E1934 (REAPPROVED 2024): STANDARD GUIDE FOR EXAMINING ELECTRICAL AND MECHANICAL EQUIPMENT WITH INFRARED THERMOGRAPHY

Infrared thermography (IRT) is a nondestructive testing technique that uses infrared imaging to detect and measure thermal energy emitted from objects. This method captures temperature variations on the surface of equipment, which can indicate underlying issues. Regular thermographic inspections facilitate better maintenance planning by identifying issues before they lead to electrical and mechanical equipment failures. Methods for examining electrical equipment include detecting overheating in electrical components such as circuit breakers, transformers, and switchgear, which may indicate potential failures or malfunctions. By catching abnormal temperature patterns early, IRT helps prevent equipment failures and reduces the risk of electrical fires. In mechanical equipment testing, identifying components that are overheating due to excessive friction or misalignment with IRT helps prevent mechanical failures and extends the lifespan of equipment. By monitoring the thermal performance of mechanical equipment, IRT helps ensure that machines operate efficiently and at optimal performance levels.

The most recent version of ASTM E1934, released in the *Book of Standards*, Volume 03.03, has been reapproved by ASTM Subcommittee E07.10. This standard outlines the responsibilities of both the end user and the infrared thermographer when inspecting electrical and mechanical systems. It specifies what should be included in the documentation of qualitative and quantitative infrared examinations. The guide covers the use of equipment and materials near heated, moving, or electrically energized components. Users must establish proper safety, health, and environmental practices and identify any regulatory limitations before using the equipment.

This guide serves as a resource for end users to specify, and for infrared thermographers to perform, infrared examinations of electrical and mechanical equipment. It outlines their shared responsibilities and aims to identify and document anomalies. In electrical systems, warm anomalies usually result from increased resistance due to loose connections, short circuits, overloads, load imbalances, or faulty components, while cool anomalies indicate failed components. In mechanical systems, warm anomalies often arise from friction due to improper lubrication, misalignment, or worn components, whereas cool anomalies indicate component failure.

STANDARDS EDITOR
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IN DEVELOPMENT

The following section provides a summary of new standards, drafts, and revisions that may be of interest to the nondestructive testing and evaluation (NDT/E) community. This summary is provided in *Materials Evaluation* on a quarterly basis in January, April, July, and October. For the latest information, please visit the website of the standards provider.

PROJECT INITIATION

ANSI procedures require notification by ANSI-accredited standards developers of the initiation and scope of activities expected to result in new or revised American National Standards. The following is a list of proposed actions and new standards that have been received recently from accredited standards developers. To view information about additional standards for which a project initiation notification has been submitted, and to search approved American National Standards, please visit ansi.org, which is a database of standards information. Note that this database is not exhaustive.

- **BSR/AWS D17.4-202x,** *Specification for Additive Friction Stir Deposition for Aerospace Applications.* This is a new standard. This standard provides a process specification for the AFSD process that can be followed for purposes of creating and qualifying a deposition procedure specification (DPS) that will produce qualified components for aerospace. It borrows some of the common language and terminology from the existing AWS D17.3 and AWS D20 specification but accounts for the specific requirements for this additive manufacturing process. This standard would initially be used by the aerospace community to certify the process, but, like the AWS D17.3 specification, it is anticipated that a larger community will use it as a general AFSD process specification.
- **BSR/ADCI 01-202X,** *Commercial Diver Training – Minimum Standard.* This is a new standard establishing a core curriculum to train entry-level marine technicians and commercial divers to assist in general operations in oceanographic and commercial maritime enterprises and safely carry out technical operations underwater.
- **BSR/UL 2278-202x,** *Standard for Safety for Megawatt Charging Configured Electric Vehicle Couplers.* This is a new joint standard

for the US and Canada. There are currently no consensus standards published in the US and Canada for megawatt charging configured electric vehicle couplers. The new standard covers the new configuration of couplers, which operate at a higher voltage and current than any previously certified coupler, and presents new and increased potential hazards that must be addressed by requirements that are significantly modified compared to what exists today. This standard covers vehicle connectors and vehicle inlets designated as, and configured as, megawatt charging couplers. These devices are for use in either indoor or outdoor, non-classified locations in accordance with *National Electrical Code* (NEC), NFPA 70.

