



SURFACE VEHICLE INFORMATION REPORT

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Leakage Testing

RATIONALE

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1. Scope—This information report provides basic information on leakage testing, as applied to nondestructive testing, and affords the user sufficient information so that he may decide whether leakage testing methods apply to his particular need. Detailed references are listed in Section 2.

2. References

2.1 Applicable Publications—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J426—Liquid Penetrant Test Methods

2.2 Related Publications—The following publications are provided for information purposes only and are not a required part of this document.

2.2.1 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 425—Standard Definitions of Terms Relating to Leak Testing

ASTM E 427—Recommended Practice for Testing for Leaks Using the Halogen Leak Detector (Alkali-Ion Diode)

ASTM E 432—Standard Recommended Guide for the Selection of a Leak Testing Method

ASTM E 479—Standard Recommended Guide for Preparation of a Leak Test Specification

ASTM E 493—Standard Test Methods for Leaks Using the Mass Spectrometer Leak Detector in the Inside-Out Testing Mode

ASTM E 498—Standard Methods of Testing for Leaks Using the Mass Spectrometer Leak Detector or Residual Gas Analyzer in Tracer Probe Mode

ASTM E 499—Standard Methods of Testing for Leaks Using the Mass Spectrometer Leak Detector in the Detector Probe Mode

ASTM E 515—Standard Methods of Testing for Leaks Using Bubble Emission Techniques

ASTM E 908—Standard Practice for Calibrating Gaseous Reference Leaks

2.3 Other Publications

- Nondestructive Testing Handbook, Volume 1, "Leak Testing," 1982, American Society for Nondestructive Testing, Columbus, OH 43228.
- J. W. Marr, Leakage Testing Handbook, 1968, NASA Cr-952, Jet Propulsion Laboratory, National Aeronautics and Space Administration, Washington, DC.
- N. I. Sax, Dangerous Properties of Industrial Methods, 2nd Edition, 1963, Reinhold Publishing Corp., New York, NY.
- J. W. Perry, Chemical Engineering Handbook, 3rd Edition, 1950, McGraw-Hill Book Co., New York, NY.
- Metals Handbook, 8th Edition, Volume 11, 1976, pp. 260-270, American Society for Metals, Metals Park, OH 44073.
- ASME Boiler and Pressure Vessel Code, latest addenda, American Society for Mechanical Engineers, New York, NY.
- Qualification and Certification of Personnel, Recommended Practice SNT-TC-1A, Supplement G (Leak Testing), American Society for Nondestructive Testing, Columbus, OH 43228.
- R. J. Roehrs, Leak Testing of Welded Vessels, 2nd Annual Symposium on Nondestructive Testing of Welds, sponsored by IITRI, Chicago, IL, 1967.

3. **General**—Leakage testing is a form of nondestructive testing capable of determining the existence of leak sites and, under proper conditions, measuring the quantity of material passing through these sites. The word leak means the hole through which fluid (liquid or gas) passes in either a pressurized or evacuated system, while leakage is the term used to connote the mass flow of fluid regardless of the size of the leak. Leakage rate is the quantity of fluid per unit time that flows through the leak at a given temperature as a result of a specified pressure difference across the leak. The ASTM accepted unit of leakage rate is standard cubic centimeters per second (std. cm³/s), frequently referred to as atmosphere cubic centimeters per second (atm. cm³/s). The SI terminology is Pascal cubic meters per second (Pa m³/s). (1 Pa m³/s = 10 atm. cm³/s, approximately.)

There is no container in which a differential pressure exists (either pressurized or vacuum) that does not leak to some extent. Absolute leak tightness is an absolute impossibility. Any container must, therefore, have a maximum leakage rate specified. In considering the leakage rate that can be tolerated, one must decide whether the rate represents the total leakage from the system or the maximum leakage from a single leak. Additional factors to be considered include shelf life, product contained, toxicity, legal requirements, consequences of excessive leakage, cost of product, cost of testing, and customer requirements. Once a leakage rate has been specified then a leak test procedure describing the operating and test conditions needs to be detailed. Since leakage rate relates pressure, volume, and time, more than one set of procedural values can yield the same leakage rate. In general, the pressure used should reflect pressures that the item would see in service, however, this is not a requirement. In some isolated cases, using markedly different pressures can cause leaks to pass grossly different rates of fluid due to elastic deformation of the item being tested. Regardless of the type of leakage testing being done, safety considerations for the personnel performing these tests must be a paramount consideration.