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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS-S-851

Issued DEC 1998

Submitted for recognition as an American National Standard

Steel Grit, Shot, and Cut Wire Shot; and Iron Grit and Shot-Blast Cleaning and Peening

NOTICE

This document has been taken directly from U.S. Military Specification MIL-S-851D, Amendment 1 and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-S-851D, Amendment 1. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Under Department of Defense policies and procedures, any qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this SAE technical document.

1. SCOPE:

1.1 Scope:

The specification covers cast iron or hardened cast steel grit and shot for blast cleaning of castings, forgings, ship hulls and decks, or other parts prior to use for the removal of sand, slag, rust, and marine incrustations; and also cast iron or hardened cast steel shot, or cut steel wire shot for peening the surface of metals.

1.2 Classification:

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1.2.1 Grit and Shot: Grit and shot shall be of the following types as specified (See 6.2):

Type I Cast steel (grit and shot)

Type II Cast iron (grit and shot)

Type III Steel cut wire (shot only)

1.2.2 Sizes: Grit, shot and cut wire shall be furnished in the sizes shown in Tables II, III, and IV as specified (see 6.2).

2. APPLICABLE DOCUMENTS:

The following publications, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

2.1 SAE Publications:

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

SAE J441 Cut Wire Shot, Recommended Practice

2.2 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

RR-S-366 Sieve Test
UU-S-48 Sacks, Shipping, Paper
PPP-D-723 Drums, Fiber

FED-STD-151 Metal, Test Methods

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129 Marking for Shipment and Storage
MIL-STD-147 Palletized Unit Loads

2.3 ASTM Publications:

Available from ASTM, 100 Barr Harbor, West Conshohocken, PA 19428-2959.

ASTM D 1214-58 Sieve Analysis of Glass Spheres

2.4 Uniform Classification Committee:

Available from Uniform Classification Committee, 202 Chicago Union Station, Chicago, IL 60606.

Uniform Freight Classification Rules

3. REQUIREMENTS:

3.1 Material:

3.1.1 Type I and II: Type I cast steel grit and shot, and Type II cast iron grit and shot, shall be made from materials complying in chemical composition as specified in Table I.

TABLE I. Grit and Shot, Chemical Composition (except cut wire shot)

Type	Carbon %	Silicon %	Manganese %		Phosphorus %	Sulfur %	Other Elements %
			Shot size	%			
I	0.85-1.20	0.40-1.50	330-930 230-280 170-180 70-180	0.7-1.2 0.6-1.2 0.5-1.2 0.35-1.2	0.05 max.	0.05 max.	—
II	2.75-3.60	2.20 max.	0.50 max		0.30 max.	0.20 max.	0.25 max

3.1.2 Type III: Type III cut wire steel shot shall be made from wire conforming to SAE J441.

3.2 Breakdown resistance:

The grit and shot shall withstand the necessary impact in use without excessive breaking or deformation of the particles.

3.3 Shape and surface condition:

3.3.1 Grit: Type I and Type II grit shall consist entirely of angular particles produced by crushing cast iron or heat treated cast steel, and shall be free as far as practicable from rounded particles.

3.3.2.1 Cast steel or cast iron shot shall be spherical in shape and free as far as practical from elongated and angular particles.

3.3.3 Shot - Type III:

3.3.3.1 Cut steel wire shot shall be free from dust, grit, oil, grease, wire-drawing lubricants or other contaminants. The shot shall be free from shear cracks and laps, shall not contain excessive seams or burrs, and shall be preused or otherwise conditioned to eliminate sharp edges and shall form ball shaped shot. Some partially conditioned shot shall be acceptable provided the edges are rounded and the weight of 50 pieces or length of 10 pieces meet the limits of Table IV.

3.4 Hardness:

3.4.1 Grit and shot Type I: Unless otherwise specified in procurement documents, cast steel grit and shot shall have a hardness range equivalent of Rockwell C-42 to C-52.

3.4.2 Grit and shot Type II: Unless otherwise specified in procurement documents, cast-iron grit and shot shall have a hardness ranging from 240 to 840 Vickers Pyramid numbers or Rockwell hardness equivalent numbers C-20 to C-65. This hardness may be obtained, if necessary, by heat treatment. Such heat treated material may be ordered to a specified hardness range of about 120 Vickers Pyramid hardness numbers.

