



AEROSPACE MATERIAL SPECIFICATION	AMS2432™	REV. E
	Issued 1990-01 Reaffirmed 2010-05 Revised 2022-10	
Superseding AMS2432D		
Shot Peening, Computer Monitored		

RATIONALE

AMS2432E is the result of a Five-Year Review and update of this specification with the addition of aerospace/nonaerospace to ordering information, addition of wording regarding base requirements of AMS2430 (Section 3), added requirements for media (3.1), clarified requirements for continuously monitored (3.2.1.1), clarified Table 1 requirements, reworded to sync with Table 1 (3.2.1.3), added unless otherwise specified to dust and particle extraction (3.2.1.4), added media requirements to peening machine (3.2.1.5 and 3.2.1.6), reworded to remove redundant information (3.2.2), deleted Table 2 "Media size and intensity guidelines for various materials" as this information is to be specified or found in ARP7488, deleted media hardness requirement as this is already specified in SAE J442 (Rev D 3.2.2.1), test gages and procedures defaulted to SAE J442 and SAE J443 (3.2.3), added allowance for other methods when approved by CEO (3.2.5), deleted redundant information (3.2.6), updated requirements for peening intensities and test strip locations (3.5.1), added new requirements for agorting the peening process (3.5.2), deleted old Table 2 as this is covered by ARP7488 or shall be specified, deleted old 3.6.1 and 3.6.2 as these are covered in SAE J443 and ARP7488, added coverage requirements (3.6.1), updated process parameter sheet requirements (Table 2), added testing requirements for impact sensitive fluorescent or dye marker coatings (4.2.1.1), added preproduction test for process parameter sheet (4.2.3), updated process approval requirements (4.3.1), and revised calibration requirements adding minimum frequency (4.3.3).

NOTICE

ORDERING INFORMATION:

1. The following information should be provided to the shot peen processor by the purchaser. If the purchaser does not provide any of the following, the processor shall use the specification provisions herein.
 - AMS2432E
 - Purchase order number and revision level
 - Part number and revision level
 - Part alloy and tensile strength and/or hardness
 - Quantity of parts
 - If parts are aerospace or non-aerospace (see 4.3.1.2)

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- Media type, hardness, size in accordance with AMS2431 (see 3.1)
- Test strip type (see 3.2.2)
- Pre-shot peen cleaning method (see 3.3)
- Intensity requirement (see 3.5.1 and 3.6)
- Intensity verification locations (see 3.5.1)
- Coverage requirement (see 3.6.1)
- Coverage verification method and if use of fluorescent tracer or dye marker inks requires cognizant engineering organization approval (see 3.6.1 and 4.2.1.1)
- Part locations to be shot peened, free from peening, or peening optional (see 3.4)
- If externally applied loads are permitted on part during processing (see 3.5)
- If purchaser requires approval of the processor's shot peening process parameter sheet(s) (see 4.3.1)
- If purchaser allows the use of alternative intensity verification methods (see 3.8.1)
- Post-shot peen cleaning method: include instruction and procedure to remove iron contamination, if applicable, and if purchaser requires peening processor to perform this operation (see 3.9)
- Part preservation/shipping method (see Section 5)

1. SCOPE

1.1 Purpose

This specification establishes the requirements for computer-monitored shot peening of part surfaces by impingement of media, including metallic, glass, or ceramic shot. Computer-monitored peening is intended to provide a method of process observation, traceability, and response for all process input settings, in real time, during the entire peening process to ensure with objective evidence, the desired process outputs. AMS2430 forms an integral part of this specification.

1.2 Application

Shot peening is typically used to induce residual compressive stress in the surface layers of parts, and may be used to increase fatigue strength and resistance to stress-corrosion cracking. Shot peening with computer monitoring is typically used to provide control of the peening process to ensure consistent, repetitive peening coverage and intensity on parts. Computer-monitored processing is typically required so that the traceability steps specified herein can be utilized by the design authority to take full credit for the benefits of shot peening in the design life.

- 1.2.1 Related peening processes, such as tumble peening, slurry peening, manual peening, peen forming and straightening, peening for prevention of intergranular corrosion, and peening to produce a surface texture, are beyond the scope of this specification.