- **INCITS/ISO/IEC 19157-1:2023 [202x],** *Geographic information – Data quality – Part 1: General requirements.* This is an identical national adoption of ISO/IEC 19157-1:2023 and revision of INCITS/ISO 19157:2013 (R2019), INCITS/ISO 19157:2013/AM1:2018 (2020). This international standard establishes the principles for describing the quality of geographic data. It defines a well-considered system of components for describing data quality; defines the process for defining additional, domain-specific components for describing data quality; specifies components and the content structure of data quality measures; describes general procedures for evaluating the quality of geographic data; and establishes principles for reporting data quality. This standard is applicable to data producers providing quality information to describe and assess how well a dataset conforms to its product specification and to data users attempting to determine whether specific geographic data are of sufficient quality for their particular application.
- **BSR/IEEE 3456.2-202x,** *Standard for Testing Instruments for Deep Foundations – Part 2: High-Strain Testing Instruments.* Due to the lack of a unified standard, testing instruments for deep foundations cannot achieve economies of scale. This new standard will establish standards for engineering construction safety, which specify the basic requirements of testing instruments, including design, manufacturing, and operational requirements. A pile foundation is one of the most common forms of foundation in construction engineering. A pile foundation is usually composed of piles and platforms with the characteristics of high bearing capacity, low settlement, and broad applicability. This standard specifies general requirements for the measurement and analysis system of testing instruments, covering the composition, configurations, working conditions, typical performance, test methods, and inspection rules for judging the compressive bearing capacity and integrity of deep foundations. The standard specifications include classification, measurement system, analysis system, and safety requirements.
- **BSR/ASSP Z244.1-202x,** *The Control of Hazardous Energy – Lockout, Tagout and Alternative Methods.* This is a revision and redesignation of ANSI/ASSP Z244.1-2016 (R2020). It covers machines, equipment, and processes in which the unexpected energization or start-up of the machines or equipment, release of stored energy, or the actions of persons could result in harm. This standard also establishes requirements for the control of hazardous energy associated with machines, equipment, or processes that could cause harm to personnel. It specifies the use of lockout, tagout, or alternative methods to control hazardous energy associated with machines, equipment, or processes that could cause harm to personnel. This standard applies to activities such as erecting, installing, constructing, repairing, adjusting, inspecting, unjamming, setup, testing, troubleshooting, cleaning, dismantling, servicing, and maintaining machines, equipment, or processes.
- **BSR/IPC 9716-202x,** *Requirements for Automated Optical Inspection (AOI) Process Control for Printed Board Assemblies.* This is a new standard. Automated inspections are critical and mandatory process points within electronics manufacturing flows. Currently there are no industry standards for AOI process control. Industry generally relies on either internal expertise, equipment supplier expertise, or both. As not all companies have extensive inspection resources, in many cases inspection processes and equipment are not sufficiently identifying defects, resulting in quality escapes. This new standard provides requirements for automated inspection systems to define, set up, establish, and apply process control for manufacturing printed board assemblies, including general and specific process and equipment conditions. Requirements will include those for operating and inspection parameters, vision systems, lighting conditions, calibration, detectability, resolution, threshold limits and process windows, program setups, measurement system analysis (MSA), maintenance, and verification protocols. Any accept/reject criteria will be based on existing IPC standards (e.g., IPC-7527, IPC-A-610). The purpose of this standard is to set industry-defined requirements for AOI systems to reduce false calls, improve throughput, and shorten cycle times to ensure quality and reliability of printed board assemblies. This standard will also support electronics manufacturers to enable advanced manufacturing real-time data analytics and control capabilities.
- **BSR SAIA A92.10B-202x,** *Safe Use and Establishing Training Content and Administrative Requirements for Mast Climbing Transport Platforms (MCTPs).* This is a revision and partition of ANSI SAIA A92.10-2023, which partitions the current ANS into two ANS: Design and Safe Use/Training. It specifies requirements for application, installation, dismantling, inspection, training, maintenance, repair, and safe operation of MCTPs. This standard also provides methods and guidelines to prepare MCTP training materials, defines administrative criteria, and delivers elements required for proper training and familiarization. It applies to all types and sizes of MCTPs, as specified in ANSI/SAIA A92.10A, *Design, Calculations, Safety Requirements and Test Methods*, that are primarily used as a tool of the trade to vertically transport authorized persons, along with materials and necessary tools, to various access levels on a building or structure for construction, renovation, maintenance, or other types of work.
- **BSR SAIA A92.9B-202x,** *Safe Use and Establishing Training Content and Administrative Requirements for Mast Climbing Work Platforms (MCWPs).* This is a revision and partition of ANSI SAIA A92.9-2023. It specifies requirements for application, installation, dismantling, inspection, training, maintenance, repair, and safe operation of MCWPs. This standard also provides methods and guidelines to prepare MCWP training materials, defines administrative criteria, and delivers elements required for proper training and familiarization. It applies to all types and sizes of MCWPs, as specified in ANSI/SAIA A92.9A, *Design, Calculations, Safety Requirements and Test Methods*, that are intended to position personnel along with their necessary tools and materials at work locations.
- **BSR/ICC 1700-202x,** *Professional Qualifications Standard for Hydrogen Systems in the Built Environment.* This is a new standard. The current