3.4.3 Cut steel wire shot Type III: Cut steel wire shot shall have the following hardness:

Shot Size	Minimum Hardness Rockwell "C"
CW-62	36
CW-54	39
CW-47	41
CW-41	42
CW-35	44
CW-32	45
CW-28	46
CW-23 and finer	48

3.5 Microstructure:

The microstructure of cast steel material shall consist of uniformly tempered martensite with fine, well distributed carbides. Any microstructure sample for cast steel shot shall exhibit no more than 15% particles containing cracks or draws. A crack is linear discontinuity with length greater than three times the width and length greater than 25% of the shot diameter. A draw is a recess in the shot surface which may be rounded but extends into the shot more than 25% of the shot diameter.

3.6 Sizing:

3.6.1 Grit Types I and II: The individual sizes of grit shall conform to the requirements of Table II.

3.6.2 Shot Types I and II: The individual sizes of shot shall conform to the requirements of Table III.

3.6.3 Cut steel wire shot Type III: The individual sizes of cut steel wire shot, as cut, shall be single-size, cylindrical cuttings and conform to the requirements of Table IV. This includes either the length of ten pieces found in column three, or, as an alternate, the weight of fifty pieces found in column four. When conditioned into ball form shapes, column four requirements only shall apply.

3.7 Reclaimed materials:

The grit and shot shall contain reclaimed materials to the maximum extent possible without jeopardizing the material quality or performance of the equipment. The reclaimed material shall be reprocessed, remanufactured, or recycled in a manner which restores them to the same chemical composition and physical properties as the material originally selected for use on the bit assemblies. Reclaimed materials shall be inclusive of all alloying elements applicable that have been collected from discarded solid, liquid, or gaseous waste from garbage, refuse, sludge, and from other collections of materials.

3.8 Workmanship:

The grit and shot shall be free from defective and foreign material which will affect the serviceability. It shall be manufactured in accordance with high grade commercial practice.

TABLE II - Screening Tolerance for Grit

Grit Size	Percent Retained (Maximum)	On Screen Number and aperture	Percent Retained (minimum)	On Screen number and aperture	Percent Passing (maximum)	Through Screen number and aperture
14	0	10(0.0787)	80	14(0.0555)	10	16(0.0469)
16	0	12(0.0661)	75	16(0.0469)	15	18(0.0394)
18	0	14(0.0555)	75	18(0.0394)	15	25(0.0278)
25	0	16(0.0469)	70	25(0.0278)	20	40(0.0165)
40	0	18(0.0394)	70	40(0.0165)	20	50(0.0117)
50	0	25(0.0278)	65	50(0.0117)	25	80(0.0070)
80	0	40(0.0165)	65	80(0.0070)	25	120(0.0049)
120	0	50(0.0117)	60	120(0.0049)	30	200(0.0029)

NOTE: Percentages given on the basis of weight as determined by the test procedure for grit.

TABLE III - Screening Tolerances for Shot

Shot No.	No.	Size	No.	Size	No.	Size	No.	Size
930	5	.157	6	.132	8	.0937	10	.0787
780	6	.132	7	.111	10	.0787	12	.0661
660	7	.111	8	.0937	12	.0661	14	.0555
550	8	.0937	10	.0787	14	.0555	16	.0469
460	10	.0787	12	.0661	16	.0469	18	.0394
390	12	.0661	14	.0555	18	.0394	20	.0331
330	14	.0555	16	.0469	20	.0331	25	.0278
280	16	.0469	18	.0394	25	.0278	30	.0234
230	18	.0394	20	.0331	30	.0234	35	.0197
190	20	.0331	25	.0278	35	.0197	40	.0165
170	25	.0278	30	.0234	40	.0165	45	.0139
130	30	.0234	35	.0197	45	.0139	50	.0117
110	35	.0197	40	.0165	50	.0117	80	.0070
70	40	.0165	45	.0139	80	.0070	120	.0049

TABLE IV - Cut Steel Wire Shot Size Classification

Shot No.	Wire Diameter	Length of Ten Pieces	Weight of Fifty Pieces
		Inch [1]	Grams [1,2]
CW-62	0.0625 ± .002	0.620 ± .040	1.09 — 1.33
CW-54	.054 ± .002	.540 ± .040	.72 — .88
CW-47	.047 ± .002	.470 ± .040	.48 — .58
CW-41	.041 ± .002	.410 ± .040	.31 — .39
CW-35	.035 ± .001	.350 ± .030	.20 — .24
CW-32	.032 ± .001	.320 ± .030	.14 — .18
CW-28	.028 ± .001	.280 ± .030	.10 — .12
CW-23	.023 ± .001	.230 ± .020	.05 — .07
CW-20	.020 ± .001	.200 ± .020	.04 — .05

1. See 4.3.5.2
2. See 4.3.5.3

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for inspection:

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for Compliance: All items must meet all requirements of section 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Inspection lot: For purposes of sampling, a lot shall consist of all grit or shot of the same type, grade, and size manufactured as one batch and offered for delivery at one time.

