



Designation: E3024/E3024M – 22a

Standard Practice for Magnetic Particle Testing for General Industry¹

This standard is issued under the fixed designation E3024/E3024M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This practice establishes minimum requirements for magnetic particle testing used for the detection of surface or slightly subsurface discontinuities in ferromagnetic material. This practice is intended for industrial applications. Refer to Practice [E1444/E1444M](#) for aerospace applications. Guide [E709](#) may be used in conjunction with this practice as a tutorial.

1.2 The magnetic particle testing method is used to detect cracks, laps, seams, inclusions, and other discontinuities on or near the surface of ferromagnetic materials. Magnetic particle testing may be applied to raw material, billets, finished and semi-finished materials, welds, and in-service parts. Magnetic particle testing is not applicable to non-ferromagnetic metals and alloys such as austenitic stainless steels. See [Appendix X1](#) for additional information.

1.3 All areas of this practice may be open to agreement between the Level III or the cognizant engineering organization, as applicable, and the supplier.

1.4 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.4.1 This standard is a combined standard, an ASTM standard in which rationalized SI units and inch-pound units are included in the same standard, with each system of units to be regarded separately as standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standard-*

ization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 The following documents form a part of this practice to the extent specified herein.

2.2 *ASTM Standards:*²

[E543](#) Specification for Agencies Performing Nondestructive Testing

[E709](#) Guide for Magnetic Particle Testing

[E1316](#) Terminology for Nondestructive Examinations

[E1444/E1444M](#) Practice for Magnetic Particle Testing for Aerospace

[E2297](#) Guide for Use of UV-A and Visible Light Sources and Meters used in the Liquid Penetrant and Magnetic Particle Methods

[E3022](#) Practice for Measurement of Emission Characteristics and Requirements for LED UV-A Lamps Used in Fluorescent Penetrant and Magnetic Particle Testing

2.3 *ASNT Documents:*³

[SNT-TC-1A](#) Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing

[ANSI/ASNT CP-189](#) Standard for Qualification and Certification of Nondestructive Testing Personnel

2.4 *SAE-AMS Documents:*^{4,5}

[AMS 2641](#) Magnetic Particle Inspection Vehicle

[AMS 3040](#) Magnetic Particles, Nonfluorescent, Dry Method

[AMS 3041](#) Magnetic Particles, Nonfluorescent, Wet Method, Oil Vehicle, Ready-To-Use

[AMS 3042](#) Magnetic Particles, Nonfluorescent, Wet Method, Dry Powder

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American Society for Nondestructive Testing (ASNT), P.O. Box 28518, 1711 Arlington Ln., Columbus, OH 43228-0518, <http://www.asnt.org>.

⁴ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, <http://www.sae.org>.

⁵ Copies of standards, specifications, drawings, and publications required by manufacturers in connection with specification acquisition should be obtained from the contracting activity or as directed by the contracting officer.

¹ This practice is under the jurisdiction of ASTM Committee [E07](#) on Nondestructive Testing and is the direct responsibility of Subcommittee [E07.03](#) on Liquid Penetrant and Magnetic Particle Methods.

Current edition approved March 15, 2022. Published March 2022. Originally approved in 2016. Last previous edition approved in 2022 as E3024/E3024M – 22. DOI: 10.1520/E3024_E3024M-22A.

*A Summary of Changes section appears at the end of this standard

AMS 3043 Magnetic Particles, Nonfluorescent, Wet Method, Oil Vehicle, Aerosol Packaged
 AMS 3044 Magnetic Particles, Fluorescent, Wet Method, Dry Powder
 AMS 3045 Magnetic Particles, Fluorescent, Wet Method, Oil Vehicle, Ready-To-Use
 AMS 3046 Magnetic Particles, Fluorescent, Wet Method, Oil Vehicle, Aerosol Packaged
 AMS 5062 Steel, Low Carbon Bars, Forgings, Tubing, Sheet, Strip, and Plate 0.25 Carbon, Maximum
 AMS I-83387 Inspection Process, Magnetic Rubber
 AS 4792 Water Conditioning Agents for Aqueous Magnetic Particle Inspection
 AS 5371 Reference Standards Notched Shims for Magnetic Particle Inspection