workforce is inadequately prepared to meet the industry's demands for implementing hydrogen energy and technologies. Globally, it is anticipated that over US$500 billion will be invested in the hydrogen industry by the early 2030s. Despite existing codes and standards addressing installation requirements for hydrogen systems, there is a significant lack of specific qualifications for professionals in this field. Consequently, many approvals rely on alternative design methods or compliance measures, resulting in increased costs and project delays. Furthermore, while hydrogen has been utilized for nearly a century, its use as a fuel is relatively new to many individuals, leading to a growing need for skilled workers and regulators who can ensure its safe and efficient implementation. To bridge this gap, a new Hydrogen Professional Qualifications Standard Series is under development. This series aims to offer specialized training and certifications for individuals involved in designing, engineering, installing, operating, inspecting, auditing, and instructing on hydrogen systems in the built environment. By establishing precise requirements for training and certification, jurisdictions can confidently approve the design, installation, operation, and maintenance of these intricate systems, guaranteeing that personnel possess a comprehensive understanding of relevant terminology, standards, and codes.

- **BSR/ASTM WK90161-202x,** *New Practice for Quality Control of Routine Testing in a Laboratory.* This is a new standard applicable when a control sample material is routinely run with samples for the purpose of monitoring test method performance. Guidance is given for quality control of test method performance characteristics such as test method bias, stability, and laboratory precision (long-term single facility intermediate precision) using a control sample program. It includes selection and maintenance of the control sample, control chart methods for use, out-of-control action plans, and maintenance of the program over time.
- **BSR/EOS ESD SP17.1-202X,** *ESD Association Standard Practice for the Protection of Electrostatic Discharge Susceptible Items – Process Assessment Techniques.* This is a revision of ANSI/ESD SP17.1-2020. This revision establishes a set of methodologies, techniques, and instruments to characterize a process where ESD sensitive (ESDS) items are handled. Process assessment covers risks by charged personnel, ungrounded conductors, charged ESDS items, and ESDS items in an electrostatic field. This standard applies to activities that manufacture, process, assemble, install, package, label, service, test, inspect, transport, or otherwise handle electrical or electronic parts, assemblies, and equipment susceptible to damage by electrostatic discharges. It does not apply to electrically initiated explosive items, flammable gases and liquids, or powders.
- **BSR/FM 1330-202x,** *Fire Pump Monitoring and Automated Testing.* This is a new standard. Fire-pump monitoring and automated testing systems are intended to enhance fire pump reliability and reduce the amount of personnel time needed to inspect and test them. The automation and system technology these systems use allow for significantly improved real-time pump health information, thereby improving reliability. In all cases, these new systems are subordinate to the pump control, such that they do not influence the normal starting and operation of the pump in the event of a fire.

