



Designation: B931 – 23

Standard Test Method for Metallographically Estimating the Observed Case Depth of Ferrous Powder Metallurgy (PM) Parts¹

This standard is issued under the fixed designation B931; 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*

1.1 A metallographic method is described for estimating the observed case depth of ferrous powder metallurgy (PM) parts. This method may be used for all types of hardened cases where there is a discernible difference between the microstructure of the hardened surface and that of the interior of the part.

1.2 With the exception of the values for grit size for which the U.S. standard designation is the industry standard, the values stated in SI units are to be regarded as 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *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 ASTM Standards:²

B243 Terminology of Powder Metallurgy

E407 Practice for Microetching Metals and Alloys

E456 Terminology Relating to Quality and Statistics

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

2.2 MPIF Standards:

MPIF Standard 70 Guide to Sample Preparation of Ferrous Powder Metallurgy (PM) Materials for Cross-Sectional Metallographic Evaluation

¹ This test method is under the jurisdiction of ASTM Committee B09 on Metal Powders and Metal Powder Products and is the direct responsibility of Subcommittee B09.05 on Structural Parts.

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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. Terminology

3.1 **Definitions**—Definitions of powder metallurgy (PM) terms can be found in Terminology **B243**. Additional descriptive information is available under “General Information on PM” on the B09 web page.

3.2 The metallographically estimated observed case depth is defined as the distance from the surface of the part to the point where, at a magnification of 100 $\times$, there is a discernible difference in the microstructure of the material.

4. Summary of Test Method

4.1 The powder metallurgy part is sectioned and the surface prepared for metallographic evaluation. The metallographic specimen is etched and the distance is measured from the surface of the part to the point at which a discernible difference in the microstructure of the material is observed.

5. Significance and Use

5.1 The engineering function of many PM parts may require an exterior portion of the part to have a hardened layer. Where case hardening produces a distinct transition in the microstructure, metallographic estimation of the observed case depth may be used to check the depth to which the surface has been hardened.

6. Apparatus

6.1 Equipment for the metallographic preparation of test specimens—see MPIF Standard 70.

6.2 *Metallographic Microscope*, permitting observation and measurement at a magnification of 100 $\times$.

7. Reagents and Materials

7.1 Etchants such as 2 % to 5 % nital, nital/picral combinations, or other suitable etchants. For more information on suitable etchants refer to Practice **E407**.

8. Test Specimens

8.1 Cut a test specimen from the PM part, perpendicular to the hardened surface at a specified location, being careful to avoid any cutting or grinding procedure that would affect the original microstructure.

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