



Designation: **B795—13 B795 – 20**

# Standard Test Method for Determining the Percentage of Alloyed or Unalloyed Iron Contamination Present in Powder Forged (PF) Steel Materials<sup>1</sup>

This standard is issued under the fixed designation B795; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

## 1. Scope\*

1.1 This test method covers a metallographic procedure for determining the percentage of alloyed or unalloyed iron contamination present in powder forged low-alloy steel materials and the percentage of alloyed iron contamination in powder forged iron and carbon steel materials.

1.2 Units—The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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:*<sup>2</sup>

[B243 Terminology of Powder Metallurgy](#)

[E3 Guide for Preparation of Metallographic Specimens](#)

[E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods](#)

~~[E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method](#)~~

## 3. Terminology

3.1 Definitions—Definitions of powder metallurgy terms can be found in Terminology [B243](#). Additional descriptive information is available in the Related Material Section of Vol 02.05 of the *Annual Book of ASTM Standards*.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 cross-product contamination—contamination, n—the unintentional mixing of powders with distinct differences in chemical composition.

## 4. Summary of Test Method

4.1 A section representing the core region is taken from the powder forged material and prepared for metallographic examination.

4.2 The polished and etched sample is examined microscopically at a magnification of 100 $\times$  and a systematic point count made of features with etching characteristics different from that of the matrix.

4.3 The amount of contaminant is reported as a percentage to the nearest 0.1 %.

<sup>1</sup> 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 [B09.11](#) on Near Full Density Powder Metallurgy Materials.

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<sup>2</sup> 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.

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

**5. Significance and Use**

- 5.1 Cross-product contamination occurs whenever alloy steel powders are processed in the same equipment as iron powders.
- 5.2 Unalloyed iron particles, because they may not harden upon heat treatment, are a potential source of soft spots in low-alloy steel parts.
- 5.3 Alloyed iron particles, having higher hardenability than an iron or carbon steel matrix, are a potential source of hard spots.
- 5.4 Hard or soft spots may cause problems in service or machining.
- 5.5 The results of the tests may be used to qualify parts for shipment in accordance with guidelines agreed between purchaser and manufacturer or to check the suitability of mixes for use in powder forging.

**6. Apparatus**

- 6.1 Equipment for the metallographic preparation of test specimens.
- 6.2 A metallographic microscope permitting observation and measurement at a magnification of 100x.

**7. Sampling**

- 7.1 Take a metallographic specimen from the powder forged material. The polished surface of the specimen should be not less than that required to superimpose 2500 grid points at a magnification of 100x. Multiple sections are permitted in order to obtain the necessary area for measurement on small parts or test pieces.
- 7.2 The polished surface shall be parallel to the direction of forging, that is, parallel to the direction of travel of the forging punch, or as specified in the contract or purchase order, and shall represent an area away from the surface of the material.

**8. Procedure**

8.1 *Preparation of Specimens:*

8.1.1 *Polishing*—In polishing the specimens, it is highly important that the polished surface be free from artifacts and debris. It is recommended that the procedures described in Practice Guide E3 be followed. Automated grinding and polishing procedures are recommended.

8.1.2 *Etching*—Lightly etch the freshly polished specimen with 2 % nital (2 mL nitric acid, 98 mL ethyl alcohol). Next, etch the polished and lightly etched specimen by immersion in a freshly prepared aqueous solution containing 3 g potassium metabisulfite and 10 g sodium thiosulfate per 100 mL. Rinse the specimen in running water, then rinse with low residue alcohol and dry with a blast of dry air.

8.1.2.1 The etching time will depend on alloy type, carbon content, and microstructure. The greater the alloy content, the slower the etching rate; the greater the carbon content, the faster the etching rate.

8.1.2.2 A good contrast is developed between the matrix and the contaminant because of a combination of etching and staining. The areas containing the highest alloy content are the least affected. Unalloyed iron will become darkened in a low-alloy matrix, and low-alloy particles will remain light in an iron or carbon steel matrix. In a low-alloy matrix, contaminant particles of another low-alloy powder can be distinguished from unalloyed iron contamination because the particles etch differently (see Fig. 1 and Fig.

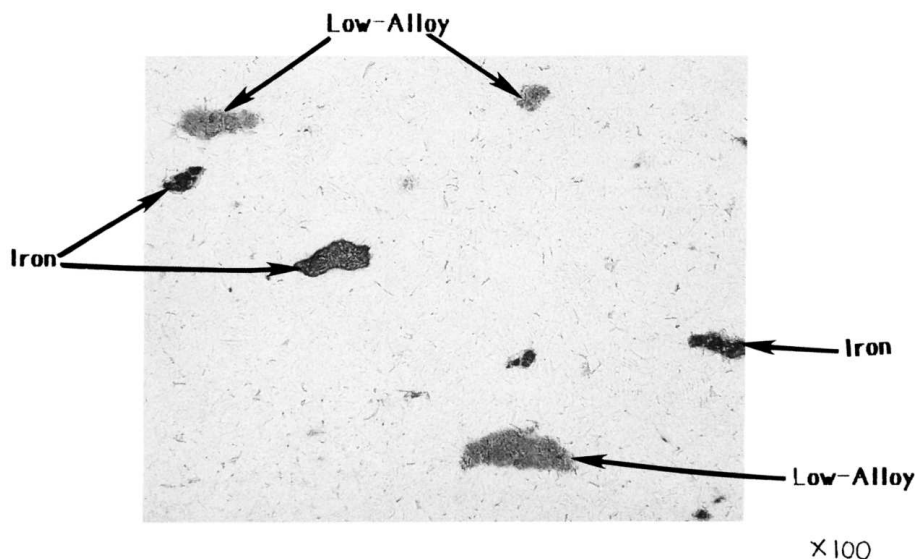


FIG. 1 Illustration of Iron and Low-Alloy Contaminants in PF-4650