CALL FOR COMMENT ON PROPOSALS LISTED

The public comment period has passed for the following draft American National Standards, which are currently in review.

- **BSR/AISC N690-202x,** *Specification for Safety-Related Steel Structures for Nuclear Facilities.* This is a revision of ANSI/AISC N690-2018. This standard applies to the design of safety-related steel structures and steel elements in nuclear facilities. Structures and structural elements subject to this standard are those steel structures that are part of a safety-related system or that support, house, or protect safety-related systems or components, the failure of which would impair the safety-related functions of these systems or components.
- **BSR/ASME A112.4.1-2014 (R202x),** *Water Heater Relief Valve Drain Tubes.* This is a reaffirmation of ANSI/ASME A112.4.1-2014 (R2019). This standard establishes performance requirements and test methods applicable to water heater relief valve drain (or runoff) tubes for use with relief valves having a steam rating of 105 000 Btu/hr or less.
- **BSR/ASSP Z359.15-202x,** *Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems.* This is a revision and redesignation of ANSI ASSE Z359.15-2014. This standard establishes requirements for the design criteria, qualification testing (performance requirements), marking and instructions, user inspections, maintenance, and storage and removal from service of single-anchor lifelines and fall arresters for users within the capacity range of 110 to 310 lb (50 to 140 kg).
- **BSR/AWS D14.6/D14.6M-202x,** *Specification for Welding of Rotating Elements of Equipment.* This is a new standard establishing material and workmanship standards for manufacturers, fabricators, repair organizations, purchasers, and owner/operators of rotating equipment that are fabricated or repaired by welding. Included are sections defining process qualifications, operator qualifications, quality control, inspection requirements, and repair requirements.
- **BSR/ASME B20.1-202x,** *Safety Standard for Conveyors and Related Equipment.* This is a revision of ANSI/ASME B20.1-2021. This standard applies to the design, construction, installation, maintenance, inspection, and operation of conveyors and conveying systems in relation to hazards.
- **BSR/ASME B31.1-202x,** *Power Piping.* This is a revision of ANSI/ASME B31.1-2022. This standard prescribes minimum requirements for the design, materials, fabrication, erection, testing, examination, inspection, operation, and maintenance of piping systems typically found in electric power generating stations, industrial and institutional plants, geothermal heating systems, and central and district heating and cooling systems. It also covers boiler-external piping for power boilers and high-temperature, high-pressure water boilers in which steam or vapor is generated at a pressure of more than 15 psig (100 kPa [gage]); and high-temperature water is generated at pressures exceeding 160 psig (1103 kPa [gage]) and/or temperatures exceeding 250 °F (120 °C).
- **BSR/AWS C2.21M/C2.21-202x,** *Specification for Thermal Spray Equipment Performance Verification.* This is a revision of ANSI/AWS C2.21M/C2.21-2015 (R2024). This revision provides members of the thermal spray industry guidelines for ensuring thermal spray equipment and systems are operating according to the manufacturer's specifications. It

specifies the essential elements of a procedure for verifying the performance of thermal spray equipment to ensure it can operate according to the manufacturer's specifications or those established by the user.

