MIL-STD-852(USAF)
21 September 1965

65003

MILITARY STANDARD

GLASS BEAD

PEENING PROCEDURES

FSC 5350

COVER SHEET

NOTICE - All holders of MIL-STD-852(USAF) dated 21 September 1965 are advised to replace the previous issue with the one contained herein. Pages ii, iv, 1, 3, 6 and 9 of the previous issue are erroneous.

DEPARTMENT OF DEFENSE
Washington, D.C. 20301

Glass Bead Peening Procedures

MIL-STD- (USAF)

1. This Military Standard is mandatory for use by the Department of the Air Force.

2. Recommended corrections, additions, or deletions should be addressed to MOAMA (MONEB) Brookley AFB Ala 36615.

FOREWORD

The purpose of this standard is to establish minimum requirements and procedures for the peening of ferrous and non-ferrous metal parts utilizing glass beads as the peening media. The requirements and procedures of this document are presented as nearly as possible in a completely self-contained form, including some of the requirements of Military Specification MIL-S-13165A, Shot Peening of Ferrous Metal Parts. It is not the intent of this standard to prescribe the types of equipment to be used in the peening operation.

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MILITARY STANDARD

GLASS BEAD PEENING PROCEDURES

1. SCOPE

1.1 Scope. This standard establishes minimum requirements and procedures for glass bead peening of ferrous and non-ferrous parts which are subjected to repeated applications of stress such as the following: axles, landing gear parts, springs, gears, structural extrusions and wing panels. The purpose of such peening is to relieve stress, increase fatigue life and increase resistance to stress corrosion.

2. REFERENCED DOCUMENTS

2.1 Referenced Documents. The following documents of the issue in effect on the date of invitation for bids, form a part of this standard.

SPECIFICATION

FEDERAL

RR-S-366	Sieves, Standard for Testing Purposes

MILITARY

MIL-A-9954	Abrasive, Glass Beads
MIL-S-13165	Shot Peening of Ferrous Metal Parts

3. DEFINITIONS

3.1 Coverage. Coverage is defined as a uniform and complete denting or obliterating of the original surface of the part being peended. This can be determined by unaided visual inspection; however, in case of doubt as to the extent of coverage, the part shall be examined with a 10 power magnifying glass or as otherwise specified on the drawing.

3.2 Intensity. Intensity is defined as a measurement of the arc height or curvature of the test strip.

3.3 Arc Height. Arc height is the height of the combined longitudinal and transverse arcs across standard chords of the test strip.

3.4 Glass Beads. Glass beads are miscropscopic spheres of solid, hard, tempered, chemically pure crown glass. The beads range in size from 0.0024 inch in diameter to 0.0661 inch in diameter.

4. GENERAL REQUIREMENTS

4.1 Glass bead intensity. Unless otherwise specified on the drawing, or by the responsible engineering activity, the intensity value of the blast of peening used, shall be as specified in Table I for the thickness of metal involved.

TABLE I

Glass Bead Peening Intensity

Thickness, Inches	Intensity
1/16 to 1/8, inclusive	.003A to .009A
Over 1/8 to 3/8 inclusive	.007A to .014A
Over 3/8	.012A to .024A

4.1.1 Relationship of "A", "N", and "C" test strips. The "A" test strip is the most commonly used strip for determining intensities as showin in Table I; however, the "N" and "C" test strips are sometimes used. There is a direct ratio of $2\frac{1}{2}$: 1 between the "A" strip and the "C" and "N" Strips. Example: An intensity of .024A ("A" strip) is equal to an intensity of .007C ("C" strip), and an intensity of .007A ("A" strip) is equal to an intensity of .024N ("N" strip).

4.1.2 Degree of intensity. The degree of intensity obtained will be determined by the properties of the two following factors:

a. Blast - properties are velocity, size, shape, density and hardness of the glass beads.

b. Exposure - properties are length of time, angle of impact, and glass bead flow rate.

4.2 Glass beads and bead size.

4.2.1 Glass beads. The glass beads used shall conform to the requirements of Military Specification MIL-A-9954.

4.2.2 Bead size. Unless otherwise specified, the normal size of beads used shall be as specified in Table II.

4.2.3 When fillet surfaces are to be glass bead peened, the nominal glass bead size shall not be greater than one-half the fillet radius. When the glass beads are required to pass through a slot or other aperture to peen an area, then the nominal glass bead size shall be no greater than $\frac{1}{4}$ the diameter of said slot or aperture.

