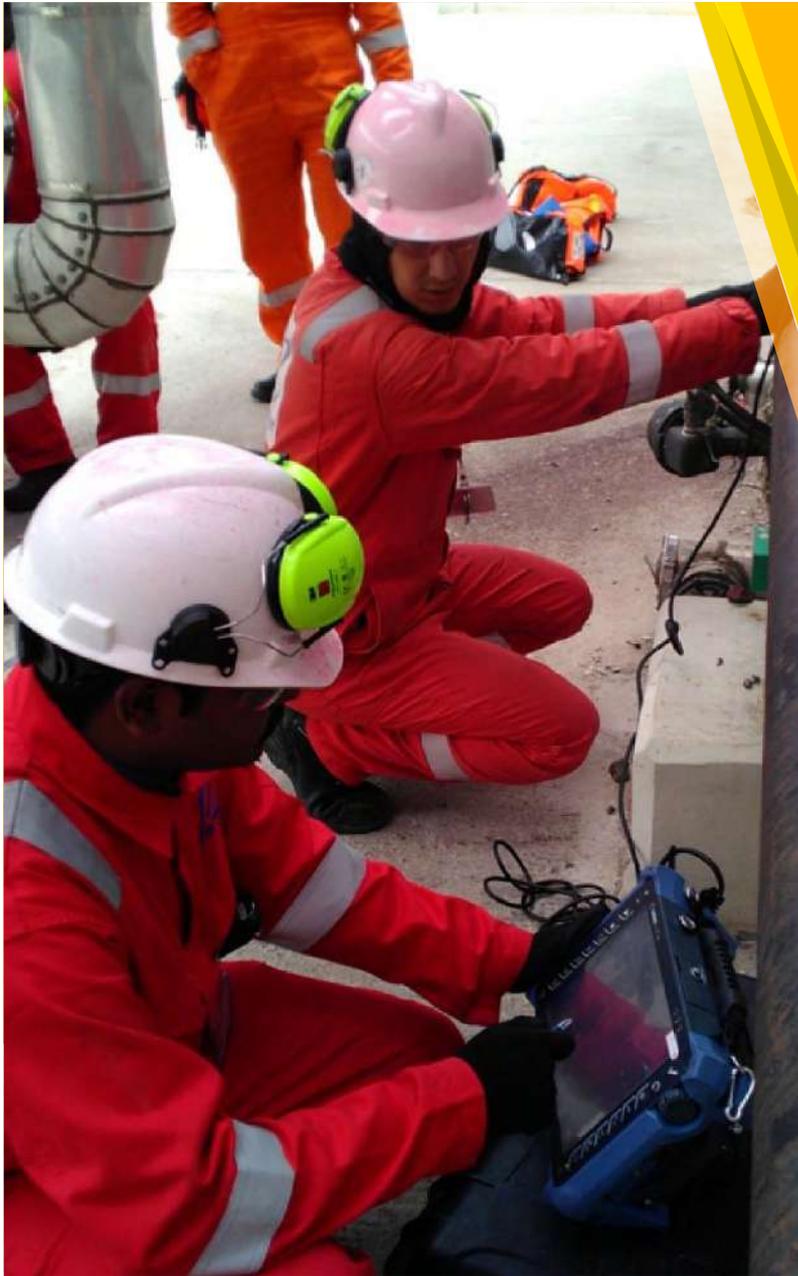
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Alternating Current Field Measurement

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Tube Inspection (ECT, RFT, MFL, NFT, IRIS, NFA, ECA)

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By Mohamed Gamil

ELECTROMAGNETIC Acoustic Transducer - EMAT

Advanced Inspection Technology in Action

INTRODUCTION

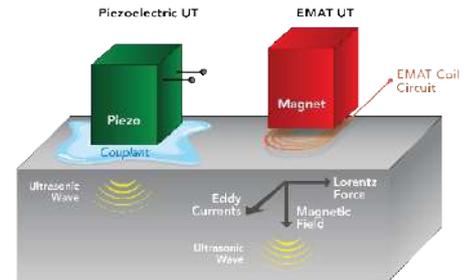
Non-Destructive Testing (NDT) is fundamental to ensuring the structural integrity and safe operation of critical industrial assets. Aging infrastructure, harsher operating environments, and increased regulatory requirements have driven the need for inspection technologies capable of delivering reliable results under non-ideal conditions. Traditional ultrasonic testing methods, while widely adopted, often require extensive surface preparation, couplants, and direct contact with the test surface.

Electromagnetic Acoustic Transducer (EMAT) inspection technology offers a practical alternative in scenarios where conventional ultrasonic methods face significant limitations. EMAT's ability to perform non-contact, couplant-free inspections makes it particularly suitable for in-service assessments, high-temperature components, and coated or corroded surfaces. This paper explores EMAT technology from both a technical and practical perspective, emphasizing its role as a complementary inspection method rather than a replacement for conventional UT.