- **BSR/NFPA 25-202x,** *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.* This is a revision of ANSI/NFPA 25-2023. This revision establishes the minimum requirements for the periodic inspection, testing, and maintenance of water-based fire protection systems and the actions to undertake when changes in occupancy, use, process, materials, hazard, or water supply that potentially impact the performance of the water-based system are planned or identified.
- **BSR/NFPA 715-202x,** *Standard for the Installation of Fuel Gases Detection and Warning Equipment.* This is a revision of ANSI/NFPA 715-2023. This standard contains requirements for the selection, design, application, installation, location, operation, performance, inspection, testing, and maintenance of equipment that detects and warns of concentrations of fuel gases in buildings and structures that could pose a life or property safety risk.
- **BSR/NFPA 770-202x,** *Standard on Hybrid (Water and Inert Gas) Fire-Extinguishing Systems.* This is a revision of ANSI/NFPA 770-2021. This revision contains the minimum requirements for the design, installation, acceptance, inspection, testing, and maintenance of hybrid fire-extinguishing systems that use a combination of atomized water and inert gas to extinguish fire.
- **BSR/ASME PHM-01-202x,** *Guideline for Manufacturing Prognostics and Health Management (PHM): Determining PHM Inclusion in Factory Operations.* This is a new standard intended to assist manufacturers in making decisions about when and where to integrate monitoring, diagnostic, and prognostic tools and systems in their facilities to ideally optimize maintenance of their manufacturing operations and improve their production planning. It is designed to aid in answering key questions such as where implementation of PHM can improve productivity and costs, maintain process quality targets, or help solve chronic maintenance problems.
- **BSR/ASME B31.3-202x,** *Process Piping.* This is a revision of ANSI/ASME B31.3-2022. Rules for the *Process Piping Code*, Section B31.3, have been developed considering piping typically found in petroleum refineries; onshore and offshore petroleum and natural gas production facilities; chemical, pharmaceutical, textile, paper, ore processing, semiconductor, and cryogenic plants; food and beverage processing facilities; and related processing plants and terminals. This Code prescribes requirements for materials and components, design, fabrication, assembly, erection, examination, inspection, and testing of piping, and it applies to piping for all fluids, including raw, intermediate, and finished chemicals; petroleum products; gas, steam, air, and water; fluidized solids; refrigerants; and cryogenic fluids.
- **BSR/HPVA HP-1-202x,** *Standard for Hardwood and Decorative Plywood.* This is a revision of ANSI/HPVA HP-1-2020. The standard establishes nationally recognized marketing classifications, quality criteria, test methods, definitions, and product marking and designation practices for plywood produced primarily from hardwoods. This revision includes several revisions to the veneer grading tables and content throughout.
- **BSR/AWWA D121-202x,** *Bolted Aboveground Thermosetting FRP Panel-Type Tanks for Water Storage.* This is a new standard that describes the design, fabrication, installation, construction, inspection, and testing of bolted aboveground thermosetting fiberglass-reinforced plastic (FRP) panel-type tanks for potable water, reclaimed water, and nonpotable water. Included are requirements for the fabrication, handling design, construction, and testing of FRP panels, concrete and steel foundation structure members, foundation steels bolts, and accessories.
- **BSR/NFPA 10-202x,** *Standard for Portable Fire Extinguishers.* This is a revision of ANSI/NFPA 10-2022. The provisions of this standard apply to the selection, installation, inspection, maintenance, recharging, and testing of portable fire extinguishers and Class D extinguishing agents. The requirements given herein are minimum and do not apply to permanently installed systems for fire extinguishment, even where portions of such systems are portable (such as hose and nozzles attached to a fixed supply of extinguishing agent).
- **BSR/AGMA ISO 14104-A17,** *Gears – Surface Temper Etch Inspection after Grinding, Chemical Method.* This reaffirmation of a national adoption, ANSI/AGMA 2007-C00:1995/ISO 14104:1995 (R2013), explains the materials and procedures necessary to determine, evaluate, and describe localized overheating on ground surfaces. A system to describe and classify the indications produced during this inspection is included; however, specific acceptance or rejection criteria are not. An industry-wide survey was conducted to establish common solutions in time that were acceptable to the greatest number of users. Safety and environmental precautions are included for those not familiar with storage, handling, use, and disposal of concentrated acids, alkalis and solvents; however, they do not supersede the latest applicable requirements.
- **BSR/IIAR 6-202x,** *Standard for Inspection, Testing, and Maintenance of Closed-Circuit Ammonia Refrigeration Systems.* This is a revision of ANSI/IIAR 6-2019. This standard specifies minimum requirements for inspection, testing, and maintenance of closed-circuit ammonia refrigeration systems. It is intended to assist individuals responsible for developing and implementing inspection, testing, and maintenance programs for facilities with stationary closed-circuit ammonia refrigeration systems using recognized and generally accepted good engineering practices (RAGAGEP).
- **BSR/IEEE 2831-202x,** *Recommended Practice for Distributed Traveling Wave Fault Location Devices for High-Voltage Direct-Current (HVDC) Transmission Lines.* This is a new standard. The category and composition, technical requirements, test methods, inspection rules, marking, packing, transportation, storage, and installation of distributed traveling wave fault location devices for HVDC transmission lines are detailed. This recommended practice is applicable to distributed traveling wave fault location devices for HVDC transmission lines and alternating current (AC) transmission lines.
- **BSR/IEEE 2832-202x,** *Guide for Control and Protection System Test of Hybrid Multi-Terminal High Voltage Direct Current (HVDC) Systems.* This is a new standard providing general guidance on the control and protection tests of hybrid multi-terminal HVDC systems that consist of line-commutated converter (LCC) at the sending end and voltage source converter (VSC) at the receiving end. It involves preconditions, composition of the test system, test contents and boundaries, test items and design principles, and organization and quality control