4.3 Coverage. All surfaces on which peening is required shall be peened to 100% coverage.

TABLE II

U.S. STD. SCREEN	BEAD SIZE - % ROUND, MIN. - % PASSING												
	1 60% Round	2 60% Round	3 65% Round	4 70% Round	5 70% Round	6 80% Round	7 80% Round	8 80% Round	9 80% Round	10 90% Round	11 90% Round	12 90% Round	13 95% Round
10	100												
12	95-100	100											
14	0-15	95-100	100										
20	0-5	0-15	95-100	100									
30		0-5	0-15	95-100	100								
40			0-5	0-15	95-100	100							
50				0-5	0-15	95-100	100						
60					0-5		95-100	100					
70						0-15		95-100	100				
80						0-5	0-15		95-100	100			
100							0-5	0-15		95-100	100		
120								0-5	0-15		95-100	100	
140									0-5			95-100	100
170										0-15			95-100
200										0-5	0-15		
230											0-5	0-15	
325												0-5	0-15
400													0-5

The above screen sizes conform to the requirements of Federal Specification RR-S-366.

Figure IV illustrates the intensities obtainable using some of the above glass bead sizes.

4.4 Unless otherwise specified, the variation in boundaries of areas to be peened, when limited, shall be -0 to + 1/8 inch.

4.5 Workmanship.

4.5.1 Masking. Areas of the part which are designated to be free of any glass bead peening marks shall be suitably masked to protect such surfaces from the blast stream. When it is impractical to mask or otherwise protect the areas designated to be free from shot peening marks, the areas may be machined off, if necessary, provided sufficient stock remains on the part to permit such material to be removed and not affect the dimensional requirements. (see 5.1 and 5.2)

4.5.2 After shot peening and removal of masking, all glass beads and fragments shall be removed from the surface of the part. Only methods which will not scratch or erode the surface shall be used.

5. DETAIL REQUIREMENTS

5.1 Processing Procedure. Areas to be peened shall be within dimensional requirements prior to glass bead peening. All heat treatment, machining, grinding and polishing shall be completed prior to glass bead peening. Ferrous and non-ferrous metals shall not be peened interchangeably with the same glass beads in the same machine. No glass beads used on ferrous parts shall later be used on non-ferrous parts.

5.2 Stresses.

a. Unless otherwise specified, glass bead peening may be performed either before or after manufacturing operations that involve plastic deformation which induce favorable residual stresses.

b. When manufacturing operations induce residual stresses which may be detrimental to service after peening, the part shall be given a suitable stress relief heat treatment prior to glass bead peening.

c. No manufacturing operations which relieve stresses developed by peening or which develop detrimental residual stresses shall be permitted after glass bead peening. However, it is permissible to improve the surface finish after peening by lapping, honing or blasting, provided such operations do not generate temperatures in excess of 245° F for aluminum parts or 475° F for ferrous metal parts, and do not remove materials layers exceeding 10% of the "A" intensity or arc height. Example: Up to 0.0007 inches may be removed from a part peened to 0.007A intensity.

d. Glass bead peening of parts while under stress from an exterior force shall not be permitted unless specified on the drawing or with the approval of the responsible engineering activity.

5.3 Heat treatment. When peened parts are heated after glass bead peening, such as for baking of paint or protective coatings, embrittlement relief after electroplating, or other strain relief heat treatment, aluminum and aluminum alloy parts shall not be subjected to processing temperatures exceeding 245°F and ferrous metal parts shall not be subjected to processing temperatures in excess of 475°F.

5.4 Magnetic particle or fluorescent inspection. When magnetic particle or flourescent penetrant inspection is required, parts shall be subjected to such inspection prior to glass bead peening.

5.5 Corrosion protection. Glass bead peened parts shall be protected from corrosion during processing and until final coating, installation or packaging is complete.

5.6 Peening Intensity.

5.6.1 Test equipment. For determining glass bead peening intensity the following test equipment is required:

a. Test strips "A" (See Figure I)

b. Holding fixture (See Figure II)

c. Almen Gage No 2 (See notes)

5.6.2 Test procedure. Test strip "A" shall be attached as shown in Figure II to the holder shown in Figure III, and mounted on a fixture or article and exposed to the blast stream in such a manner and for a time which will approach the peening conditions at the surface of the actual work piece, and give the desired intensity. After exposure the test strip shall be removed from the holder and the arc height or deflection measured with an Almen Gage #2, and the intensity compared with the requirements of the drawing. In measuring the arc height of the peened test strip, the center of the unpeened side of the test strip shall be placed against the indicator stem of the Almen Gage.

