

Peening Media
Ceramic Shot

RATIONALE

AMS2431/7B results from a Five Year Review and update of this specification and adds coverage for AZB100 ceramic shot.

1. SCOPE

1.1 Purpose

The complete requirements for procuring the product shall consist of this document and the latest issue of the basic specification, AMS2431.

1.2 Application

Ceramic shot conforming to this specification is typically intended for use in peening of metal surfaces to impart compressive stresses to these surfaces thereby increasing resistance to fatigue and stress-corrosion cracking. Generally, ceramic shot may be used where ferrous contamination of the part is undesirable or very hard parts (over 60 HRC) are to be peened for maximum residual compressive stress.

2. APPLICABLE DOCUMENTS

See AMS2431.

3. TECHNICAL REQUIREMENTS

3.1 Ceramic shot shall conform to AMS2431 and the requirements specified herein.

3.2 Composition shall be high quality zirconium oxide and silica. The percentage variation by weight ranges of the main constituents of ceramic shot shall be:

TABLE 1 - COMPOSITION

Constituent	min	max
Zirconium Oxide	60	70
Silica	28	33
Alumina	--	10
Other Constituents, total	--	3

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3.2.1 Hardness

Hardness shall be measured by the manufacturer at least on mother production batches. User should measure hardness at his discretion or when a counter analysis is required.

For AZB850 to AZB150, at least 90% of the readings shall fall within the range of 643 to 785 HV (58 to 63 HRC, for reference only).

For AZB100, the mean value of the readings shall fall within the same range of 643 to 785 HV.

比重瓶测量密度法

3.2.2 Density shall be between 3.60 and 3.95 g/cc, measured at 70°F (21°C) by a pycnometric method.

3.2.3 Magnetic particles shall not exceed 0.1% by weight of the original sample.

3.2.4 Surface Discolorations

Not more than 15% of the shot shall show foreign discolorations. A particle shall be considered objectionable for foreign discoloration when more than 25% of its surface area is discolored.

3.2.5 Coatings

Foreign materials are not permitted.

3.3 Workmanship

制造工艺/工艺质量

3.3.1 Shape

球面—椭球

Ceramic shot shall be spherical to ellipsoid in shape. Table 2 shows the maximum percentage of ceramic shot having a sphericity lower than 0.5 and the minimum percentage of ceramic shot having a sphericity of 0.8 and above (true spheres). See Section 8 for definition of sphericity.

Maximum number of permissible broken or angular beads is shown on column 11 of Table 2. This number shall never exceed 3% of the actual count. See Section 8 for definition of roundness.

3.3.2 Satellites

Maximum allowable number of shot with satellites shall be Table 3. See Section 8 for definition of satellites.

3.4 Size shall conform to the requirements of Table 2.

3.5 Test Methods and Procedures

3.5.1 Size Classification

Sieve analysis shall be determined in accordance with ASTM D 1214. Screens shall be in accordance with U.S. Standard Series described in ASTM E 11.

3.5.2 Composition shall be measured by the manufacturer at least on mother production batches by x-ray fluorescence or by other method acceptable to purchaser. User should measure composition at his discretion or when a counter analysis is required.

3.5.3 Hardness shall be determined by a Vickers diamond pyramid penetrator using 1000 gram load in accordance with ASTM E 384 or ASTM C 1327. To avoid fracture of beads, the loads shall be as follows: 200 gram load for AZB100, 500 gram load for AZB150, AZB210 and AZB300 and 1000 gram load for AZB425, AZB600 and AZB850.

