



Designation: E1444/E1444M – 22a

Standard Practice for Magnetic Particle Testing for Aerospace¹

This standard is issued under the fixed designation E1444/E1444M; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

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 aerospace applications using the wet fluorescent method. Refer to Practice [E3024/E3024M](#) for industrial applications. Guide [E709](#) can be used in conjunction with this practice as a tutorial.

NOTE 1—This practice replaces MIL-STD-1949.

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 Portable battery powered electromagnetic yokes are outside the scope of this practice.

1.4 All areas of this practice may be open to agreement between the cognizant engineering organization and the supplier, or specific direction from the cognizant engineering organization.

1.5 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.

1.5.1 *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.

1.6 *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.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization 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

[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

[E3024/E3024M](#) Practice for Magnetic Particle Testing for General Industry

2.3 *ASNT Documents:*³

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

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

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.

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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 Arlingate Ln., Columbus, OH 43228-0518, <http://www.asnt.org>.

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

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

AMS 2175 Castings, Classification and Inspection of
 AMS 2641 Magnetic Particle Inspection Vehicle
 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 Packaged⁵
 AMS 5355 Investment Castings
 AS 4792 Water Conditioning Agents for Aqueous Magnetic
 Particle Inspection
 AS 5282 Tool Steel Ring Standard for Magnetic Particle
 Inspection
 AS 5371 Reference Standards Notched Shims for Magnetic
 Particle Inspection
 SAE AMS-STD-595 Colors Used in Government Procure-
 ment

2.5 Federal Standard:^{4,6}

FED-STD-313 Material Safety Data, Transportation Data
 and Disposal Data for Hazardous Materials Furnished to
 Government Activities

2.6 Military Standards:^{4,6}

A-A-59230 Fluid, Magnetic Particle Inspection, Suspension
 MIL-STD-1949 Inspection, Magnetic Particle

2.7 OSHA Document:⁷

29 CFR 1910.1200 Hazard Communication

2.8 ANSI Document:^{4,8}

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

2.9 ISO Standards:⁹

ISO 10012 Measurement Management Systems—
 Requirements for Measurement Processes and Measuring
 Equipment (ISO 10012 is not intended as a substitute for,
 or as an addition to, the requirements of ISO/IEC 17025.)
 ISO 9712 Non-destructive Testing — Qualification and Cer-
 tification of NDT Personnel
 ISO/IEC 17025 General Requirements for the Competence
 of Testing and Calibration Laboratories

2.10 AIA Document:¹⁰

NAS 410 NAS Certification and Qualification of Nonde-
 structive Test Personnel

2.11 ASD-STAN Document:¹¹

EN 4179 Qualification and Approval of Personnel for
 Non-Destructive Testing

2.12 *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 par-
 ticle testing, which appear in Terminology E1316, shall apply
 to the terms used in this practice.

4. Significance and Use

4.1 *Description of Process*—Magnetic particle testing con-
 sists 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 dis-
 continuity is positioned on the surface and perpendicular to the
 magnetic flux.

4.2 This practice establishes the basic parameters for con-
 trolling 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 exami-
 nations in accordance with this practice shall be qualified and
 certified in accordance with SNT-TC-1A, ANSI/ASNT CP-
 189, NAS 410, EN4179, ISO 9712, or as specified in the
 contract or purchase order.

5.2 *Agency Qualification*—The agency performing this
 practice may be evaluated in accordance with Specification
 E543.

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 speci-
 fied 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 3 (III) for magnetic particle testing in accordance with
 the requirements of 5.1. Procedures shall be submitted to the
 cognizant engineering organization for review, or approval, or
 both, when requested.

⁴ 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.

⁵ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale,
 PA 15096-0001, <http://www.sae.org>.

⁶ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4,
 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://dodssp.daps.dla.mil>.

⁷ 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>.

⁸ Available from American National Standards Institute (ANSI), 25 W. 43rd St.,
 4th Floor, New York, NY 10036, <http://www.ansi.org>.

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

¹⁰ Available from Aerospace Industries Association of America, Inc. (AIA), 1000
 Wilson Blvd., Suite 1700, Arlington, VA 22209-3928, <http://www.aia-aerospace.org>.

¹¹ Available from ASD-STAN, asd-stan.org.