5.6.3 Test frequency. At least one intensity determination as described in 5.6.2 shall be made to represent each machine for each two hours of operation or fraction thereof. In all cases, at least one determination shall be made at the beginning and one at the end of each period of operation. Two test strips shall be used for each intensity determination.

5.7 Inspection. All items that have been glass bead peened shall be inspected for compliance with 4.3.

5.7.1 Rejection. All parts peened between a last previous successful test and the first unsuccessful test or the time a machine is found to be unsatisfactory by virtue of failure of the test strips to meet any of the requirements of this standard, as well as any parts peened after the test which indicated failure, shall be rejected. These parts may be repeened once and resubmitted for inspection.

6. NOTES AND FIGURES

6.1 Desired effect. Glass bead peening, to have the desired effect, requires that the specified intensity and coverage be achieved on critical areas, where high tension stresses or stress ranges are most likely to cause fatigue and stress corrosion failures in service. Actual experience with service failures or fatigue tests may sometimes be required to discover or confirm the location of such areas subjected to critical stressing, as a result of any combination of service, design or manufacturing operations.

6.2 Shielded areas. 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 the more exposed or favorably oriented areas.

6.3 Thin sections. The glass bead peening of very thin sections to high intensities shall be avoided because of the distortion and high residual tensile stresses in the core material that may result from such peening. This is particularly true where the part is a tension member or has surfaces finished after heat treatment.

6.4 Special procedures. Where a special peening procedure is required, the drawing must definitly designate the critical areas. This is particularly important in instances referred to 6.2 and 6.3.

6.5 Simple shapes. Simple shapes may not require special procedures as to critical areas because such areas are generally accessible for full peening effect when uniformly exposed to the blast stream.

6.6 Glass bead size selection. In selecting glass bead sizes, consideration shall be given to the following factors:

a. Shape of part

b. Size of fillets

c. Finish desired

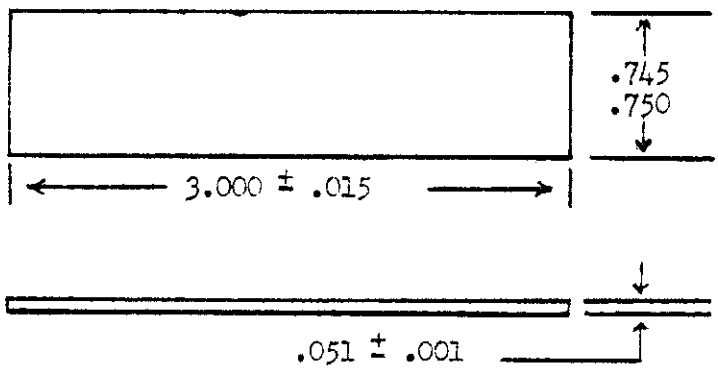
d. Intensity desired

e. Abrasive effect

6.7 Almen Gage #2. This gage is of the dial indicator type with the maximum value of graduations being 0.001 inch. It has a counterclock-wise dial, back adjustable bracket, low friction jeweled bearings and equipped with an extension point for activation of the dial needle.

FIGURE I

TEST STRIP "A"



Analysis of stock: SAE 1070, cold rolled spring steel.

Edge # 1 (on 3 inch edges).

Finish: Blue temper (or bright), uniformly hardened. Heat set between flat plates under pressure for a minimum of 2 hours at 800°F ± 25°F. Hardness 44-50 Rockwell C.