Operating Principles of EMAT Technology

An EMAT system typically consists of a permanent magnet and an electrically conductive coil positioned near the surface of the test material. When an alternating current is applied to the coil, a dynamic magnetic field is generated, which interacts with the static magnetic field of the magnet. This interaction produces ultrasonic waves within the material through electromagnetic mechanisms such as the Lorentz force and magnetostrictive effects.

Unlike piezoelectric transducers, EMATs generate ultrasonic energy directly in the material, eliminating the need for mechanical coupling. Depending on probe design and excitation parameters, EMAT systems can generate a variety of wave modes, including shear horizontal (SH) waves, Rayleigh waves, and guided waves, allowing targeted inspection for specific damage mechanisms such as cracking, corrosion, and wall-thickness loss.

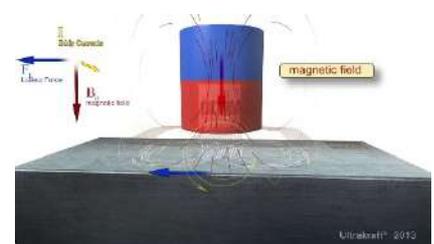


Actual Inspection INSPECTION BACKGROUND

An operator managing above-ground carbon steel pipelines identified recurring integrity concerns related to corrosion under insulation (CUI) and surface-breaking cracks at pipe supports. Conventional ultrasonic inspection required insulation removal and operational shutdown, resulting in high costs and safety risks.

INSPECTION METHODOLOGY

An EMAT-based guided wave inspection approach was selected to assess pipeline condition while maintaining normal operation. EMAT probes were installed at accessible pipeline locations, generating guided ultrasonic waves that propagated along the pipe length to detect changes in wall thickness and surface defects.



RESULTS

The EMAT inspection successfully identified:

- Localized wall-thickness reductions indicative of CUI.
- Surface-breaking cracks in high-stress regions near supports.
- Areas requiring targeted follow-up inspection using localized NDT methods.

The inspection was completed without insulation removal or production interruption.

DISCUSSION

The case study demonstrates EMAT's effectiveness as a screening and diagnostic tool for pipeline integrity management. By enabling rapid assessment under operational constraints, EMAT supported risk-based decision-making and optimized maintenance planning.

CONCLUSION

Electromagnetic Acoustic Transducer inspection technology represents a mature and practical addition to the modern NDT toolkit. While it does not replace conventional ultrasonic testing, EMAT provides significant advantages in specific applications involving high temperature, surface coatings, and limited accessibility. Field experience confirms that EMAT-guided wave inspection can deliver reliable, actionable data for pipeline integrity management and other industrial applications. Continued advancements in EMAT probe design and signal processing are expected to further enhance its role within advanced inspection strategies.

Advantages of EMAT Technology

- **Couplant-Free Operation** – EMATs do not require gels, oils, or water, making them suitable for in-service inspections and high-temperature applications.
- **Surface Tolerance** – Effective on painted, rough, or oxidized surfaces where conventional ultrasonic testing struggles.
- **Rapid Deployment** – Faster scanning speeds with minimal surface preparation.
- **High-Temperature Capability** – Can be used on hot surfaces, often up to 600°C depending on the design.
- **Versatility in Wave Modes** – Ability to generate different ultrasonic wave types (shear horizontal, guided waves, Rayleigh waves) for comprehensive defect detection.

These characteristics make EMAT particularly valuable in applications where downtime, access, or safety constraints limit the use of conventional NDT methods.

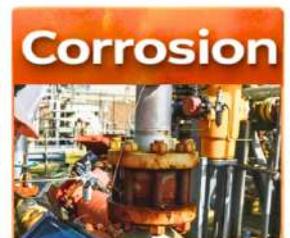
Limitations of EMAT Technology

- **Lower Sensitivity** – Compared to piezoelectric UT probes, EMATs often have lower signal-to-noise ratios.
- **Material Restrictions** – Requires conductive or ferromagnetic materials; non-conductive materials like plastics cannot be inspected.
- **Higher Equipment Cost** – Advanced electronics and probe design make EMATs more expensive than conventional UT.
- **Limited Penetration** – Less effective in detecting very deep flaws compared to bulk-wave ultrasonic testing.
- **Specialized Expertise Needed** – Operators require training to interpret EMAT signals correctly.

Understanding these limitations is essential for effective inspection planning and realistic performance expectations.

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Tank Floor

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Scanner

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DURABILITY,
COST-EFFECTIVE SCANNER.



