AEROSPACE MATERIAL SPECIFICATION

AMS2431™/1	REV. G

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Superseding AMS2431/1F

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

RATIONALE

AMS2431/1G results from a Five-Year Review and update of this specification with simplified definition of elongated shot (2.2.4), clarification of shaking and tapping (3.9.1, Table 4), sampling clarified (4.1, 4.1.1, 4.1.2, 4.1.4, 4.1.5), and added wording that suggests microstructure evaluation be performed prior to hardness when using the same specimen (4.1.3, 4.1.7).

1. SCOPE

1.1 Purpose

This specification, in conjunction with the general requirements for peening media covered in AMS2431, establishes the requirements for the procurement of conditioned cast steel shot with a hardness of 45 to 52 HRC.

1.2 Application

Cast steel shot, regular hardness, has been used typically in peening metal surfaces to impart compressive stresses to these surfaces thereby increasing resistance to fatigue and stress-corrosion cracking, but usage is not limited to such applications. Generally, regular hardness cast steel shot is used on parts of hardness under 50 HRC.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2431 Peening Media, General Requirements

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
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For more information on this standard, visit
https://www.sae.org/standards/content/AMS2431/1G/

2.2 Definitions

Shall be in accordance with AMS2431, and include the following:

2.2.1 CRACKED SHOT

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

2.2.2 HOLLOW

A void with an area that is greater than 10% of the area of the shot particle.

2.2.3 SHRINKAGE

An internal cavity with an irregular dendritic surface and is greater than 40% of the area of the shot particle.

2.2.4 ELONGATED SHOT

Shot where the length is approximately twice the diameter.

3. TECHNICAL REQUIREMENTS

3.1 Cast steel shot, regular hardness, shall conform to AMS2431 and the requirements specified herein.

3.2 Composition shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS2431 and as follows.

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.

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, determined in accordance with ASTM E384 (see 8.3).

3.4 Microstructure shall exhibit uniformly tempered martensite with fine, well-distributed carbides determined in accordance with 3.9.4.

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

3.7.1 Shape, determined in accordance with 3.9.3.

3.7.1.1 Acceptable Shapes

Shapes conforming to Figure 1 are acceptable.

3.7.1.2 Marginal Shapes

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

3.7.1.3 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 Shot Particles Max(1)	Number of Unacceptable Shot 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

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

3.7.2 Internal Defects

No more than 15% of the shot particles, by count, shall exhibit cracks, hollows, or shrinkage determined in accordance with 3.9.4 and 4.1.7 (see Figure 4).

3.8 Shot Size

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

Table 4 - Screening requirements [1]

Shot Size	0% Max	2% Max on Screen	50% Max Cumulative on Screen	90% Min Cumulative on Screen	98% Min Cumulative on Screen	Shaking and Tapping Time Minutes (±5 seconds)
ASR 930	5 (0.157)	6 (0.132)	7 (0.111)	8 (0.0937)	10 (0.0787)	5
ASR 780	6 (0.132)	7 (0.111)	8 (0.0937)	10 (0.0787)	12 (0.0661)	5
ASR 660	7 (0.111)	8 (0.0937)	10 (0.0787)	12 (0.0661)	14 (0.0555)	5
ASR 550	8 (0.0937)	10 (0.0787)	12 (0.0661)	14 (0.0555)	16 (0.0469)	5
ASR 460	10 (0.0787)	12 (0.0661)	14 (0.0555)	16 (0.0469)	18 (0.0394)	5
ASR 390	12 (0.0661)	14 (0.0555)	16 (0.0469)	18 (0.0394)	20 (0.0331)	5
ASR 330	14 (0.0555)	16 (0.0469)	18 (0.0394)	20 (0.0331)	25 (0.0278)	5
ASR 280	16 (0.0469)	18 (0.0394)	20 (0.0331)	25 (0.0278)	30 (0.0234)	5
ASR 230	18 (0.0394)	20 (0.0331)	25 (0.0278)	30 (0.0234)	35 (0.0197)	10
ASR 190	20 (0.0331)	25 (0.0278)	30 (0.0234)	35 (0.0197)	40 (0.0165)	10
ASR 170	25 (0.0278)	30 (0.0234)	35 (0.0197)	40 (0.0165)	45 (0.0139)	10
ASR 130	30 (0.0234)	35 (0.0197)	40 (0.0165)	45 (0.0139)	50 (0.0117)	10
ASR 110	35 (0.0197)	40 (0.0165)	45 (0.0139)	50 (0.0117)	80 (0.0070)	10
ASR 70	40 (0.0165)	45 (0.0139)	50 (0.0117)	80 (0.0070)	120 (0.0049)	10

[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 E11 or ISO 3310-1 shall be nested in ascending order with a pan on the bottom. The test sieves diameter shall be a minimum 8 inch (203.2 mm) and height of 1 inch (25.4 mm) or 2 inches (50.8 mm). 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 270 to 300 rpm and the tapping speed shall be 140 to 160 taps per minute. Shaking and tapping shall be conducted for 5 minutes ± 5 seconds, unless there are sieves in the stack that are finer than 30 mesh in which case the shaking and tapping shall be conducted for 10 minutes ± 5 seconds. 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.

$$\text{Density} = \text{Shot weight (grams)} \div \text{Shot volume (mL)} \quad \text{(Eq. 1)}$$

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

Shall be in accordance with AMS2431 and the following.

4.1 Sampling and Testing

Approximately 800 grams in total shall be collected from a single production lot. This quantity will be selected from different containers of product belonging to the same lot in order to achieve a representative collection. This quantity shall then be split using a sample splitter to create two sample quantities for the following tests:

4.1.1 Composition

Each sample will be tested for composition.

4.1.2 Hardness

A minimum of 20 microhardness readings shall be made from a 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 Specimens 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 mount used for hardness testing may also be used for microstructure evaluation. It is recommended that hardness testing be carried out after microstructure evaluation in order to avoid potential damage to the microstructure during hardness testing.

4.1.4 Density

One density test shall be performed from each sample using approximately 60 grams of shot each.

4.1.5 Size

Two representative samples of 100 grams each shall be used for size evaluation.

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

4.1.6 Shape

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

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

4.1.7 Internal Defects

The mount prepared for microhardness testing may also be used to evaluate internal defects. A minimum of 100 shot particles shall be evaluated for defects. Internal defects (Figure 4) include cracks, hollows, and shrinkage. A maximum of 10%, by count, of shot particles evaluated may contain cracks. A maximum of 10%, by count, of shot particles evaluated may contain hollows. A maximum of 10%, by count, of shot particles evaluated may contain shrinkage. A maximum total of 15%, by count, of shot particles evaluated may exhibit any defects, cracks, hollows, or shrinkage (see 3.7.4). Shot 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.