requirements. The tests involved include factory test, acceptance test, site commissioning test, and trial operation.

- **BSR/AWS B5.16-202x,** *Specification for the Qualification of Welding Engineering Personnel.* This is a new standard that establishes the requirements for qualification of welding engineering technologists and welding engineers employed in the welding industry. It defines the minimum experience, examination, application, qualification, and requalification requirements, and methods. This specification is a method for engineering personnel to establish a record of their qualification and abilities in welding industry work, in the development of procedures, process controls, quality standards, problem solving, and so forth.
- **BSR/ASME B1.20.5-1991 (R202x),** *Gaging for Dryseal Pipe Threads – Inch.* This is a reaffirmation of ANSI/ASME B1.20.5 -1991 (R2019). The scope of this standard is to provide information regarding practical dryseal thread inspection methods and commonly used gauges for production evaluation purposes.

ISO DRAFT INTERNATIONAL STANDARDS

The following are standards that the International Organization for Standardization (ISO) is considering for approval. The proposals have received substantial support within the technical committee that developed them and are now being circulated to ISO members for comment and vote. Readers interested in reviewing or commenting on these standards should order copies from ANSI.

- **ISO/IEC DIS 21471,** *Information technology – Automatic identification and data capture techniques – Extended rectangular data matrix (DMRE) bar code symbology specification*
- **ISO/DIS 15708-1,** *Non-destructive testing – Radiation methods for computed tomography – Part 1: Terminology*
- **ISO/DIS 15708-2,** *Non-destructive testing – Radiation methods for computed tomography – Part 2: Principles, equipment and samples*
- **ISO/DIS 15708-4,** *Non-destructive testing – Radiation methods for computed tomography – Part 4: Qualification*
- **ISO/IEC DIS 29794-5,** *Information technology – Biometric sample quality – Part 5: Face image data*
- **ISO/DIS 12219-12,** *Interior air of road vehicles – Part 12: Artificial leather made from PVC or Polyurethane – Specification and methods for the determination of fogging characteristics of trim materials in the interior of automobiles*
- **ISO/DIS 15708-3,** *Non-destructive testing – Radiation methods for computed tomography – Part 3: Operation and interpretation*
- **ISO/DIS 16831,** *Non-destructive testing – Ultrasonic testing – Characterization and verification of ultrasonic equipment for the determination of thickness*
- **ISO/IEC DIS 29158,** *Automatic identification and data capture techniques – Bar code symbol quality test specification – Direct Part Mark (DPM)*
- **ISO/DIS 19078,** *Gas cylinders – Inspection of the cylinder installation, and requalification of high-pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles*
- **ISO/DIS 19828,** *Welding for aerospace applications – Visual inspection of welds*
- **ISO/DIS 21009-1,** *Cryogenic vessels – Static vacuum-insulated vessels – Part 1: Design, fabrication, inspection and tests* ME

SOCIETYNOTES

WE WANT TO HEAR FROM YOU!

