SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

AMS 2431/1D

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Superseding AMS 2431/1C

Peening Media (ASR)
Cast Steel Shot, Regular Hardness (45 to 52 HRC)

RATIONALE

AMS 2431/1D is a Five Year Review and update of this specification.

1. SCOPE

The complete requirements for procuring the product shall consist of this document and the latest issue of the basic specification, AMS 2431.

1.1 Application

Cast steel shot, regular hardness, conforming to this specification is intended for use in peening metal surfaces to impart compressive stresses to these surfaces thereby increasing resistance to fatigue and stress-corrosion cracking. Generally, regular hardness cast steel shot is used on parts of hardness under 50 HRC.

2. APPLICABLE DOCUMENTS

See AMS 2431.

3. TECHNICAL REQUIREMENTS

3.1 Cast steel shot, regular hardness, shall conform to AMS 2431 and the requirements specified herein.

3.2 Composition shall conform to the percentages by weight shown in Table 1, determined in accordance with ASTM E 350.

TABLE 1 - COMPOSITION

Element	min	max
Carbon	0.80	1.20
Manganese (3.2.1)	--	1.20
Silicon	0.40	1.50
Phosphorus	--	0.05
Sulfur	--	0.05

3.2.1 Minimum manganese content shall conform to the minimum percentage by weight shown in Table 2.

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TABLE 2 - MINIMUM MANGANESE CONTENT

Shot Size	Wt Percent
ASR-70 to ASR-130	0.35
ASR-170 and ASR-190	0.50
ASR-230 and up	0.60

3.3 Hardness

Not less than 90% of the readings, using a microhardness tester with a minimum 500 gram load, shall fall within the range of 45 to 52 HRC, or equivalent (See 8.2), determined in accordance with ASTM E 384.

3.4 Microstructure shall exhibit uniformly tempered martensite with fine, well-distributed carbides.

3.5 Density shall be not less than 7.0 grams per milliliter, determined in accordance with 3.9.2.

3.6 Contamination shot shall be clean and free of dirt, grit, oil, or grease.

3.7 Quality requirements shall conform to 3.7.1, 3.7.2, 3.7.3, and 3.7.4, determined in accordance with 3.9.3.

3.7.1 Acceptable Shapes

Shapes in accordance with Figure 1 are acceptable.

3.7.2 Marginal Shapes

Shapes conforming to Figure 2 are permissible to the extent specified in Table 3.

3.7.3 Unacceptable Shapes

Shapes conforming to Figure 3 are permissible to the extent specified in Table 3.

TABLE 3 - SHAPE REQUIREMENTS

Shot Size	Area per Field Square Inch (mm^2)	Number of Fields Viewed	Number of Marginal Particles max(1)	Number of Unacceptable Particles max(2)
ASR 930	1 (645)	1	8	2
ASR 780	1 (645)	1	12	2
ASR 660	1 (645)	1	16	3
ASR 550	1 (645)	1	20	4
ASR 460	1 (645)	1	28	5
ASR 390	1 (645)	1	39	7
ASR 330	0.25 (161)	1	14	3
ASR 280	0.25 (161)	1	20	4
ASR 230	0.25 (161)	1	14	5
ASR 190	0.25 (161)	1	20	7
ASR 170	0.25 (161)	1	28	10
ASR 130	0.0625 (40)	1	10	4
ASR 110	0.0625 (40)	1	14	5
ASR 70	0.0625 (40)	1	39	13

Notes: (1) Maximum number of marginal shapes is approximately 3% of the total number of particles viewed for ASR 70 to ASR 230, 6% for ASR 280 to ASR 550, and 7% for ASR 660 to ASR 930.
(2) Maximum number of unacceptable shapes is approximately 1% of the total number of particles viewed.

3.7.4 Internal Defects

No more than 15% of the particles, by count, shall exhibit cracks, hollows, or shrinkage (See Figure 4).

