



AEROSPACE RECOMMENDED PRACTICE

ARP7488™

Issued

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Peening Design and Process Control Guidelines

RATIONALE

ARP7488 was previously a part of AMS2430. It was determined that it should be an Aerospace Recommended Practice.

1. SCOPE

This Aerospace Recommended Practice (ARP) describes design and processing considerations for the peening process when AMS2430 or AMS2432 are specified.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 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.

AMS2430 Automatic Shot Peening

AMS2431 Peening Media General Requirements

SAE J2441 Shot Peening

3. GUIDELINES

For design guidance to the purchaser or the cognizant engineering organization, the following information is provided. The peening process should be considered in the overall process planning for each individual part. The peening operation should be in the proper sequential order so subsequent processes do not negate the peening affects. Secondly, the peening process itself should be designed to assure proper peening of all required areas. Consulting with a peening processor may provide insight of manufacturing design and limitation considerations. The part cleaning method, type of equipment and controls, intensity verification areas and methods, coverage inspection method, post-peening cleaning method, and preservation and shipping method should be provided. The purchaser or the cognizant engineering organization should communicate if the peening process and control procedures and/or sample peened parts for each part number need to be approved prior to production peening by the processor.

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3.1 Typical Depth of Compressive Stress

Table 1 shows typical depths of compressive stress for peened components. Many factors will affect the actual compressive stress depth such as material type, part hardness, and peening media size, and type. Measurement of compressive depth can be performed by destructive analysis of actual parts or coupons of the same material heat treated to the hardness as the actual part.

Table 1 - Approximate depth of compressive stress

Material	Intensity, inch (mm)		
	0.008N (0.20N)	0.008A (0.20A)	0.008C (0.20C)
	Compressive Stress Depth, inch (mm)		
Aluminum	0.003 (0.08)	0.010 (0.25)	0.027 (0.69)
Titanium	0.002 (0.05)	0.007 (0.18)	0.018 (0.46)
Steel less than 200 ksi (1379 MPa) tensile strength	0.003 (0.08)	0.008 (0.20)	0.025 (0.64)
Steel 200 ksi (1379 MPa) tensile strength and greater	0.002 (0.05)	0.005 (0.13)	0.015 (0.38)
Nickel alloys	0.002 (0.05)	0.006 (0.15)	0.020 (0.51)

3.2 Intensity considerations

Tables 2 and 3 shows typical intensity values of various materials and thicknesses.

Table 2 - Media size and intensity guidelines for various materials

Material	Material Thickness 0.090 to 0.375 inch (2.29 to 9.52 mm)		Material Thickness Over 0.375 inch (9.52 mm)	
	Media Size	Intensity, inch (mm) -0.002A (-0.05A) +0.005A (+0.13A)	Media Size	Intensity, inch (mm) -0.002A (-0.05A) +0.005A (+0.13A)
Titanium Alloys	110 minimum	0.008A (0.20A)	110 minimum	0.008A (0.20A)
Steel, tensile strength less than 200 ksi (less than 1379 MPa)	170 minimum	0.010A (0.25A)	230 minimum	0.012A (0.30A)
Steel, tensile strength 200 ksi and above (1379 MPa and above)	170 minimum	0.010A (0.25A)	230 minimum	0.014A (0.36A)
Aluminum	170 minimum	0.008A (0.20A)	230 minimum	0.012A (0.30A)

Notes:

- Media sizes listed in Table 8 are for ASR (cast steel shot, regular) and ASH (cast steel shot, hard).
- For material thickness under 0.090 inch (2.29 mm), see 3.4.4

Table 3 - Media size and intensity for holes under 0.750 inch (19.05 mm)

Material	Media Size	Intensity inch (mm)
Aluminum Alloys: Holes Under 0.735 inch (18.67 mm) diameter	70 minimum	0.010N minimum (0.25N minimum)
All Alloys except Aluminum: Holes Under 0.750 inch (19.05 mm) diameter	70 minimum	0.010N minimum (0.25N minimum)
Notes: 1. Media sizes listed in Table 9 are for ASR (cast steel shot, regular) and ASH (cast steel shot, hard). 2. For material thickness under 0.090 inch (2.29 mm), see 3.4.4		

3.3 Peening media size for peening materials

For applications not covered in Tables 2 and 3, materials should not be peened with media smaller for the intensities shown in Table 4 except when shielded areas are involved.

Table 4 - Minimum recommended media sizes

Intensity inch (mm)	Peening Media ¹
0.012A (0.30A)	ASR or ASH-280 AWCR, AWS, or AWCH-28 AGB (0.039 - 0.028 inch diameter) AZB (0.033 inch nominal diameter)
0.016A (0.40A)	ASR or ASH-390 AWCR, AWS, or AWCH-41 AGB (0.056 - 0.039 inch diameter) AZB (0.046 inch nominal diameter)
0.020A (0.50A)	ASR or ASH-550 AWCR, AWS, or AWCH-54 AGB (0.079 - 0.056 inch diameter)
Notes: 1. See AMS2431 for definitions.	

3.4 Peening Areas

The engineering drawing typically designates areas to be peened. If the drawing is not specific to all areas of the part, each individual area should be addressed and instructions provided by the purchaser to the processor.

3.4.1 Areas not requiring peening and not required to be masked should be considered optional.

3.4.2 Areas specified not to be peened may either be masked from the peening stream or they may be peened if subsequent machining operations remove the effects of peening on such areas. When it is impractical to mask or protect areas designated to be free from peening, sufficient stock should be provided in these areas for subsequent removal of affected material for compliance with dimensional requirements of the applicable drawing. The control of stock removal should be specified in the post-peening process planning.

3.4.3 Shielded or partially shielded areas, walls of deep recesses, or other areas less accessible to the maximum effect of the blast stream will receive less peening as to intensity and coverage than more exposed or more favorably oriented areas, and may therefore require additional peening or repositioning of the part to achieve correct peening in these areas. Use of special nozzle equipment or employment of deflector peening operations may be useful in diminishing the amount of additional peening.

3.4.4 The peening of very thin, under 0.090 inch (2.29 mm), or small sections to high intensities should be avoided because of the distortion and high residual tensile stresses in the core material that may result from such peening. The peening intensity used for thin sections should be such that the cross-sectional area under compressive stress should not exceed 10 percent of the total cross-sectional part width.