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Tank Details

Diameter: 30 m
Thickness: Inner 10 mm
Annular 12 mm
Lining: 500 Micron
Const.: Lap Weld
Material: Carbon steel
Location: Middle East
Service: Crude Oil

Scanner Details

Model: MFE MARK 4
Scan Width: 500 mm
Mode: Corrosion Map
Pattern: Parallel, Reverse & Transverse



Featured By



Magnetic Flux Leakage (MFL) Testing From Tank Floor Scanning to Engineering-Level Integrity Decisions.

Executive Summary

Complete **Corrosion Assessment** for Decision Makers

Tank floor corrosion represents one of the most critical integrity risks in oil storage facilities. In this case study, Magnetic Flux Leakage (MFL) inspection was applied to assess floor plate condition, **identify corrosion patterns**, and **support maintenance** and hydrotesting decisions.

The inspection successfully delivered **full-area corrosion mapping**, enabling **targeted repairs**, cost optimization, and confident integrity validation—demonstrating MFL as a **strategic inspection and decision-support technology**, not merely a screening tool.

1. Industry Context:

Why Tank Floor Integrity Demands More

Tank floor degradation often develops silently due to:

- Soil-side corrosion
- Moisture accumulation
- MIC (Microbiologically Influenced Corrosion)
- Long-term coating degradation

Industry experience shows that **visual inspection and limited UT spot checks alone are insufficient** to represent actual corrosion distribution. Undetected thinning remains a leading cause of:

- Product leakage
- Environmental incidents
- Unplanned shutdowns
- Regulatory non-compliance



2. Asset Description

Asset Type: Oil Storage Tank

- **Inspection Target:** Bottom plates (floor)
- **Inspection Objective:**
 - Detect metal loss & corrosion
 - Map damage distribution
 - Support repair planning
 - Confirm readiness for hydrotesting

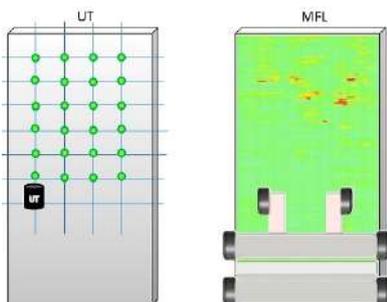
The inspection was conducted as part of a **preventive integrity program**, reflecting a proactive asset management strategy.

3. Why Magnetic Flux Leakage (MFL) Was Selected

MFL was selected based on its ability to provide:

- ✓ Around 97% floor coverage
- ✓ High inspection productivity
- ✓ Minimal surface preparation
- ✓ Data suitable for assessment
- ✓ Detect general & localized corrosion

Unlike point-based inspection techniques, MFL delivers **continuous integrity visibility** across the entire tank floor.



4. MFL Technology – Inspection Principle

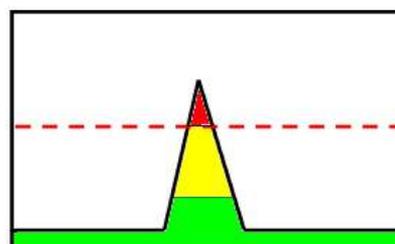
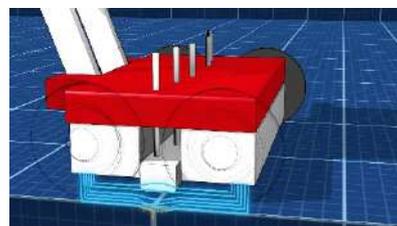
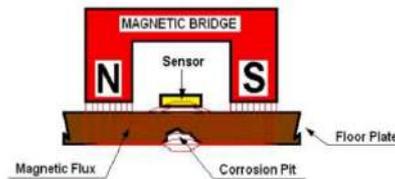
MFL inspection works by magnetizing the steel floor plates close to magnetic saturation.

- **In sound material:** magnetic flux remains contained
- **In corroded or thinned areas:** magnetic flux leaks
- **Sensors** capture leakage intensity and patterns

This allows identification of:

- General wall loss
- Pitting corrosion
- Localized metal loss zones

Signal amplitude and shape provide insight into defect severity and extent.



5. Inspection Methodology & Quality Control Scope of Work

- Full MFL scanning of accessible tank floor areas
- Structured scanning grid and overlap control
- Signal acquisition, filtering, and classification
- Post-processing and reporting

Quality Assurance Measures

- Equipment calibration and system checks
- Controlled scanning speed
- Signal verification by qualified analysts
- Cross-validation of critical indications

The inspection was executed to ensure **data reliability suitable for integrity decisions**, not just screening.

