



Standard Test Methods for Oil Content, Oil-Impregnation Efficiency, and Surface- Connected Porosity of Sintered Powder Metallurgy (PM) Products Using Archimedes' Principle¹

This standard is issued under the fixed designation B963; 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 standard describes three related test methods that cover the measurement of physical properties of oil-impregnated powder metallurgy products.

1.1.1 Determination of the volume percent of oil contained in the material.

1.1.2 Determination of the efficiency of the oil-impregnation process.

1.1.3 Determination of the percent surface-connected porosity by oil impregnation.

1.2 With the exception of the values for density and the mass used to determine density, for which the use of the gram per cubic centimetre (g/cm^3) and gram (g) units is the long-standing industry practice, the values in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered 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

B243 Terminology of Powder Metallurgy

D1217 Test Method for Density and Relative Density (Specific Gravity) of Liquids by Bingham Pycnometer

D1298 Test Method for Density, Relative Density, or API

Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method

E456 Terminology Relating to Quality and Statistics

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 Definitions of powder metallurgy (PM) terms can be found in Terminology **B243**. Additional descriptive material is available in the Related Material section of Vol. 02.05 of the *Annual Book of ASTM Standards*.

4. Summary of Test Method

4.1 The part or test specimen is first weighed in air. It is then oil impregnated to fill the surface-connected porosity and the specimen is reweighed. The test specimen is then weighed when immersed in water and its volume calculated based on Archimedes' principle. The oil is then removed and the specimen is reweighed.

4.2 The *oil content* of an oil-impregnated part or test specimen is then calculated as a percentage of the volume of the specimen. This may be done for the as-received and the fully oil-impregnated specimen.

4.3 The *oil-impregnation efficiency* is calculated by dividing the as-received oil content by the fully impregnated oil content and expressing the result as a percentage.

4.4 The volume percentage of *surface-connected porosity* (as measured by oil impregnation) is then calculated based on the amount of oil in the fully oil-impregnated specimen.

5. Significance and Use

5.1 Oil content values are generally contained in specifications for oil-impregnated PM bearings.

5.2 The oil-impregnation efficiency provides an indication of how well the as-received parts had been impregnated.

5.3 The desired self-lubricating performance of PM bearings requires a minimum amount of surface-connected porosity

¹ These test methods are under the jurisdiction of ASTM Committee B09 on Metal Powders and Metal Powder Products and are the direct responsibility of Subcommittee B09.04 on Bearings.

Current edition approved Sept. 1, 2014. Published September 2014. Originally approved in 2008. Last previous edition approved in 2013 as B963 – 13. DOI: 10.1520/B0963-14.

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.