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
AMS2430	Shot Peening
ARP7488	Peening Design and Process Control Guidelines
AS7766	Terms Used in Aerospace Metals Specifications
SAE J442	Test Strip, Holder, and Gage for Shot Peening
SAE J443	Procedures for Using Standard Shot Peening Almen Test Strip

3. TECHNICAL REQUIREMENTS

AMS2430 provides the base requirements for the shot peening stated in this specification and is referenced throughout this document.

3.1 Peening Media

New and in-process media shall be in accordance with AMS2430. Media type and size shall be specified. Storage of media shall prevent the mixing of media type, size, or hardness. Mixing of media type or hardness within the peening machine is not permitted unless approved by the cognizant engineering organization (CEO) (see 3.2.1.6).

3.2 Equipment and Materials

3.2.1 Peening Machine

3.2.1.1 The peening machine shall run automatically and may be computer controlled. It shall be capable of controlling the process within the parameter tolerances stated in Table 1 and the ability to abort the peening process when necessary (see 3.5.2). Peening machines shall be equipped with computers for continuously monitoring and recording the parameters shown in Table 1 within the tolerance indicated at a minimum rate of 0.5 second scans and shall include the date and time of the processing. Recording shall be digitally recorded or in hard copy and retained in accordance with 4.4.

3.2.1.2 The peening machine shall provide a means of propelling, at a controlled rate, media with air pressure against the part. Alternatively, metallic media may be propelled by centrifugal force. The machine shall provide a means of moving, at a uniform speed, either the part through the media stream or the media stream over the part in either translation, rotation, or both, as required. The part shall not be subjected to any random movement during the process. The machine shall be capable of consistently reproducing the required shot peening intensities.

Table 1 - Parameters for peening machines

Parameter	Units ⁽³⁾	Process Tolerances ⁽⁴⁾ , Calibration	Process Tolerances ⁽⁴⁾ Shutdown Limits Plus or Minus
Media Flow ⁽²⁾ (for each nozzle)	lb/min (kg/min)	10%	>8 pounds (3.62) 10% ≤8 pounds (3.62) 20%
Air Pressure ⁽¹⁾ (for each nozzle)	psi (kPa)	10%	>20 psi (68) 10% ≤20 psi (136) 20%
Wheel Speed (for each wheel)	rpm	10%	>2000 rpm 1% <2000 rpm 20 rpm
Nozzle or Wheel Translation Speed	in/min (mm/min)	10%	10%
Deflector Speed	in/min (mm/min)	10%	10%
Air, Media Flow, Nozzle, and/or Wheel Shutdown	Seconds	N/A	3
Turntable Speed	rpm	10%	10%
Part Speed	rpm/in/min (mm/min)	10%	10%
Conveyor Speed	in/min (mm/min)	10%	10%
Peening Cycle Time	Seconds	N/A	1
Nozzle/Wheel Position	in/deg (mm/deg)	N/A ⁽⁵⁾	0.062 inch (1.57 mm)/5 degrees
Table/Part Indexing	in/deg (mm/deg)	N/A ⁽⁵⁾	0.062 inch (1.57 mm)/5 degrees

(1) Air pressure shall be measured at a location that ensures stability of the process.

(2) Media flow rate for wet peening is not required. When AMS2432E was published, there was no known technology for measuring wet glass or ceramic.

(3) Alternative measurement units may be used.

(4) Tolerance at set point, not full-scale

(5) N/A if controlled by an encoder. If controlled by an encoder, shall be per machine supplier instructions.

3.2.1.3 Restarting of the machine after a shutdown shall only be done by authorized personnel.

3.2.1.4 Unless otherwise specified, the machine shall incorporate equipment to extract dust and fine particle contaminants.

3.2.1.5 Equipment shall include a media separator such as vibrating screens to mechanically control size. Shape control by spiral separator or inclined belt may be integral to the machine for continuous processing, or by offline equipment/arrangement used at a defined frequency necessary to meet requirements.

3.2.1.6 The use of more than one media type or media hardness in the same machine should be avoided to reduce potential for cross contamination that could affect the performance of the peening process. Recognizing that this is not always possible, action should be considered to address the risk of cross contamination.

3.2.2 Test Strips

Test strips shall conform to SAE J442, Grade 1S. Mechanically deforming strips to meet the prebowl requirement is not permitted. Usage shall conform to SAE J443.

3.2.2.1 Subsize or otherwise standard shaded or masked test strips shall be in accordance with AMS2430.

3.2.3 Gage

Test gages used for measuring standard and sub-size strips shall be in accordance with SAE J442. Procedure for determining and verifying peening intensity shall be in accordance with SAE J443.