6. Results & Key Observations

The inspection identified:

- Zones of **general corrosion**
- **Localized metal loss** areas requiring evaluation
- Corrosion severity variations across floor plates

Findings enabled classification of:

- Acceptable degradation
- Repair-required locations
- Areas fit for continued service

This approach prevented unnecessary plate replacement while maintaining safety margins.

7. From Inspection Data to Engineering Decisions

The MFL data directly supported:

- Definition of repair scope
- Optimization of maintenance activities
- Reduction of repair time and cost
- Confirmation of tank readiness for hydrotesting

This case highlights the value of inspection-driven decision-making.

8. Compliance with Industry Codes & Standards

The inspection approach aligns with best practices outlined in:

- API 653 – Tank Inspection, Repair, Alteration, and Reconstruction
- Risk-Based Inspection (RBI) methodologies
- Industry-recognized tank floor integrity programs

MFL data supports API 653 objectives by enabling informed decisions on repair, monitoring, and continued operation.

9. Technology Partner Spotlight

Technology Partner – MFL Inspection Solutions

Advanced MFL systems play a critical role in delivering reliable, high-resolution inspection data. Modern platforms provide:

- Stable magnetization
- High-sensitivity sensor arrays
- Consistent signal repeatability
- Efficient large-area coverage

Such technologies enable inspectors and asset owners to transition from inspection execution to integrity intelligence.

10. Lessons Learned

1. Proactive tank floor inspection reduces long-term risk
2. Full area scanning reveals corrosion patterns missed by spot checks
3. MFL is most effective when integrated into an integrity strategy
4. Inspection data quality directly impacts maintenance decisions

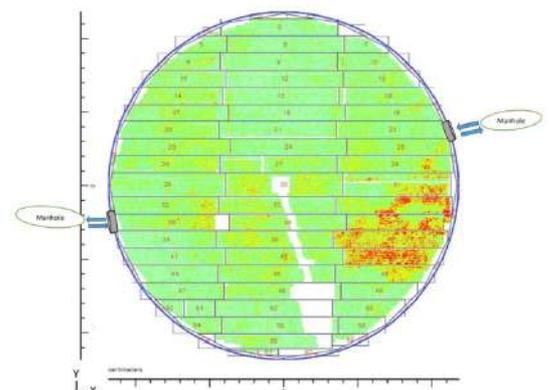
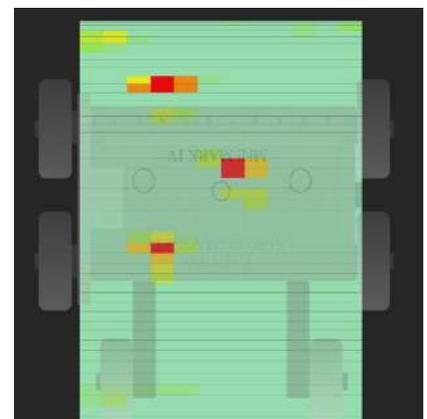
11. Conclusion: MFL as a Strategic Integrity Tool

The case confirms that **Magnetic Flux Leakage testing is a cornerstone technology for modern tank integrity management.**

When applied correctly, MFL delivers:

- Speed without compromising accuracy
- Actionable corrosion intelligence
- Confidence before hydrotesting and recommissioning

As industry expectations evolve, **MFL will remain essential for safe, compliant, and cost-effective tank operation.**



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May has held numerous Principal Level III and corporate management positions, ASNT NDT Level III certifications in PT, MT, RT, and UT, May has previously held API510, 570, 653 certificates from the American Petroleum Institute as well as CWI and SCWI certifications from the AWS. In addition to spending more than 30 years as a hands-on NDE practitioner and radiation safety officer.



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Advanced NDT Specialist, Dhahran, Eastern Province,
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Mohammed Abu four is a globally acclaimed leader in the field of Nondestructive Testing (NDT), with over 42 years of experience advancing inspection excellence across the oil and energy industry. A graduate of the University of Northampton (UK) with a degree in NDT, Mohammed also holds numerous professional certifications that have enabled him.



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Neal J. Couture, FASAE, CAE, is Chief Executive Officer of the American Society for Nondestructive Testing (ASNT) and is a member of the ASNT Board of Directors, ASNT Foundation Board of Trustees, and ASNT India Private Limited Company Board of Directors. Neal has more than 20 years' experience as a leader in the not-for-profit industry and is a subject matter expert in association management.



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Dr. BABU has 30 years of International Experience in Energy, Oil & Gas, Construction Industry in QA/QC, NDT, Condition Monitoring & Diagnostics Testing, Currently he is holding a position of Quality Director in Rotary Group & CEO of ANSA Holdings, Singapore He is also the current Chairman of the International Committee for NDT (ICNDT), Vienna & the President of NDT Society (Singapore).

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