FIGURE II

HOLDING FIXTURE WITH TEST STRIP

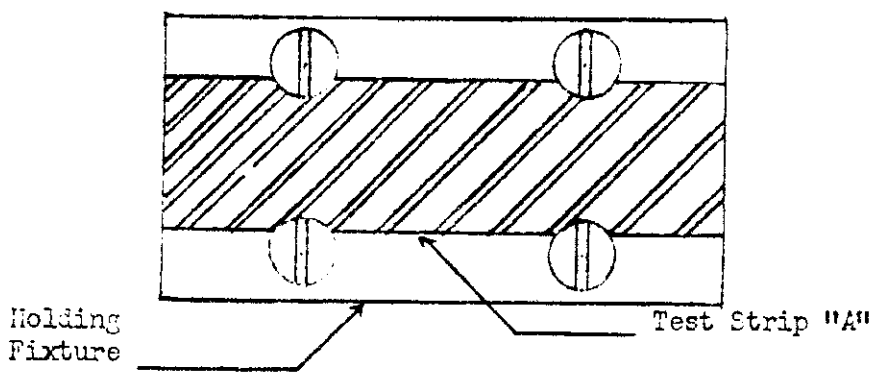
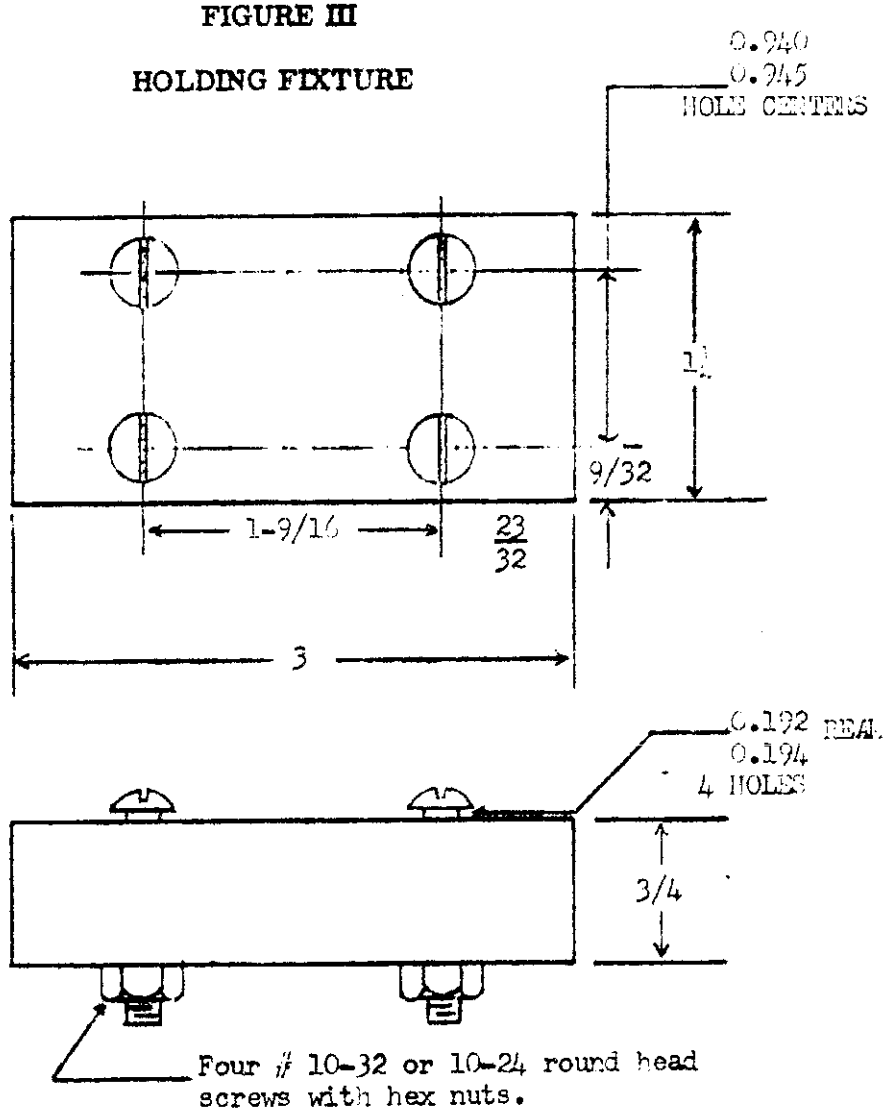


