SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE RECOMMENDED PRACTICE

Submitted for recognition as an American National Standard

SAE J1993

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CAST STEEL GRIT

1. *Scope*—This SAE Recommended Practice describes the chemical composition and the physical requirements for high carbon cast steel grit.

1.1 **Description**—Cast steel grit is the product obtained by crushing cast steel shot. The resulting angular particles are heat-treated and screened to a range of sizes as described in specification SAE J444.

2. *References*

2.1 **Applicable Documents**—The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

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

SAE J444—Cast Shot and Grit Size Specifications for Peening and Cleaning

2.1.2 ASTM PUBLICATIONS—Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM A 370—Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM E 11—Specification for Wire-Cloth Sieves for Testing Purposes
ASTM E 384—Test Methods for Microhardness of Materials

3. *Size Classification and Hardness Identification*

3.1 The three standard hardnesses shall be identified as follows in Table 1:

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TABLE 1—SIZE CLASSIFICATION AND HARDNESS IDENTIFICATION

G (for Grit)	Nominal Size Mesh Number	Hardness Range
HCS G	*	S (42 - 52 HRC)
HCS G	*	M (52 - 60 HRC)
HCS G	*	H (60 HRC min)

* Grit sizes per SAE J444
For example: G 25-S

4. Chemical Composition

a. Carbon—0.85 to 1.20%
b. Manganese—0.60 to 1.20%
c. Silicon—0.40% minimum
d. Sulphur—0.05% maximum
e. Phosphorus—0.05% maximum

5. Hardness

5.1 Standard hardness ranges for grit are as follows:

a. G (*) S—The hardness range shall be 42 to 52 HRC
b. G (*) M—The hardness range shall be 52 to 60 HRC
c. G (*) H—The hardness shall be 60 HRC minimum

5.2 90% of the hardness readings shall be within the specified range. For G (*) H (*), 90% of the readings shall be 60 HRC or higher.

5.3 Special Hardnesses—Other hardnesses may be specified by the user.

6. Microstructure—The microstructure of cast steel grit shall consist of martensite, tempered to a degree consistent with the hardness with fine, well distributed carbides, if any. Some retained austenite may be observed in H hardness grit. Decarburized surfaces, pearlite, and intergranular carbides and grain boundary segregation are undesirable and may be present in no more than 15% of the particles.

7. General Appearance—The cast steel grit shall be as angular as commercially possible. A total of no more than 40% of the grit particles shall have objectionable defects nor contain more than 1% by weight of nonmetallic material. Any one particle tested that has several objectionable defects will only be counted once in the total. Notwithstanding the allowable percentages as listed as follows, no more than a total of 40% objectionable particles are allowed.

7.1 Particle Shape—For the hard steel grits, G(*)M, G(*)H, there shall be no more than 5% round or half round particles.

7.2 **Shrinkage**—No more than 10% of the particles in the sample shall contain shrinkage. Shrinkage is an internal cavity with irregular dendritic surface, greater in area than 40% of the pellet area.

7.3 **Cracks**—No more than 40% of the particles examined shall contain major cracks. A major crack is defined as a linear discontinuity whose length is greater than three times its width and is radial in direction.

7.4 **Microstructure**—Carbide networks, grain boundary segregation, decarburization, and high temperature transformation products such as pearlite are undesirable. No more than 15% of the particles tested shall contain these defects.

8. Density—The density of the cast steel grit shall not be less than 7.3 g/cm^3.

9. Sampling Procedures

9.1 **Obtaining Samples**—Samples must be representative of each shipment or production lot.

9.2 **Sample Preparation**—Sample mounting for testing—Grit samples used for testing hardness, microstructure, and objectionable defects shall be mounted one layer deep in bakelite or other strong metallurgical mounting compound. The mounted sample shall be ground to the center of the particle and polished using methods suitable for microscopic examination.

10. Test Procedures

10.1 **Size Classification**—A 100 g sample shall be tested for size using 8 in diameter ASTM E 11 test sieves designated in Table 1 for each grit size. The sample and sieves shall be mechanically agitated in a circular motion, at a rate of 275 to 295 times per minute, and tapped at a rate of 145 to 160 taps per minute. The agitation times shall be as follows:

a. If the sieves include any 35 mesh or smaller, the agitation time shall be 10 min ± 5 s.

b. If the sieves are all larger than 35 mesh, the agitation time shall be 5 min ± 5 s.

The grit remaining on each sieve shall be weighed on a balance with a sensitivity of at least 0.1 g. The cumulative sample weight shall be recorded to the nearest 0.1 g.

10.2 **Chemical Analysis**—Any suitable procedure, such as ASTM prescribed methods, may be used.

10.3 **Hardness Testing**—Hardness measurements shall be taken on any sound area of a particle, preferably halfway between the center and the edge, on a minimum of ten particles in the mounted specimen. The hardness shall be determined in accordance with ASTM E 384 or equivalent microhardness testing methods. For G-80 and smaller grit, a load of 100 g shall be used. For G-50 and G-40 grit a load of 500 g shall be used. For grit larger than G-40 the load may be either 500 or 1000 g. Conversion to approximate Rockwell C numbers may be obtained from ASTM A 370 and manufacturers of hardness testers.

10.4 **Microstructure**—The mounted and polished specimen shall be etched with a suitable etchant and examined at a magnification of approximately 500 diameters.

10.5 **Shrinkage and Cracks**—Shrinkage and cracks shall be determined using a magnification of ten diameters.

10.6 **Density**—Density shall be determined using any suitable displacement procedure using ethanol or methanol as the displaced liquid. A pycnometer may be used for more precise measurements.

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