At Work is a new feature in *Materials Evaluation* that shines a spotlight on the work that ASNT members are doing every day to create a safer world, from the research lab to in-field inspections to the executive C-suite. To nominate someone to be profiled, please email MEEditor@asnt.org. Note: Nominees must be current members of ASNT and actively involved in the NDT field.

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2024

6th International Conference on Tomography of Materials and Structures
1–5 July, Cape Town, South Africa
tomography2024.com

QIRT 2024 – 17th Quantitative InfraRed Thermography Conference
1–5 July, Zagreb, Croatia
energetika-marketing.hr/qirt-2024

European Congress of Radiology
3–7 July, Vienna, Austria
myesr.org/congress

51st Annual Review of Progress in Quantitative Nondestructive Evaluation
22–24 July, Denver, CO
event.asme.org

2024 Pressure Vessels & Piping Conference
28 July–2 August, Bellevue, WA
event.asme.org

7th Malaysia International NDT Conference and Exhibition
20–21 August, Malaysia
msnt.org.my

ICENDE 2024
22–24 August, Hyderabad, Telangana
asntindia.org

18th International Conference on Advances in Experimental Mechanics
3–5 September, Liverpool, UK
bssm.org

61st Annual British Conference on NDT and Materials Testing Exhibition
3–5 September, Telford, UK
materialstesting.org

Exhibition of Experimental Mechanics
3–5 September, Liverpool, UK
bssm.org

Oman Materials, Corrosion and Integrity Summit 2024
9–11 September, Muscat, Oman
omcorr.com

ICSD 2024 12th International Conference on Sustainable Development
11–12 September, Rome, Italy
ecsdev.org

Airlines for America (A4A) Nondestructive Testing Forum
16–19 September, Nashville, TN
a4andtforum.com

23rd International Nondestructive Testing and Evaluation of Wood Symposium
17–21 September, São Paulo, Brazil
ndtesymposium.org

36th Conference of the European Working Group on Acoustic Emission
18–20 September, Potsdam, Germany
ewgae2024.com

15th International Pipeline Conference
23–27 September, Calgary, AB, Canada
event.asme.org

International Robot Safety Conference 2024
1–3 October, Cincinnati, OH
automate.org

Carbon Fiber 2024
8–10 October, Charleston, SC
carbonfiberevent.com

Looking for NDT Training Course listings? *The directory of educational institutions and training programs that offer nondestructive testing programs or classes is available online at asnt.org > Learn > Educational Directory. Additions or modifications to this listing should be sent to NDToutreach@asnt.org.*

51st National Conference on Non-Destructive Testing
15–17 October, Bielany Wrocławskie, Poland
kkbn.pl

Third World Congress on Condition Monitoring
15–18 October, Beijing, China
wccm2021.com

ASNT 2024: The Annual Conference
21–24 October, Las Vegas, NV
asnt.org

54th NDE for Safety 2024/Defectoscopy 2024
12–14 November, Beroun, Czech Republic
cndt.cz

34th Annual Conference & Exhibition on Non-Destructive Evaluation
12–14 December, Chennai, India
isnt.in

2025

14th Conference on Industrial Computed Tomography (iCT) 2025
4–7 February, Antwerp, Belgium
uantwerpen.be

3rd International Conference & Exhibition on NDE 4.0
3–6 March, Taj Yeshwantpur, Bengaluru, India
2025.nde40.com

NASCC: The Steel Conference
2–4 April, Louisville, KY
nascc.aisc.org

Automate Show
12–15 May, Detroit, MI
automate.org

Pan-American Conference for Nondestructive Testing
9–12 June, Niagara Falls, ON, Canada
panndt.org

ASNTONLINE

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5-7 JUNE
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VT Virtual Cert Prep Course
12-14 JUNE
Instructor: Caleb Fecker

Basic Virtual Cert Prep Course
24-28 JUNE
Instructor: Bryan Lancon

Membership Monday*
8 JULY
Time: 7 a.m. and 4 p.m. (ET)
Presenter: ASNT staff

Live Webinar: Enhancing Weld Inspection – Integrating TFM and TFMi with Advanced Ultrasonic Technologies*
17 JULY
Time: 1:00–2:00 p.m. (ET)
Presenter: Will Haworth

Basic Virtual Cert Prep Course
19-23 AUGUST
Instructor: Joe Busby

UT Virtual Cert Prep Course
23-25 SEPTEMBER
Instructor: Allen Sanders

Membership Monday*
7 OCTOBER
Time: 7 a.m. and 4 p.m. (ET)
Presenter: ASNT staff

PT Virtual Cert Prep Course
10-11 OCTOBER
Instructor: Allen Sanders

Basic Virtual Cert Prep Course
14-18 OCTOBER
Instructor: Raul Leon

Dates, times, and topics are subject to change. For more information, or to register for events, go to asnt.org. To affiliate with the Virtual Section, go to asnt.org > Membership > Sections > Virtual Section.

*Free registration for ASNT members.

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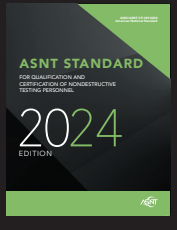

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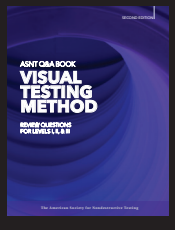

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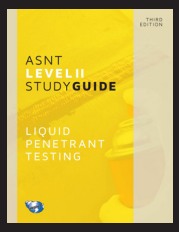

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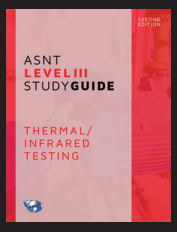

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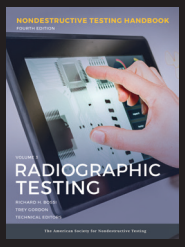

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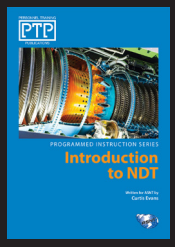

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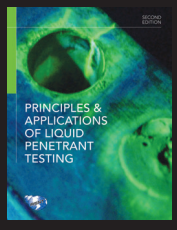

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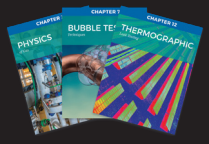

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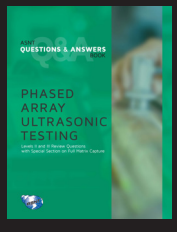

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MACHINE VISION-BASED TOOLS

for automotive service and repair

BY DANIEL LAU

Machine vision systems and other visual inspection methods are commonly used in the automotive industry for manufacturing, service, and repair. This article is focused on nondestructive visual testing methods for vehicle service and repair.

Introduction

Auto mechanics and vehicle owners can identify many issues through visual inspection. However, unaided visual inspections that rely on the visual acuity of the inspector may miss problem areas. Furthermore, while unaided visual inspections can often yield qualitative results, quantifying findings without advanced tools can pose significant challenges. For example, although an auto mechanic might recognize that a vehicle is misaligned during a visual inspection, without quantitative inspection tools, it's rare for them to precisely align the vehicle to meet the manufacturer's specifications.

This article focuses on the application of machine-vision systems for identifying vehicle issues and generating quantitative results, which subsequently guide prescriptive repair processes. Automotive mechanics rely on visual inspection for the following:

- **Making an initial assessment.** Technicians start with a visual inspection to get an overall understanding of the vehicle's condition and catch obvious problems such as leaking fluids or damaged parts.
- **Identifying leaks.** By visually inspecting the underside of a car, mechanics can spot leaks from the engine, transmission, brakes, or cooling system. The color and location of the fluid can indicate the source of the leak.
- **Checking wear and tear.** Components such as brake pads, belts, hoses, and tires are checked for wear and tear. Tires, for instance, are inspected for tread depth and wear patterns that might indicate alignment issues.