3.5.4 Contamination

3.5.4.1 Magnetic Particle

Content shall be determined by slowly sprinkling approximately 1500 gram of the sample ceramic shot on an inclined aluminum tray that is 0.062 inch (1.57 mm) deep by 6 inches (152 mm) wide by 12 inches (305 mm) long. The tray shall be supported by a nonmagnetic frame so that it is inclined with a 6 inch (152 mm) rise from end to end, (30 degrees from horizontal). Four 1 × 1 × 6 inches (25 × 25 × 152 mm) bar magnets are positioned against the under surface and crosswise to the inclined tray about the middle of its length. Thickness of tray at magnet location shall not exceed 0.062 inch (1.57 mm). Magnets shall be not less than 10 000 Gauss each and arranged so that the magnetic north and south poles alternate. The magnetic particles (iron) that accumulate on the tray as the beads roll down shall be brushed into a preweighed dish. The procedure shall be repeated with the same 1500 gram sample until all visible magnetic particles are collected. The dish shall be reweighed and the magnetic particle content calculated as a percentage of the total original sample.

3.5.4.2 Surface discolorations shall be determined microscopically using magnification as per 4.1.5.

3.5.5 Shape

A visual count shall be made of three fields of at least 100 shot each on the sample prepared as per 4.1.5.

3.5.6 Density

Sixty grams of shot, carefully weighed to the nearest 0.1 gram, and previously dried, shall be placed in a 100 mL graduated cylinder containing approximately 50 mL of reagent water. The resultant volume minus initial volume represents the volume of the shot.

$$\text{Density} = \frac{60\text{g}}{\text{Shot Volume}}$$

TABLE 2 – CERAMIC SHOT FOR PEENING – SIZES AND SPHERICITY

Designation	Nominal Sizes, Millimeters	Nominal Sizes, Inch	Nominal Sizes, Mesh	Sieve Size, Millimeters Maximum 0.5% Retained	Sieve Size, Millimeters Maximum 5% Retained	Sieve Size, Millimeters Maximum 10% Passing	Sieve Size, Millimeters Maximum 3% Passing	Minimum % of Shot W/Sphericity 0.8 and Above (True Spheres)	Maximum Number of Shot with Sphericity Below 0.5 per Square Centimeter	Number Broken or Angular Beads Acceptable per Square Centimeter
AZB850	0.85/1.18	0.033/0.047	16/20	1.400	1.180	0.850	0.710	65	4	2
AZB600	0.6/0.85	0.024/0.033	20/30	1.000	0.850	0.600	0.425	65	8	4
AZB425	0.425/0.6	0.017/0.024	30/40	0.710	0.600	0.425	0.300	70	14	8
AZB300	0.300/0.425	0.012/0.017	40/50	0.500	0.425	0.300	0.250	70	27	15
AZB210	0.212/0.300	0.008/0.012	50/70	0.355	0.300	0.212	0.180	80	55	20
AZB150	0.150/0.212	0.006/0.008	70/100	0.250	0.212	0.150	0.125	80	300	65
AZB100	0.100/0.150	0.004/0.006	100/140	0.180	0.150	0.106	0.063	80	600	90

TABLE 3 – CERAMIC SHOT WITH SATELLITES

Designation	Maximum Number of Shot with Satellites per Square Centimeter	Maximum Number of Shot with 3 or More Satellites per Square Centimeter
AZB850	8	3
AZB600	13	6
AZB425	38	12
AZB300	66	21
AZB210	125	40
AZB150	174	50
AZB100	348	100

4. QUALITY ASSURANCE PROVISIONS

See AMS2431 and the following:

4.1 Sampling

Samples for testing shall be representative of each production batch. Any 25 kg container from each production batch is representative of the production batch. The sampling method is to select randomly a 25 kg container from each production batch and blend the contents. Test samples can then be obtained by successive passes through a sample splitter until the test samples quantity $150 < Q < 300$ g is obtained. Two samples of approximately 200 grams each shall be split to the following test quantities.

4.1.1 Composition

Not less than two samples from each shipment.

4.1.2 Hardness

At least 10 micro-hardness readings shall be made with no more than 1 impression from any one shot.

4.1.3 Specific Gravity

Two 60 gram samples for specific gravity determination.

4.1.4 Size

Two representative samples of 60 grams minimum weight.

