

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

SAE

AMS 2431/1A

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Superseding AMS 2431/1

PEENING MEDIA (ASR) Cast Steel Shot, Regular Hardness (45 to 52 HRC)

1. SCOPE:

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

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:

(R)

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	0.85	1.20
Manganese (3.2.1)	--	1.20
Silicon	0.40	1.50
Phosphorous	--	0.05
Sulfur	--	0.05

3.2.1 Minimum manganese content shall vary according to shot size and the minimum percentage by weight shown in Table 2.
(R)

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TABLE 2 - Minimum Manganese Content

Shot Size	%
S-70 and S-110	0.35
S-170	0.50
S-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, determined in accordance with ASTM E 384.

3.4 Microstructure:

Shall exhibit uniformly tempered martensite with fine, well-distributed carbides.

**3.5 Density:
(R)**

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.

3.7.4 Internal Defects: No more than 15% of the particles, by count, may 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.

(R) TABLE 3 - Shape Requirements

Shot Size	Area per Field Square Inch (mm ²)	Number of Fields Viewed	Number of Marginal Particles All Fields max ⁽¹⁾	Number of Unacceptable Particles All Fields max ⁽²⁾
ASR 930	1 (645)	8	20	7
ASR 780	1 (645)	6	21	7
ASR 660	1 (645)	4	19	6
ASR 550	1 (645)	3	21	7
ASR 460	1 (645)	2	19	6
ASR 330	0.25 (161)	4	19	6
AST 280	0.25 (161)	3	21	7
ASR 230	0.25 (161)	2	19	6
ASR 170	0.25 (161)	1	19	6
ASR 110	0.0625 (40)	2	20	7
ASR 70	0.0625 (40)	2	27	9

Notes: (1) Maximum number of marginal shapes is approximately 3% of the total number of particles viewed.

(2) Maximum number of unacceptable shapes is approximately 1% of the total number of particles viewed.

(3) For S-230 shot and larger, a minimum magnification of 10X shall be used; for shot finer than S-230, a minimum magnification of 30X shall be used.

(R) TABLE 4 - Screening Requirements

Shot Size	All Pass Screen	2% max on Screen	50% max Cumulative on Screen	90% max Cumulative on Screen	98% min Cumulative on Screen
ASR 930	5 (0.157)	6 (0.132)	7 (0.11)	8 (0.0937)	10 (0.0787)
ASR 780	6 (0.132)	7 (0.11)	8 (0.0937)	10 (0.0787)	12 (0.0661)
ASR 660	7 (0.11)	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 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 170	25 (0.0278)	30 (0.0234)	35 (0.0197)	40 (0.0165)	45 (0.0139)
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 = 50% Screen Opening (e.g.: Nominal size of ASR 230 shot is .0278 diameter).

(2) Test screens used shall be U.S. Standard sizes in accordance with ASTM E 11.

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 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 \pm 5 seconds for sieves 30 mesh and coarser and 10 minutes \pm 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: Sixty grams of shot, previously dried and weighed, shall be placed in a 100 mL graduated cylinder containing 50 mL of ethanol or methanol. The total volume minus 50 mL represents the volume of the shot. The density is determined using Equation 1.

$$\text{Density} = \frac{60 \text{ grams}}{\text{Shot Volume}} \quad (\text{Eq.1})$$

- 3.9.3 Shape: Visual evaluation, at a minimum magnification of 10X for shot sizes S-230 and larger (R) and 30X for shot sizes finer than S-230, 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 (R) 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 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.
- 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 Alternate methods for size evaluation may be utilized provided that they can be correlated to (R) 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 (R) completely fills the areas specified in Table 3. The number of areas, or fields of view, evaluated at 10X or 30X (See 3.9.3) for each shot size shall be as indicated in Table 3.

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

4.1.7 Internal Defects: The mount prepared for microhardness testing may be also used to evaluate (R) internal defects. A minimum of 600 particles shall be evaluated for internal defects. Internal defects (Figure 4) include cracks, hollows, and shrinkage. A maximum of 1%, by count, of particles evaluated shall contain cracks. A maximum of 10%, by count, of particles evaluated shall contain hollows. A maximum of 10%, by count, of particles evaluated shall contain shrinkage. A maximum total of 15%, by count, of particles evaluated may exhibit any internal defects, cracks, hollows, or shrinkage (See 3.7.4). Particles with more than one defect will be counted only once in the total. A minimum magnification of 30X shall be used for evaluation of internal defects.

5. PREPARATION FOR DELIVERY:

See AMS 2431 and the following:

5.1 Packaging and Identification:

Steel shot shall be packaged in 40 to 55 pound (18 to 25 kg) units in plastic coated bags or pails.

6. ACKNOWLEDGMENT:

See AMS 2431.

7. REJECTIONS:

See AMS 2431.

8. NOTES:

See AMS 2431 and the following:

8.1 Intended Use:

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.

8.2 Definitions:

8.2.1 Cracked shot is one that exhibits a linear discontinuity with length greater than three times its width and length greater than 20% of the particle diameter.