FIGURE III

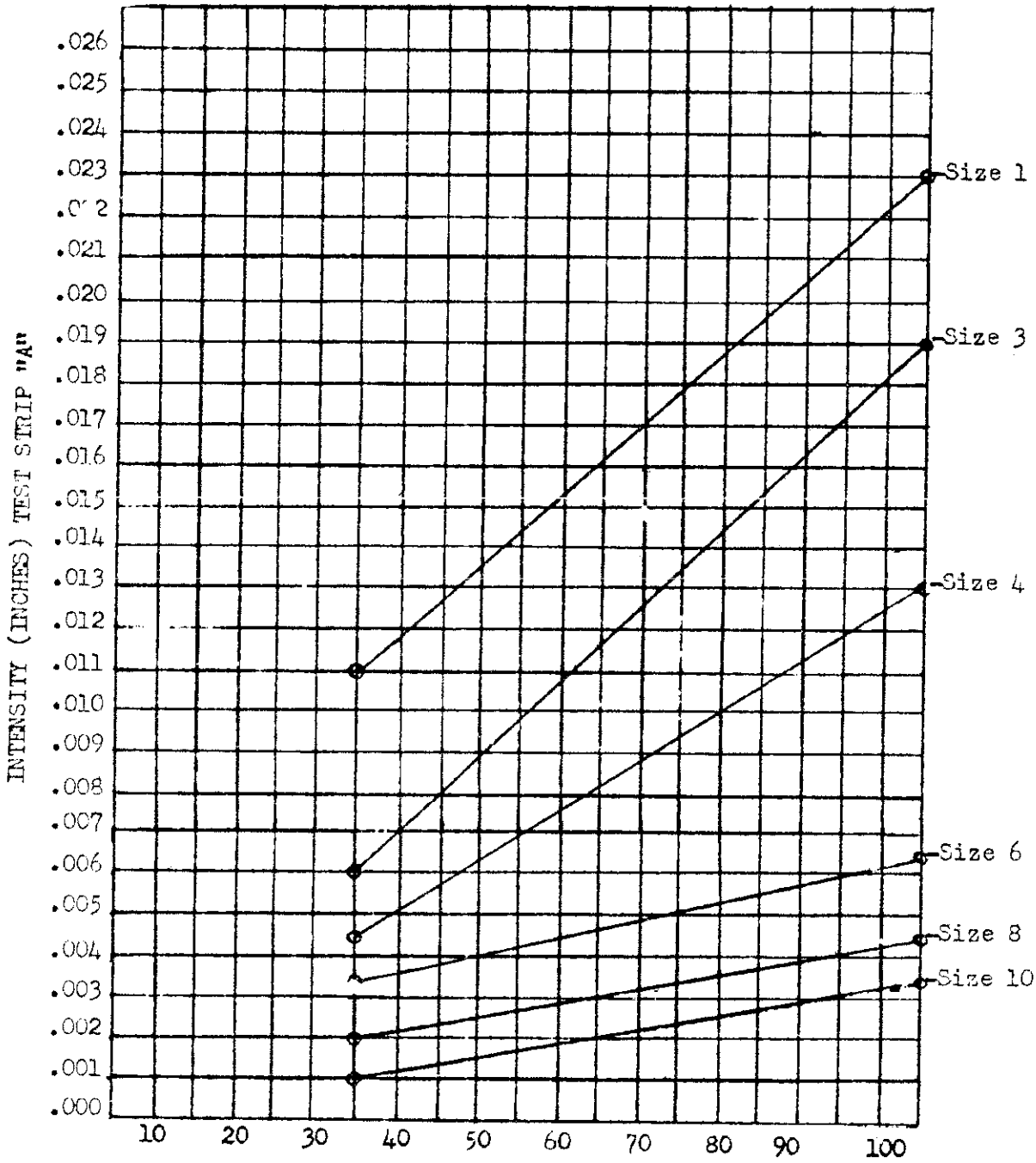
HOLDING FIXTURE



Analysis of Stock: SAE 4130-Rockwell 50-55C.

FIGURE IV

Typical peening intenities obtained from various size glass beads and various air pressures using a 3/8 inch nozzle, 90° angle, 4-6 inch distance.



6.8 The Almen Gage #2 and "A" test strips may be procured from one of the following manufacturers:

The Wheelabrator Corp
Mishawaka, Indiana

Foster D. Snell Inc.
29 W 50th Street
New York, New York

Southwest Test Lab
Box 1379
Fort Worth, Texas

Custodians:

Air Force - 69

Preparing activity:

Air Force - 69

NOTICE OF VALIDATION

MIL-STD-852
Notice 1
18 April 1988

MILITARY SPECIFICATION

GLASS BEAD PEENING PROCEDURES

MIL-STD-852, dated 21 Sep 65, has been reviewed and determined to be valid for use in acquisition.

Custodians:

Air Force - 99

Preparing Activity:

Air Force - 84

Reviewer:

DLA - IS

AMSC N/A

FSC 5350

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