3.2.4 Test Strip Holder

Test strip holder shall be in accordance with SAE J442.

3.2.5 Test Strip Fixture

A test strip fixture will be made from either a scrap part or a representative non-adjustable fixture fitted with test strip holder(s) to mount the test strip(s) for use during the intensity development or intensity verification in accordance with SAE J443. If test strip holders for masked test strips are used, they shall be approved by the CEO. The test strip fixture shall represent the surface to be peened and be rotated or translated in the same manner as the part during the peening process or as otherwise specified or approved by the CEO. The design of the strip fixture shall be approved by the CEO. The fixture shall be numbered and recorded in the process parameter sheet and shall be used for all subsequent intensity verifications.

3.2.6 Machine Verification Tool

A machine verification tool is an test strip holder designed to establish process intensity baselines. The tool shall also be used to verify consistent machine performance relative to the baseline during production. The machine verification tool shall be documented on the process parameter sheet and its design and use shall be approved by the CEO.

3.2.7 Nozzle Holding Fixture

When a non-robotic air nozzle peening machine is used, each nozzle shall be held in a fixture so that the angle of impingement and stand-off distance conforms to the process parameter sheet during peening. The nozzle holding fixture, when used, shall be numbered and recorded on the process parameter sheet.

3.2.8 Control Cage

When a centrifugal wheel machine is used, the control cage, which regulates the position and angle of the maximum intensity zone generated by the wheel, shall be set in respect to the part location, so that the angle of impingement of the maximum intensity zone will remain constant to process parameter sheet requirements. A reference point on the impeller cage position indicator shall be part of the wheel system. The position of the control cage shall be recorded on the process parameter sheet.

3.2.9 Media Size Inspection Equipment

Shall be in accordance with AMS2430.

3.2.10 Media Shape Inspection Equipment

Shall be in accordance with AMS2430.

3.3 Preparation for Peening

Shall be in accordance with AMS2430.

3.4 Masking

Areas of the part that are designated to be free from any shot peening shall be suitably masked or protected from the peening stream. Unless otherwise specified, the variation in boundaries of the areas to be peened, when limited, shall be -0 to + 0.125 inch (-0 to +3.18 mm).

3.5 Peening

Shall be in accordance with AMS2430 and the following:

3.5.1 Peening intensities and shot peening locations used for intensity verification (test strip locations) shall be specified.

3.5.2 During peening, if any of the limits in Table 1 are exceeded for a 3 second or longer time period, the peening shall be aborted, the machine shutdown, and the out of tolerance event recorded by the machine controller (see 8.2.1). Notation of root cause and corrective action of any abort and shutdown shall be documented. After the abort condition has been corrected, the peening system shall be restarted to resume operations to complete the balance of the process cycle from the point of the shutdown, or the cycle shall be restarted from the beginning. Parts processed during an aborted cycle shall be identified and reported to the customer as in 4.5.

3.6 Shot Peening Properties

Shall be in accordance with AMS2430 and the following:

3.6.1 Coverage

Shall be in accordance with AMS2430.

3.6.1.1 Impact Sensitive Fluorescent or Dye Marker Coatings

When specified, impact sensitive fluorescent or dye marker coatings shall be applied in accordance with manufacturers instructions. After initial coverage is verified, coating of entire part may be reduced to critical areas with CEO approval.

3.6.1.2 For aluminum parts having large plane form surfaces (such as wing-skins), the areas outside of the strip locations coverage may be determined visually using the unaided eye.

3.7 Process Parameter Sheet

Shall be in accordance with AMS2430 and the following:

3.7.1 Process Development

Shall be in accordance with AMS2430.

3.7.2 Shutdown Limits

Shutdown limits for air pressure and shot flow shall be refined during procedure development to ensure conformance to drawing intensity requirements. To establish shutdown limits, two arc height tests shall be conducted at the intensity time, one at a high air pressure limit/low shot flow combination and the other at a low air pressure limit/high shot flow combination. The air pressure and shot flow shutdown limits shall be adjusted until these arc heights are within drawing intensity range and then documented on the process parameter sheet.

3.7.3 All shot peening process parameter sheets shall include figures showing the machine and fixture set up with nozzle/wheel relation to the fixture/part and shall document the process parameters shown in Table 2 at minimum.

