

Peening Media (ASH)  
Cast Steel Shot, High Hardness (55 to 62 HRC)

RATIONALE

AMS 2431/2D 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, high 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, high hardness cast steel shot is used on parts of hardness 50 HRC or over

2. APPLICABLE DOCUMENTS

See AMS 2431.

3. TECHNICAL REQUIREMENTS

3.1 Cast steel shot, high 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.

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2007 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

**TO PLACE A DOCUMENT ORDER:** Tel: 877-606-7323 (inside USA and Canada)  
Tel: 724-776-4970 (outside USA)  
Fax: 724-776-0790  
Email: CustomerService@sae.org  
SAE WEB ADDRESS: <http://www.sae.org>

TABLE 2 - MINIMUM MANGANESE CONTENT

Shot Size	Wt Percent
ASH-70 to ASH-130	0.35
ASH-170 and ASH-190	0.50
ASH-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 55 to 62 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.

#### 3.7.4 Internal Defects

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

TABLE 3 - SHAPE REQUIREMENTS

Shot Size	Area per Field Square Inch (mm <sup>2</sup> )	Number of Fields Viewed	Number of Marginal Particles All Fields(1), max	Number of Unacceptable Particles, All Fields(2), max
ASH 930	1 (645)	1	8	2
ASH 780	1 (645)	1	12	2
ASH 660	1 (645)	1	16	3
ASH 550	1 (645)	1	20	4
ASH 460	1 (645)	1	28	5
ASH 390	1 (645)	1	39	7
ASH 330	0.25 (161)	1	14	3
ASH 280	0.25 (161)	1	20	4
ASH 230	0.25 (161)	1	14	5
ASH 190	0.25 (161)	1	20	7
ASH 170	0.25 (161)	1	28	10
ASH 130	0.0625 (40)	1	10	4
ASH 110	0.0625 (40)	1	14	5
ASH 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 ASH 70 to ASH 230, 6% for ASH 280 to ASH 550, and 7% for ASH 660 to ASH 930.

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

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
ASH 930	5 (0.157)	6 (0.132)	7 (0.111)	8 (0.0937)	10 (0.0787)
ASH 780	6 (0.132)	7 (0.111)	8 (0.0937)	10 (0.0787)	12 (0.0661)
ASH 660	7 (0.111)	8 (0.0937)	10 (0.0787)	12 (0.0661)	14 (0.0555)
ASH 550	8 (0.0937)	10 (0.0787)	12 (0.0661)	14 (0.0555)	16 (0.0469)
ASH 460	10 (0.0787)	12 (0.0661)	14 (0.0555)	16 (0.0469)	18 (0.0394)
ASH 390	12 (0.0661)	14 (0.0555)	16 (0.0469)	18 (0.0394)	20 (0.0331)
ASH 330	14 (0.0555)	16 (0.0469)	18 (0.0394)	20 (0.0331)	25 (0.0278)
ASH 280	16 (0.0469)	18 (0.0394)	20 (0.0331)	25 (0.0278)	30 (0.0234)
ASH 230	18 (0.0394)	20 (0.0331)	25 (0.0278)	30 (0.0234)	35 (0.0197)
ASH 190	20 (0.0331)	25 (0.0278)	30 (0.0234)	35 (0.0197)	40 (0.0165)
ASH 170	25 (0.0278)	30 (0.0234)	35 (0.0197)	40 (0.0165)	45 (0.0139)
ASH 130	30 (0.0234)	35 (0.0197)	40 (0.0165)	45 (0.0139)	50 (0.0117)
ASH 110	35 (0.0197)	40 (0.0165)	45 (0.0139)	50 (0.0117)	80 (0.0070)
ASH 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 ASH 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  $\pm$  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

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 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.

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

#### 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

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.

## 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 Terms used in AMS are clarified in ARP1917 and as follows:

8.1.1 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.

8.1.2 Hollow is a void with an area that is greater than 10% of the area of the shot particle.

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

8.2 Hardness conversions to Rockwell C values for metals are presented in ASTM E 140.

8.3 Dimensions and properties in inch/pound units and the Fahrenheit temperatures are primary; dimensions and properties in SI units and the Celsius temperatures are shown as the approximate equivalents of the primary units and are presented only for information.

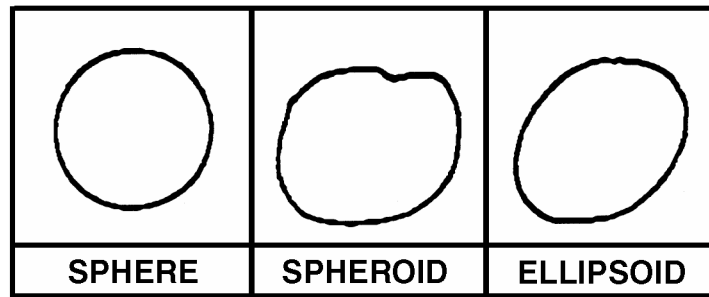


FIGURE 1 - ACCEPTABLE SHAPES

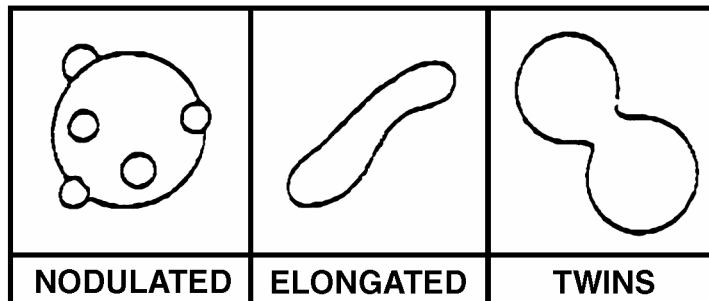


FIGURE 2 - MARGINAL SHAPES

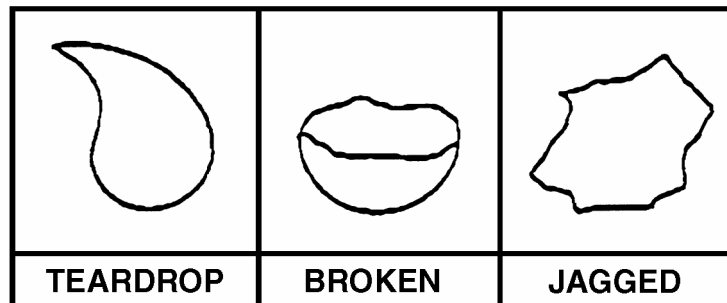


FIGURE 3 - UNACCEPTABLE SHAPES

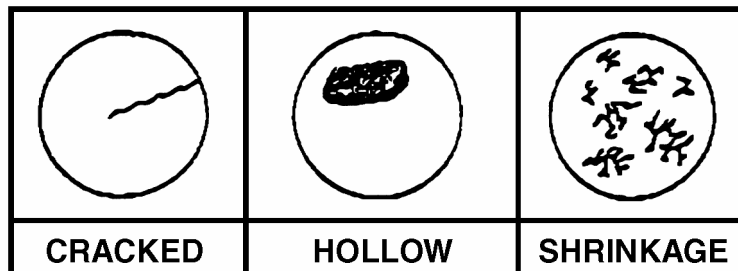


FIGURE 4 - INTERNAL DEFECTS