4.1.3 Sampling for inspection of containers: A random sample of filled containers shall be selected from each lot in accordance with MIL-STD-105, Inspection Level I, using an Acceptable Quality Level of 2.5 percent defective to verify compliance to this specification regarding fill, closure, marking, and other requirements not involving tests.

4.1.4 Sampling for quality conformance tests: From each inspection lot, two containers shall be selected at random. The material from each container shall be quartered or riffled by the method described in ASTM D 1214-58, paragraph 4, except that 500 grams of grit or shot shall be used for tests. Each of the samples thus obtained shall be subjected to all of the prescribed tests. If either of the samples fails one or more of these tests, the lot shall be rejected. Rejected lots may be resubmitted for quality conformance tests, provided the supplier has removed or reworked all nonconforming products.

4.2 Quality Conformance Inspection:

Quality conformance inspection shall consist of the following tests:

a. Chemical composition (See 3.1).
b. Shape and surface condition (See 3.3).
c. Hardness (See 3.4).
d. Microstructure (See 3.5).
e. Sizing (See 3.6).

4.3 Test Methods:

4.3.1 Chemical composition: The chemical composition of grit and shot as specified in 3.1 shall be determined in accordance with procedures outlined in FED-STD-151.

4.3.2 Shape and surface condition: The shape and surface condition of grit and shot as specified in 3.3 shall be determined by visual examination. Particles selected at random from the samples in 4.1.3 shall be spread in a single layer on a suitable flat surface and examined visually with the aid of suitable lighting and magnification for single view identification and count of nonconforming particles. Areas selected for counting shall have a 70% site occupancy (70% of area obscured by particles).

4.3.3 Hardness: The hardness of the grit and shot as specified in 3.4 shall be determined in accordance with procedures outlined in FED-STD-151. At least 20 particles shall be selected from the samples in 4.1.3. For small size grit and shot, when necessary, hardness may be determined with a micro hardness test machine using a knoop indenter and a 1 kilogram load, and then converting to Rockwell C. The average hardness of the 20 particles shall conform to the specified requirement.

4.3.4 Microstructure: The microstructure of cast steel as specified in 3.5 shall be determined by metallographic examination procedure after preparation as outlined in FED-STD-151. Particles selected at random from the samples in 4.1.3 shall be used for this test.

4.3.5 Sizing:

4.3.5.1 Screening tests: The size of the grit and shot, Type I and II, as specified in 3.6.1 and 3.6.2, shall be determined by using 100-gram portions of samples in 4.1.3, and screening as follows: using standard testing sieves in accordance with RR-S-366, nest the required sieves in ascending order with a pan on the bottom. Place the 100 gram sample in the top sieve and place the nested sieves in a rotating and tapping type of shaking machine. The rotating speed shall be 275 to 295 rotations per minute, and 145 to 160 taps per minute. Shaking and tapping shall be continued for 5 minutes ± 5 seconds when a nominal sieve size of 35 or coarser is used. For nominal sizes finer than 35 sieve, shaking shall continue for 10 minutes ± 5 seconds. After shaking, the percentage of material on each screen shall be determined by weighing.

4.3.5.1.1 Interpretation of screening results: Any two identically numbered U.S. Standard Test Sieves can give different weight percent results of the same shot sample because of the tolerance on average opening size permitted by RR-S-366 (and ASTM E 11) referenced therein). Tables II and III define grit and shot sizes in terms of such sieves. Therefore, the weight percent requirements expressed in these tables apply even under adverse tolerance conditions of test sieve average opening size. For example, in Table III the "Max. 5% On Screen" applies in conjunction with the smallest, and "Cumulative Min. 85% On Screen" applies with the largest average opening sizes permitted by RR-S-366 for their respectively listed test sieves.