~~Designation:E2024–05~~

~~Standard Test Methods for~~ Designation: E2024/E2024M – 11

Standard Practice for Atmospheric Leaks Using a Thermal Conductivity Leak Detector[1]

This standard is issued under the fixed designation E2024/E2024M; 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

~~1.1These test methods cover procedures for detecting the sources of gas leaking at the rate of 4.5×10^{-9} mol/s ($1 \times 10^{*}$~~

1.1 This practice covers procedures for detecting the sources of gas leaking at the rate of 1×10^{-5} Pa m^3/s (1×10^{-4} standard cm^3/s) or greater. The tests may be conducted on any object that can be pressurized with a tracer gas that is detectable by a thermal conductivity detector. The test sensitivity will vary widely depending on the tracer gas used.

~~1.2~~

1.2 *Units*—The values stated in either SI or std-cc/sec units are to be regarded separately as standard. The values stated in each system may not be exact equivalents: therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E543 Specification for Agencies Performing Nondestructive Testing

E1316 Terminology for Nondestructive Examinations

2.2 *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

2.3 *AIA Standard:*

NAS-410 Certification and Qualification of Nondestructive Test Personnel[4]

3. Terminology

3.1 *Definitions*—For definitions of terms used in these test methods, see Terminology E1316, Section E.

4. ~~Summary of Test Method~~ Summary of Practice

4.1 *Scanning Method*—This test method sets minimum requirements for a thermal conductivity leak detector. It provides for calibration of the detector and gives procedures for pressurizing the test object, locating leaks and estimating the leakage rate.

4.2 *Accumulation Method*—The accumulation method is sometimes the only practical method for accessing complex shaped flanges or sections of pressurized vessels to be leak tested. It may be achieved by entrapping or enclosing an area of a test

---

[1] ~~These test methods are under the jurisdiction of ASTM Committee~~

[1] This practice is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and ~~are~~is the direct responsibility of Subcommittee E07.08 on Leak Testing Method.

Current edition approved ~~Dec.~~July 1, ~~2005.~~2011. Published ~~December 2005.~~July 2011. Originally approved in 1999. Last previous edition approved in 1999 as ~~E2024-99.~~E2024 - 05. DOI: ~~10.1520/E2024-05.~~10.1520/E2024_E2024M-11.

[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 the American Society for Nondestructive Testing, 1711 Arlingate Plaza, P.O. Box 28518, Columbus, OH 43228–0518.~~

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

[4] ~~Available from the Aerospace Industries Association of America, Inc., 1250 Eye Street, N.W., Washington, DC 20005.~~

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

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

component with a suitable covering and sampling the buildup of tracer gas concentration with the thermal conductivity leak detector. The acceptance criteria is based on the tracer gas concentration detected by the thermal conductivity detector after an accumulation time from leakage from the leak(s) into the known sample volume.

5. Significance and Use

5.1 These test methods are useful for locating and estimating the size of pressurized gas leaks, either as quality control tests or as field inspection procedures. Also, they are valuable as pretests before other more time consuming and more sensitive leak tests are employed. These test methods are semi-quantitative techniques used to locate leaks but cannot be used to quantify except for approximation. These test methods may be used in an accept-reject test mode.

6. Basis of Application

6.1 The following items are subject to contractual agreement between the parties using or referencing these test methods:

6.2 *Personnel Qualification*

6.2.1 If specified in the contractual agreement. Personnel performing examinations to these test methods shall be qualified in accordance with a nationally or internationally recognized NDT personnel qualification practice or standard such as ANSI/ASNT-CP-189, SNT-TC-1A, NAS-410, or similar document and certified by the employer or certifying agency, as applicable. The practice or standard used and its applicable revision shall be identified in the contractual agreement.

6.3 *Qualification of Nondestructive Agencies*—If specified in the contractual agreement, NDT agencies shall be qualified and evaluated as described in Practice E543. The applicable edition of Practice E543 shall be specified in the contractual agreement.

6.4 *Re-examination of Repaired/Reworked Items*—Re-examination of repaired/reworked items is not addressed in these test methods, they shall be specified in the contractual agreement

7. Interferences

7.1 *Background Gases*—Thermal conductivity detectors are sensitive to all gases that have a thermal conductivity value different from air and their sensitivity changes with the degree of difference. Background gases in the test area may significantly alter the test sensitivity to a particular tracer gas.

7.2 *Cleanliness of Test Surface*—The areas to be tested must be free of oil, grease, paint, water, and other contaminants that might mask a leak or be drawn into the leak detector and clog the probe.

7.3 *Pressurizing with Test Gas*—In order to evaluate leakage accurately, the test gas in all parts of the device or system must contain substantially the same concentration of tracer gas. When the device contains air prior to the introduction of test gas, or when an inert gas and a tracer gas are added separately, this may not be true. Devices in which the effective diameter and length are not greatly different, such as tanks, may be tested satisfactorily by simply adding tracer gas; however, when long or restricted systems (piping) are to be tested, more uniform tracer gas distribution will be obtained by first evacuating to less than 100 Pa (.75 torr), and then filling with the tracer gas or by employing proper purge technique.

7.4 *Unknown Tracer Gas Concentration*—When performing the calibration of the leak detector, a capillary standard leak generally is used that contains 100 % concentration of the tracer gas. Leak testing often is done on devices or systems that do not contain this same gas concentration as the standard leak. Doing so will cause the test sensitivity (detector response) to be less than that from the standard leak.

7.5 *Operator Scanning Variations* —The leak detector response will change when the test operator varies the scanning parameters because the scanning distance and speed determines the tracer gas concentration that the leak detector measured. Any change in scanning parameters from those used for calibration may cause a reduction in test sensitivity and instrument response.

7.6 *Gas Compatibility*—Some gases, such as hydrogen and ammonia, may permanently alter the instrument sensitivity and stability. Refer to the instrument manufacturer's manual.

8. Apparatus

8.1 *Thermal Conductivity Leak Detector*~~—This detector should have a minimum detectable leak rate of 4.5×10^{-9} mol/s (1×10~~—This detector should have a minimum detectable leak rate of 1×10^{-5} Pa m^3/s (1×10^{-4} Std cm^3/s). To perform tests as specified in these test methods, the detector should have the following minimum features:

8.1.1 Thermal conductivity sensor.

8.1.2 Device to maintain a stable probe air velocity.

8.1.3 Controls to zero detector.

8.1.4 Battery status indicator for portable instruments. The instrument sensitivity for a portable detector shall not vary prior to a low battery indication.

8.2 *Standard Leaks of Both Fixed and Variable Type*~~—The leak rate of the standard leak used for the system calibration shall be equal to the acceptance level (maximum permissible leakage rate). The leak rate of the standard leak may be less than the acceptance level when the system tracer concentration is less than 100% for testing.~~ —The leak rate of the standard leak (CL) used for the system calibration shall be equal to the acceptance level (maximum permissible leakage rate). The leak rate of the standard leak will be less than the acceptance level when the system tracer concentration is less than 100 % for testing. value of the standard leak to be used is determined by the following formula: