Designation: B855 – 06

Standard Test Method for Volumetric Flow Rate of Metal Powders Using Arnold Meter and Hall Funnel[1]

This standard is issued under the fixed designation B855; 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 This test method covers a procedure for measuring the flow characteristics of a given volume of powder.

1.2 The values stated in SI units are to be regarded as the standard (except for the Hall Flowmeter Funnel, which is produced in inch-pound units). The values given in parentheses are for information only.

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]

B213 Test Method for Flow Rate of Metal Powders
B215 Practices for Sampling Metal Powders
B243 Terminology of Powder Metallurgy
B703 Test Method for Apparent Density of Powders Using Arnold Meter

3. Terminology

3.1 *Definitions*—Useful definitions of terms for metal powders and powder metallurgy are found in Terminology B243.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *volumetric flow rate*—the time required for a given volume of powder to flow through an orifice in a standard instrument according to a specified procedure.

4. Summary of Test Method

4.1 This test method consists of slowly sliding a bushing partially filled with powder over a 20 cm^3 hole in a hardened steel block. The volume of the powder obtained upon removal of the steel block is transferred to a Hall Flowmeter and the flow rate reported in seconds per 20 cm^3.

5. Significance and Use

5.1 The volumetric flow rate is a measure of the flow characteristics of a metal powder. Measuring flow by volume as compared with flow per unit mass eliminates the variable of the powder density.

5.2 The ability of a powder to flow and pack is a function of interparticle friction. As the surface area increases, the amount of friction in a powder mass also increases. Consequently, the friction between particles increases, giving less efficient flow and packing.

5.3 Knowledge of the volumetric flow permits the number of parts that can be made per hour to be estimated.

5.4 This test method may be part of the purchase agreement between powder manufacturers and powder metallurgy (P/M) part producers, or it can be an internal quality control test by either the producer or the end user.

6. Apparatus

6.1 *Arnold Density Meter*[3]—(Test Method B703) a hardened, tempered, and demagnetized steel block having a center hole 31.6640 ± 0.0025 mm (1.2466 ± 0.0001 in.) in diameter and a height of 25.4000 ± 0.0025 mm (1.0000 ± 0.0001 in.) that corresponds to a volume of 20 cm^3 (1.22 $in.^3$) (Fig. 1).

6.2 *Bushing*—either brass or bronze. Approximately 38 mm (1.50 in.) inside diameter (ID) by 45 mm (1.75 in.) outside diameter (OD) by 38 mm (1.50 in.) long (Fig. 1).

6.3 *Hall Flowmeter*[4]—(Test Method B213) A standard flowmeter funnel having a calibrated orifice of 0.10 in. (2.54 mm) in diameter complete with stand (Fig. 2).

[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 B09.02 on Base Metal Powders.

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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] The sole source of supply of the Arnold Density Meter complete with bushing known to the committee at this time is Arnold P/M Consulting Services, 648 Cedar Road, St. Marys, PA 15857. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

[4] The sole source of supply of the complete Hall Flowmeter known to the committee at this time is ACuPowder International LLC, 901 Lehigh Avenue, Union NJ 07083-7632. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

