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SAE SPECIFICATION J1993 - HIGH CARBON CAST STEEL GRIT

 <p>SAE The Engineering Society For Advancing Mobility Land Sea Air and Space INTERNATIONAL 480 Commonwealth Drive, Warrendale, PA 15096-0001</p>	SURFACE VEHICLE RECOMMENDED PRACTICE		REV. SEP1996
		Issued 1993-03 Revised 1996-09	
		Superseding J1993 MAR93	

1. Scope

This SAE Recommended Practice describes the chemical composition and physical characteristic requirements for high-carbon cast-steel grit to be used for blast cleaning and etching operations.

2. References

2.1 Applicable Publications - The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE, ASTM and ISO publications shall apply.

2.1.1 - SAE Publications - Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001

- SAE J444 - Cast Shot and Grit Size Specifications for Peening and Cleaning
- SAE J445 - Metallic Shot and Grit Mechanical Testing

2.1.2 - ASTM Publications - Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

- ASTM B 215, Method B - Methods of Sampling Finished Lots of Metal Powders
- ASTM E 140 - Hardness Conversion Tables for Metals (Relationship Between Brinell Hardness, Vickers Hardness, Rockwell Hardness, Rockwell Superficial Hardness and Knoop Hardness)
- ASTM E 384 - Test method for Microhardness of Materials

2.1.3 - ISO Publications - Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002

- ISO 11124 Part 3 - High-carbon cast-sheet steel shot and grit
- ISO 11125 Part 1 - Preparation of steel substrates before application of paints and related products - Test methods for metallic abrasives - Part 1: Sampling
- ISO 11125 Part 2 - Preparation of steel substrates before application of paints and related products - Test methods for metallic abrasives - Part 2: Determination of particle size distribution
- ISO 11125 Part 3 - Preparation of steel substrates before application of paints and related products - Test methods for metallic abrasives - Part 3: Determination of hardness
- ISO 11125 Part 4 - Preparation of steel substrates before application of paints and related products - Test methods for metallic abrasives - Part 4: Determination of apparent density
- ISO 11125 Part 5 - Preparation of steel substrates before application of paints and related products - Test methods for metallic abrasives - Part 5: Determination of percentage defective particles and microstructure.
- ISO 11125 Part 6 - Preparation of steel substrates before application of paints and related products - Test methods for metallic abrasives - Part 6: Determination of foreign matter
- ISO 11125 Part 7 - Preparation of steel substrates before application of paints and related products - Test methods for metallic abrasives - Part 7: Determination of moisture

3. Description

High-carbon cast-steel grit is the product obtained by crushing heat-treated high-carbon cast-steel shot. The resulting angular particles are screened to a range of sizes from G10 to G325 as described in J444.

4. Size Classification & Hardness Identification

High-carbon cast-steel grit will be identified by HCS G, followed by a number which represents the sieve designation, in accordance with SAE J444, followed by a letter designating the grit hardness range. See the example following 6.3 for the full grit designation.

5. Chemical Composition

Element	Weight Percent
Carbon	0.80 - 1.2%
Manganese	0.60 - 1.2%
Silicon	0.4% minimum
Sulfur	0.05% maximum
Phosphorous	0.05% maximum

6. Hardness

6.1 - Standard Hardness - The four standard hardness ranges for high-carbon cast-steel grit are as follows:

- HCS G(°)S - The hardness range shall be 40 to 51 HRC
- HCS G(°)M - The hardness range shall be 47 to 56 HRC
- HCS G(°)L - The hardness range shall be 54 to 61 HRC
- HCS G(°)H - The hardness range shall be 60 HRC minimum

6.2 - 90% of the hardness readings shall be within the specified range. For HCS G(°)H, 90% of the readings shall be 60 HRC or higher.

6.3 - Special Hardness - Other hardnesses may be specified by the user. The minimum hardness range that can be specified is 7 points HRC. Example: HCS G25S indicates a high-carbon cast-steel grit meeting the G25 requirements in SAE J444, with a hardness designation of S (40 to 51 HRC).

7. Microstructure

The microstructure of high-carbon 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 of grit.

8. 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 characteristics or contain more than 1% by weight of nonmetallic material. Any one particle tested that has more than one objectionable characteristic will only be counted once in the total. Notwithstanding the allowable percentages listed as follows, no more than a total of 40% objectionable particles are allowed.

8.1 - Objectionable Characteristics

8.1.1 - Particle Shape - For the hard steel grits, HCS G(°)L, HCS G(°)H, there shall be no more than 5% round or half round particles. For the soft steel grits, HCS G(°)S and HCS G(°)M, there shall be no more than 10% round or half round particles.

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

8.1.3 - 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.

8.1.4 - 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.

9. Density

The density of the cast-steel grit shall be not less than 7.3 g/cm³

10. Inspection Procedures

10.1 - Sampling - Samples for testing shall be representative of each shipment or production lot. The method of sampling shall be ASTM B 215, Method B.

10.2 - Sample Mounting for Testing - Grit samples used for testing for hardness, microstructure and objectionable defects shall be mounted one layer deep in bakelite or other suitable strong metallurgical sample mounting media.

The mounted sample shall be ground to the center of the particles and polished using methods acceptable for microscopic examination. When grinding and polishing the sample, care must be taken not to overheat the sample and affect the microstructure and/or hardness.

10.3 - Chemical Analysis - Any suitable ASTM analytical procedure for steel may be used to test chemical composition.

10.4 - 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 100g shall be used. For G-50 and G-40 grit, a load of 500g 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 E 140 and manufacturers of hardness testers.

10. Inspection Procedures Continued

10.4 - 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 100g shall be used. For G-50 and G-40 grit, a load of 500g 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 E 140 and manufacturers of hardness testers.

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

10.6 - Shrinkage & Cracks - Shrinkage and cracks shall be determined using a magnification of 10 diameters.

10.7 - Density - Density shall be determined by placing 50 mL of water or alcohol in a 100 mL graduate, adding 100 g of shot and recording the increase in volume. Dividing 100 g by the volume increase will give the density in g/cm³. A pycnometer method may be used for more critical density measurements.

10.8 - Mechanical Tests - See SAE J445 for methods of checking uniformity of shipments of grits.

11. Notes

11.1 - Marginal Indicia - The change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

12. Rationale

Not applicable.

13. Relationship of SAE to ISO Standard

Not applicable.

Applications

This SAE Recommended Practice describes the chemical composition and physical characteristic requirements for high-carbon cast-steel grit to be used for blast cleaning and etching operations.

Reference Section

- SAE J444 - Cast Shot and Grit Size Specifications for Peening and Cleaning
- SAE J445 - Metallic Shot and Grit Mechanical Testing
- ASTM B 215, Method B - Methods of Sampling Finished Lots of Metal Powders
- ASTM E 140 - Hardness Conversion Tables for Metals (Relationship Between Brinell Hardness, Vickers Hardness, Rockwell Hardness, Rockwell Superficial Hardness, and Knoop Hardness)
- ASTM E 384 - Test methods for Microhardness of Materials
- ISO 11124 Part 3 - High-carbon cast-steel shot and grit
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- ISO 11125 Part 6 - Preparation of steel substrates before application of paints and related products - Test methods for metallic abrasives - Part 6: Determination of foreign matter
- ISO 11125 Part 7 - Preparation of steel substrates before application of paints and related products - Test methods for metallic abrasives - Part 7: Determination of moisture

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