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Table 2 - Process parameter sheet requirements

Process parameter sheet number and date
Purchaser approval date (if required)
Part number (drawing) revision and date
Part material and tensile strength and/or hardness
AMS2432
Intensity requirement
Test strip type (N, A, C) and/or subsize strip information if applicable
Part locations to be shot peened, free from peening, or peening optional
Percent coverage requirement
Media type, hardness, size in accordance with AMS2431
Type of machine
Machine number or serial number
Number of nozzles or wheels
Size of nozzles or wheels
Size of metering orifice (pneumatic machine only, if metered)
Nozzle or slinger position and/or angle of impingement
Nozzle holding fixture (if applicable)
Centrifugal wheel machine control cage position and angle with respect to part (if applicable)
Centrifugal wheel machine control cage position of intensity zone (if applicable)
Media flow rate
Media flow rate shutdown limits from Table 1 and actual shutdown limits from 3.7.2
Air pressure and/or wheel speed
Air pressure and/or wheel speed shutdown limits from Table 1 and actual shutdown limits from 3.7.2
Shot velocity (if applicable)
Shot velocity (if applicable) shutdown limits from Table 1 and actual shutdown limits from 3.7.2
Frequency at which digital process data is sampled (see 3.2.1.1 and Table 1)
Length of duration of shutdown tolerance violation before automatic shutdown
Nozzle (or wheel) -to-part distance (stand-off distance)
Speed of nozzle and or part movement in translation and rotation
Speed of nozzle and or part movement in translation and rotation shutdown limits from Table 1
Part holding and/or masking fixture
Intensity verification fixture
Intensity verification locations
Machine verification tool or velocity sensor (if applicable)
Saturation curve data
Pre-shot peen cleaning method
Part masking
Coverage time or passes for specified area
Coverage inspection method-visual examination only, or fluorescent tracer or dye marker inks, and customer approval if required
Post-shot peen cleaning method
Part preservation/shipping method

3.8 Production Part Peening

Shall be in accordance with AMS2430 and the following:

- 3.8.1 An alternative intensity verification method, such as use of a machine verification tool or media velocity sensor, for production part peening may be used only if approved by the CEO. The control method and frequency shall be complied with as documented on the process parameter sheet.

3.9 Post-Peening Processes

Shall be in accordance with AMS2430 and the following:

- 3.9.1 When surface finish or dimensions after peening do not meet specified requirements, they may be corrected by a second peening operation when approved by the CEO. Alternatively, unless material removal is prohibited, they may be corrected by one or more of the following: polishing, lapping, honing, or sanding. If material removal is selected, evidence of peening impressions shall remain after material removal. Grinding or etching shall not be used unless approved by the CEO.

3.10 Tolerances

Shall be in accordance with AMS2430.

3.11 Test Methods

Shall be in accordance with AMS2430.

4. QUALITY ASSURANCE PROVISIONS

4.1 Inspection and Process Control

Shall be in accordance with AMS2430.

4.2 Classification of Tests

Shall be in accordance with AMS2430.

4.2.1 Acceptance Tests

Shall be in accordance with AMS2430 and the following:

4.2.1.1 Impact sensitive fluorescent or dye marker coatings, if specified (3.6.1), shall be performed at the frequency specified.

4.2.2 Periodic Tests

Shall be in accordance with AMS2430 and the following:

4.2.2.1 Test gage zeroing is a periodic test shall be performed, at a minimum, once daily.

4.2.3 Preproduction Tests

Development and qualification of the peening process parameter sheet (see 3.7 and 4.3.1) is a preproduction test and shall be performed prior to part production and when the CEO requires confirmatory testing.

4.3 Preproduction Requirements

4.3.1 Approval

4.3.1.1 Aerospace Applications

4.3.1.1.1 The process parameter sheet and a preproduction part if specified, shall be approved by the CEO before production parts are supplied.

4.3.1.1.2 If the processor makes a significant change to any material, equipment, or process parameter sheet from that which was used for process approval, all tests shall be performed, and the results submitted to the CEO for process reapproval unless the change is approved by the CEO. A significant change is one which, in the judgment of the CEO, could affect the properties or performance of the parts.

4.3.1.1.3 Process parameter sheets that were approved to earlier revisions of AMS2432 do not require revision, unless otherwise specified. Any process parameter sheets that are revised shall meet all requirements of the current revision of AMS2432.