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

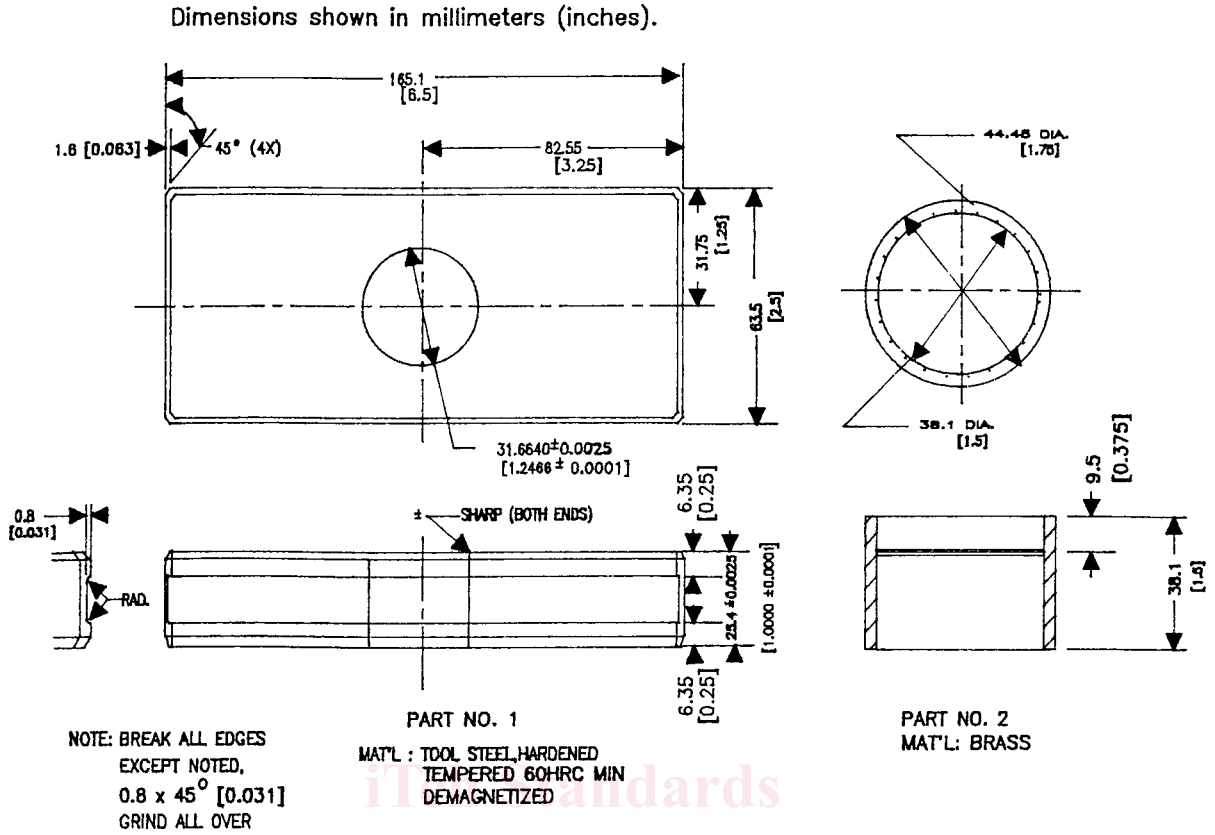

FIG. 1 Arnold Apparent Density Meter

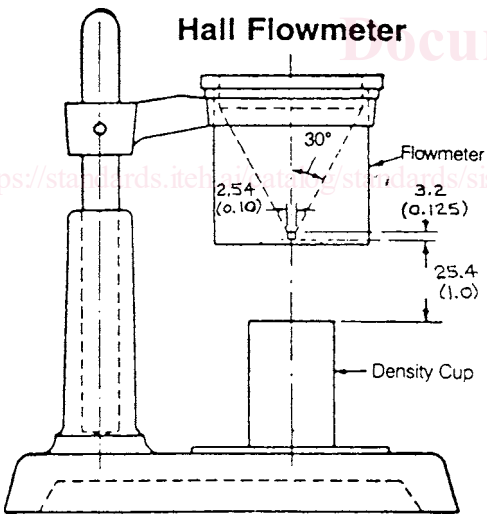

FIG. 2 Hall Flowmeter

6.4 *Base*—A level, vibration-free base to support the Hall Flowmeter.

6.5 *Paper*—Glazed or waxed paper measuring approximately 150 mm by 150 mm square (6.0 in. by 6.0 in.).

6.6 *Timing Device*—Stopwatch or other suitable device.

7. Sampling

7.1 Obtain a test sample in accordance with Practices B215.

7.2 The powder sample shall be of sufficient volume to fill the bushing to three-quarters of its height.

8. Preparation of Apparatus

8.1 Clean the steel block, bushing, and Hall funnel thoroughly to eliminate any loose powder particles.

9. Procedure

9.1 Place the steel block on a sheet of glazed or waxed paper.

9.2 Place the bushing on the steel block on either side of the hole.

9.3 Fill the bushing slowly and carefully to three-quarters of its height with powder. (An inscribed ring on the ID of the bushing indicates the proper fill height.)

9.4 With downward pressure on the bushing, slowly slide the bushing towards the hole while twisting it. This gives a snowplow action to the powder as it falls slowly into the hole. Continue this motion until the bushing passes the hole. Stop, and again with downward pressure on the bushing slide it straight back over the hole to its starting position. The sliding action must be slow enough to allow for complete filling of the steel block cavity.

9.5 Remove the steel block from the paper, being careful not to tip the block and spill additional powder on to the paper.

9.6 The volumetric flow rate of the 20 cm^3 of powder may be determined using either of the following methods:

9.6.1 *Method 1–Stationary Powder Start to Flow Measurement*:

9.6.1.1 Block the discharge orifice at the bottom of the flowmeter funnel with a dry finger.