3.8 Size shall conform to the requirements of Table 4, determined in accordance with 3.9.1.

TABLE 4 - SCREENING REQUIREMENTS

Shot Size	All Pass Screen	2% max on Screen	50% max Cumulative on Screen	90% min Cumulative on Screen	98% min Cumulative on Screen
ASR 930	5 (0.157)	6 (0.132)	7 (0.111)	8 (0.0937)	10 (0.0787)
ASR 780	6 (0.132)	7 (0.111)	8 (0.0937)	10 (0.0787)	12 (0.0661)
ASR 660	7 (0.111)	8 (0.0937)	10 (0.0787)	12 (0.0661)	14 (0.0555)
ASR 550	8 (0.0937)	10 (0.0787)	12 (0.0661)	14 (0.0555)	16 (0.0469)
ASR 460	10 (0.0787)	12 (0.0661)	14 (0.0555)	16 (0.0469)	18 (0.0394)
ASR 390	12 (0.0661)	14 (0.0555)	16 (0.0469)	18 (0.0394)	20 (0.0331)
ASR 330	14 (0.0555)	16 (0.0469)	18 (0.0394)	20 (0.0331)	25 (0.0278)
ASR 280	16 (0.0469)	18 (0.0394)	20 (0.0331)	25 (0.0278)	30 (0.0234)
ASR 230	18 (0.0394)	20 (0.0331)	25 (0.0278)	30 (0.0234)	35 (0.0197)
ASR 190	20 (0.0331)	25 (0.0278)	30 (0.0234)	35 (0.0197)	40 (0.0165)
ASR 170	25 (0.0278)	30 (0.0234)	35 (0.0197)	40 (0.0165)	45 (0.0139)
ASR 130	30 (0.0234)	35 (0.0197)	40 (0.0165)	45 (0.0139)	50 (0.0117)
ASR 110	35 (0.0197)	40 (0.0165)	45 (0.0139)	50 (0.0117)	80 (0.0070)
ASR 70	40 (0.0165)	45 (0.0139)	50 (0.0117)	80 (0.0070)	120 (0.0049)

Notes: (1) Nominal Size = 90% Screen Opening (e.g.: Nominal size of ASR 230 shot is 0.0234 diameter.

3.9 Test Methods and Procedures

3.9.1 Size Screening Test

The size of shot, specified in 3.8, shall be determined by using a 100-gram (approximately) sample and screening as follows: The required standard testing sieves in accordance with ASTM E 11 shall be nested in ascending order with a pan on the bottom. The 100-gram sample shall be poured onto the top sieve and the nested sieves shall be placed in a rotating and tapping type of shaking machine. The rotating speed shall be 275 to 295 rpm and the tapping speed shall be 145 to 160 taps per minute. Shaking and tapping shall be continued for 5 minutes ± 5 seconds for sieves 30 mesh and coarser and 10 minutes ± 5 seconds for sieves finer than 30 mesh. After shaking, the percentage of shot on each screen shall be determined by weighing the shot retained on each screen.

3.9.2 Density

Approximately 60 grams of shot, previously dried and weighed to the nearest 0.1 gram, shall be placed in a 100 mL graduated cylinder containing approximately 50 mL of denatured alcohol or methanol. The total volume minus 50 mL represents the volume of the shot. The density is determined using Equation 1.

Density = Shot weight (grams) ÷ Shot volume (ml)

(Eq. 1)

3.9.3 Shape

Visual evaluation, at a magnification of 10 to 30X shall be performed using the areas and number of fields specified in Table 3 for each respective shot size.

3.9.4 Microstructure

The sample shall be mounted, polished, and etched with 2% Nital, or other suitable etchant, and examined using a microscope at approximately 500X magnification.

4. QUALITY ASSURANCE PROVISIONS

See AMS 2431 and the following

4.1 Sampling and Testing

Two samples of approximately 800 grams each shall be selected from separate containers chosen at random from each lot. Each sample shall be split using a sample splitter to test quantities as follows:

4.1.1 Composition

Not less than two samples from each lot shall be evaluated.

4.1.2 Hardness

A minimum of 20 microhardness readings shall be made from each sample with no more than one impression on any one shot. The hardness test impression shall be located approximately midway between the surface and the center of the shot.

4.1.2.1 Samples for microhardness testing shall be prepared by encapsulating a single layer of shot in a plastic mount and polishing down to nominal half spheres.

4.1.3 Microstructure

The sample used for hardness testing may also be used for microstructure evaluation.

4.1.4 Density

Two 60-gram samples shall be evaluated for density determination.

4.1.5 Size

Two representative samples of not less than 100 grams each shall be used for size evaluation.

4.1.5.1 Alternative methods for size evaluation may be utilized provided that they can be correlated to the sieve analysis method and are acceptable to purchaser.

4.1.6 Shape

A representative sample shall consist of an amount of shot, in one layer, which completely fills the areas specified in Table 3. The number of areas, or fields of view, evaluated at 10 to 30X magnification (See 3.9.3) for each shot size shall be as indicated in Table 3.

4.1.6.1 Alternative methods of inspection for shape are permitted provided that they can be correlated to the optical method and are acceptable to purchaser.

4.1.7 Internal Defects

The mount prepared for microhardness testing shall be also used to evaluate defects. A minimum of 100 particles shall be evaluated for defects. Internal defects (Figure 4) include cracks, hollows, and shrinkage. A maximum of 10%, by count, of particles evaluated may contain cracks. A maximum of 10%, by count, of particles evaluated may contain hollows. A maximum of 10%, by count, of particles evaluated may contain shrinkage. A maximum total of 15%, by count, of particles evaluated may exhibit any defects, cracks, hollows, or shrinkage (See 3.7.4). Particles with more than one defect shall be counted only once in the total. A magnification of 10 to 30X shall be used for evaluation of defects.