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Standard Guide for Selection of a Leak Testing Method[1]

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1. Scope

1.1 This guide[2] is intended to assist in the selection of a leak testing method.[3] Fig. 1 is supplied as a simplified guide.

1.2 The type of item to be tested or the test system and the method considered for either leak measurement or location are related in the order of increasing sensitivity.

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:*

E 425 Terminology Relating to Leak Testing[4]

3. Terminology

3.1 *Definitions*—The definitions of terms relating to leak testing which appear in Terminology E 425 shall apply to the terms in this guide.

4. Selection of System

4.1 The correct choice of a leak testing method optimizes sensitivity, cost, and reliability of the test. One approach is to rank the various methods according to test system sensitivity.

4.2 The various testing methods must be individually examined to determine their suitability for the particular system being tested. Only then can the appropriate method be chosen. For example, radioactive gases are not generally employed as a tracer for leak location because of the hazards associated with their use. However, such gases are employed in leakage detection equipment when they can be safely added to, and removed from, a test chamber on a periodic basis.

4.3 It is important to distinguish between the sensitivity associated with the instrument employed to measure leakage and the sensitivity of the test system followed using the instrument. The sensitivity of the instrument influences the sensitivity that can be attained in a specific test. The range of temperatures or pressures, and the types of fluids involved, influence both the choice of instrument and the test system.

4.4 The sensitivity of various test systems differ. For example, a test utilizing a mass spectrometer leak detector normally has an ultimate sensitivity of 4.4×10^{-15} mol/s when the procedure involves the measurement of a steady-state gas leakage rate. The sensitivity of the test may be increased under special conditions to 4.4×10^{-19} mol/s by allowing an accumulation of the leakage to occur in a known volume before a measurement of leakage is made. In the first case, the sensitivity of the test equals the sensitivity of the instrument; whereas in the second case, the sensitivity of the test is 10^4 times greater than that of the instrument. If the test system utilizes a mass spectrometer operating in the detector-probe mode, the sensitivity of the test can be 10^2 to 10^4 smaller than that of the mass spectrometer itself.

5. Leakage Measurement

5.1 In general, leakage measurement procedures involve covering the whole of the suspected region with tracer gas, while establishing a pressure differential across the system by either pressurizing with a tracer gas or by evacuating the opposite side. The presence and concentration of tracer gas on the lower pressure side of the system are determined and then measured.

5.2 A dynamic test method can be performed in the shortest time. While static techniques increase the test sensitivity, the time for testing is also increased.

5.3 Equipment or devices that are the object of leakage measurement fall into two categories: (*1*) open units, which are accessible on both sides, and (*2*) units that are sealed. The second category is usually applied to mass-produced items including gas and vacuum tubes, transistors, integrated circuit modules, relays, ordnance units, and hermetically sealed instruments.

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[1] This guide is under the jurisdiction of ASTM Committee E-7 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.08 on Leak Testing.

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[2] For ASME Boiler and Pressure Vessel Code applications see related Recommended Guide SE-432 in the Code.

[3] Additional information may be obtained from Marr, J. W., *Leakage Testing Handbook*, Report No. CR-952, NASA, Scientific and Technical Information Facility, P. O. Box 33, College Park, MD 20740 (Organizations registered with NASA) or Clearing House for Federal, Scientific and Technical Information, Code 410.14, Port Royal Road, Springfield, VA 22151.

[4] *Annual Book of ASTM Standards*, Vol 03.03.