2.5 *Federal Standard*:^{5,6}

FED-STD-313 Material Safety Data Sheets, Preparation and the Submission of

2.6 *Military Standard*:^{5,7}

A-A-59230 Fluid, Magnetic Particle Inspection, Suspension

2.7 *OSHA Document*:^{5,8}

29 CFR 1910.1200 Hazard Communication

2.8 *ISO Documents*:^{5,9}

ISO 7810 Identification Cards—Physical Characteristics

ISO 9712 Nondestructive Testing—Qualification and Certification of NDT Personnel

ISO 10012 Measurement Management Systems—Requirements for Measurement Processes and Measuring Equipment

2.9 *ANSI Documents*:¹⁰

ANSI/NCSL Z540.1 Calibration Laboratories and Measuring Test Equipment – General Requirements

ANSI/NCSL Z540.3 General Requirement for Calibration Laboratories and Measuring Test Equipment

2.10 *Order of Precedence*—In the event of conflict between the text of this practice and the referenced documents cited herein, the text of this practice takes precedence.

3. Terminology

3.1 *Definitions*—The definitions relating to magnetic particle testing, which appear in Terminology E1316, shall apply to the terms used in this practice.

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *magnetometer, n*—mechanical instrument used to measure magnetic field strength, in air, adjacent to the part.

⁶ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

⁷ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://dodssp.daps.dla.mil>.

⁸ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

⁹ Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <http://www.iso.org>.

¹⁰ Available from National Conference of Standards Laboratories, 1800 30th St., Suite 305b, Boulder, CO, 80301.

4. Significance and Use

4.1 *Description of Process*—Magnetic particle testing consists of magnetizing the area to be examined, applying suitably prepared magnetic particles while the area is magnetized, and subsequently interpreting and evaluating any resulting particle accumulations. Maximum detectability occurs when the discontinuity is positioned on the surface and perpendicular to the direction of magnetic flux in the part.

4.2 This practice establishes the basic parameters for controlling the application of the magnetic particle testing method. This practice is written so that it can be specified on the engineering drawing, specification, or contract. It is not a detailed how-to procedure to be used by the examination personnel and, therefore, must be supplemented by a detailed written procedure that conforms to the requirements of this practice.

5. General Practice

5.1 *Personnel Qualification*—Personnel performing examinations in accordance with this practice shall be qualified and certified in accordance with ASNT Recommended Practice No. SNT-TC-1A, ANSI/ASNT Standard CP-189, ISO 9712, or as specified in the contract or purchase order.

5.2 *Agency Qualification*—If specified in the contractual agreement, NDT agencies shall be qualified and evaluated as described in Specification E543. The applicable edition of Specification E543 shall be specified in the contractual agreement.

5.3 *Written Procedure*—Magnetic particle testing shall be performed in accordance with a written procedure applicable to the part or group of parts under examination. The procedure shall be in accordance with the requirements of this practice. The process, when conducted in accordance with the written procedure, shall be capable of detecting discontinuities specified in the acceptance criteria. The written procedure may be general if it clearly applies to all of the specified parts being examined and meets the requirements of this practice. All written procedures, including technique sheets for specific parts, shall be approved by an individual qualified and certified at Level III for magnetic particle testing in accordance with the requirements of 5.1. When applicable, procedures shall be submitted to the cognizant engineering organization for review, or approval, or both, when requested.

5.3.1 *Elements of the Written Procedure*—The written procedure shall include at least the following elements, either directly or by reference to the applicable documents:

5.3.1.1 Procedure identification number and the date it was written;

5.3.1.2 Identification of the part(s) to which the procedure applies; this shall include the material or alloy, or both;

5.3.1.3 For new components, sequence of magnetic particle testing as related to manufacturing process operation (for example, post-plating, after heat treat, etc.);

5.3.1.4 Identification of test parts used for system performance verification (see 7.1.1 and 7.1.2);

5.3.1.5 Process controls (see Table 1); including the definition of “use” in 7.3.2.2 and 7.4.4;