4.1.5 Shape

Sphericity, roundness and satellites are measured by an actual counting of a one layer field of ceramic beads, using minimum area to be counted as follows:

TABLE 4 – MINIMUM MAGNIFICATION & AREA VALUES FOR SHAPE CONTROL OF APPROXIMATELY 300 BEADS

Shot Size	Minimum Magnification*	300 Shot Area in cm ²
AZB850	20x	3.47
AZB600	20x	2.00
AZB425	20x	1.02
AZB300	32x	0.43
AZB210	32x	0.22
AZB150	64x	0.11
AZB100	64x	0.05

* Magnification = Optical lens × digital (camera for instance) × software (if applicable)

The measurements shall be made using a binocular magnifying glass or microscope with the minimum magnification in order to clearly see the surface of each shot (See Table 4). A 30 × 30mm sample strip is made of a double side piece of adhesive tape mounted on a substrate; plastic or glass for example. The product to be analyzed shall be taken from a 50 g representative sample of the batch. Part of this sample shall be then transferred onto a sample strip by pouring the sample onto the strip, or dipping the strip into the sample container. This shall be done until the strip is fully covered with a single layer of beads. Three different fields chosen at random on each strip with at least 100 shots in each field shall be used to make the measurements. The results for 100 shots in each of the 3 fields shall be added and then divided by the corresponding area in Table 4 to give the results per square centimeter. These results shall be compared to Table 2 and Table 3.

4.1.5.1 A mechanical method of inspection for shape is permitted provided that it can be correlated to the optical method and is acceptable to purchaser.

5. PREPARATION FOR DELIVERY

See AMS2431 and the following:

5.1 Packaging and Identification

Shot shall be packaged in 25 kg units.

6. ACKNOWLEDGMENT

See AMS2431.

7. REJECTIONS

See AMS2431.

8. NOTES

See AMS2431 and the following:

8.1 Definitions

8.1.1 Batches:

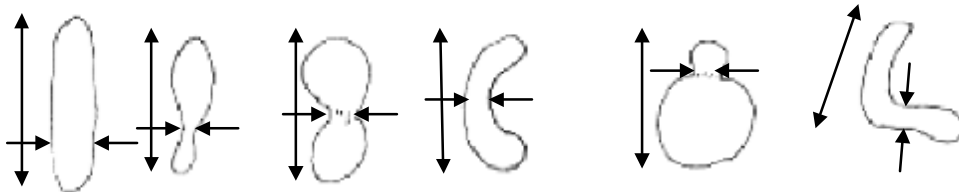
A mother production batch is greater in quantity than a production batch (i.e. multiple of production batches). A production batch is 1000 kgs.

8.1.2 Sphericity (Ref. 3.3.1):

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It refers to the aspect ratio of short to long axes of the hypothetical ellipse that would contain the actual image of the ceramic bead as seen through a microscope.

Example of shot with sphericity below 0.5:



8.1.3 Roundness (Ref. 3.3.1):

It refers to the relative angularity of grain corners, the ceramic shot having round and smooth surfaces. Scored, broken or angular particles are those that would present sharp or angular surfaces when impacted, causing metal removal or unsatisfactory or irregular finishes.

8.1.4 Satellites (Ref. 3.3.2):

Satellites are particles attached to the surface of a bead.

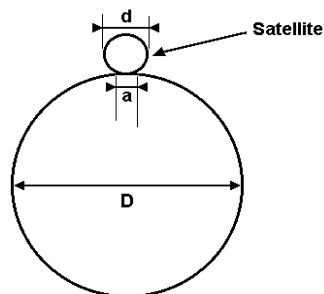
D = Bead diameter

d = Satellite diameter

A satellite is counted if all of the following conditions apply:

$$d \leq 0.25 D$$

$$d \geq 0.5 \text{ mm in the magnified view}$$



PREPARED BY AMS COMMITTEE "B"