General Specification
Process Specification for Controlled Shot-Peening

Table of contents:

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
9560	HTCT 80155	C	B	2010-06-23	EN	Approved

Dept. 9560 | Document No. HTCT 80155 | Type C | Rev. B | Released 2010-06-23 | Lng. EN | Status Approved

1 General

1.1 Definitions

(1) Alstom: Employees of Alstom or its designated representative.

(2) May: This word is used to indicate a course of action permissible within the limits of the standard.

(3) Shall: This word is used to indicate mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted.

(4) Supplier: Company or factory to which inquiry or order is awarded.

(5) Tolerance: It is the acceptable range of deviation of the actual dimension from the specified dimension.

(6) Will: Used to express a declaration of purpose on the part of the business.

1.2 Foreseen application and purpose

(1) This specification covers the blast strengthening (shot-peening) of metal parts using steel shot and glass beads to produce a permanent compression stress (pre-stressing) on the surface of the material that will satisfy requirements at a pre-established uniform depth.

(2) Shot-peening is called for mainly to increase the fatigue strength and to prevent stress-cracking corrosion.

(3) Strengthening with glass beads, wither in a slurry or dry, can be employed for parts of non-ferrous metals which shall not be contaminated with iron. This procedure is also applied after completion of shot-blasting in order to improve the quality and condition of the surfaces.

1.3 Categories and criticality

(1) Supplier needs to obtain full product qualification before any delivery. Supplier shall contact Alstom to receive instructions on product qualification requirements.

(2) All requirements of this specification have to be fully complied with. Where permissible deviations are given, supplier shall ensure that any value is appropriate within the permissible deviation given.

(3) It is critical to Alstom, that all required records are sufficiently established and where defined submitted to Alstom. In case Alstom is not requesting transmittal of such records, supplier shall ensure that such records are maintained in accordance with the terms and conditions of the order placed and international legislation.

2 Material properties requirements

2.1 Mechanical properties

2.1.1 Shot

(1) Unless otherwise specified, the supplier shall select the nominal size of the shot used in the unit. The shot shall conform to the data In Table 1 for cast shot (refer to Page 7), or in Table 2 for shot from steel cuttings (refer to Page 8).

(2) Unless otherwise specified or approved by the materials engineer, all cast steel shot used shall conform in hardness, checmical composition, microstructure, specific gravity, shape and size to Sect. 4.3.1 below (refer to Pages 8 to 10).

(3) Unless otherwise specified, the shot shall be spherical or elliptical in shape (refer to Figure. 1, Page 9). The proportion of deformed shot shall not exceed the limits specified in Table 1 (refer to Page 7). By "deformed" is meant broken, sharp-edged, dropshaped, hollowed out or "long" shot (with a ratio of length to diameter of more than 2 to 1).

(4) Unless otherwise specified, the shot shall have a hardness of Rc 45 to 55.

(5) Shot with a hardness ranging from Rc 55 to 65 is recommended for parts having hardness greater than Rc 50.

(6) The shot shall be clean and free of Incipient rust, dirt, coarse sand, oil, grease, or other contaminants. Before being used for the first time, new shot shall be pre-treated to remove sharp edges before starting the blasting.

(7) A written confirmation that the shot conforms to these specifications shall be provided upon request.

(8) The shot shall be analyzed after every four hours of uninterrupted operation to assure that it still conforms to the requirements in Table 1 (refer to Page 7) and Figure 1 (refer to Page 9).

2.1.2 Glass Beads

(1) The chemical composition, appearance, iron content, quartz content, shape and size of the glass beads shall be analyzed as called for in Sect. 4.3.2 below (refer to Pages 10 to 12).

(2) The glass beads shall be round and uniform in size, and shall be inspected as called for in Sect. 2.1.2 (3) to assure that no more than 20% of the glass beads, determined by counting, are broken. Table 5 (Page 13) lists the sieve sizes.

a) When using dry glass machines with correctly adjusted air washing systems, check the glass beads every two hours.

b) When using wet glass machines, check the glass beads after every 15 minutes of uninterrupted operation by removing a small quantity of the glass slurry from the nozzle and drying it on a stainless steel spoon.

(3) For counting, spread the glass beads out on a transparent strip (transparent adhesive tape). Then place this strip with the glass beads over a hole 12.7 mm in diameter in such a way that it can be enlarged in a 35 mm projector to 508 mm. On a surface of 3225.8 sq mm. no more than 20% of the glass may be broken. If more than 20% is broken, the machine shall be carefully cleaned and reloaded.

(4) Machines used for blasting with glass beads shall be equipped with timer switches to sure a continual record of when glass was added and when the charge was replaced.

2.1.3 Almen Strips

Analysis of the material in stock

Cold-rolled spring steel

Square: Number one (on 76.2 mm edge)

Tempered blue (or bright metal)

Uniformly hardened and tempered to 44 -50 Rc

Dept. 9560 | Document No. HTCT 80155 | Type C | Rev. B | Released 2010-06-23 | Lng. EN | Status Approved

Level to within ± 0.0381 mm arc height, measured using the instrument shown in Figure. 8 (refer to Page 17).

3 Form, fit and function requirements

This section is not applicable to this specification.

4 Testing and verification requirements

4.1 Preparatory Treatment

(1) Unless otherwise specified, all machining and heat-treatment is to be completed before the start of shot and glass bead strengthening.

(2) If a magnetic powder or penetrant test is required, that test shall be performed before starting shot or glass bead blasting.

(3) Those pieces that are to be blasted shall be free of all coatings such as, for example, grease corrosion.

(4) The blast-hardening shall be done before application of corrosion protection coatings, before anodizing, plating and painting.

(5) The zones to be blasted, the zones to be covered up and all those zones where blast strengthening is optional are to be identified clearly on the design drawing for the parts to be blasted.

(6) All zones that are not to be blasted shall be covered up or protected in a suitable manner in order to prevent scratches and impact marks produced by the shot.

(7) Where the design drawing indicates zones of the piece where the blasting or its intensity is "optional" side effects of the blasting on these zones are possible and impact marks resulting from stray shot are permissible.

4.2 Testing procedure

4.2.1 Procedure for Blast Hardening.

i) The blasting intensity is the arc height of a standard Almen test strip that has been blasted to full coverage, as defined in Section 4.2.1 iii) below and measured on an Almen test gauge as shown in Figure 8 (refer to Page 17).

ii) Almen test pieces and holding fixtures shall conform to the illustrations in Figure 3, 4, 5 and 6 (refer to Pages 15 and 16).

iii) Use Almen test specimens to adjust the machine (air pressure, gear speed, distance to nozzle, stroke, circulation.). Attach the test specimens to the holding fixture as shown in Figure 7. The test specimens should be installed in the shot-peening machine in essentially the same way as the pieces that are to be blasted. Blast the test pieces for various durations until with a given air pressure and with the nozzle at a given distance away, a doubling of the exposure time does not increase the arc height of the test piece by more than 10%. Record a curve such as that shown in Figure 2 (refer to Page 14) for this process.

iv) Do not repeen a test specimen that has been blasted once it has been removed from the test strip holding fixture.

v) The design drawing shall indicate the intensity required for each application. The desired pressure depth and the compression stress produced are the determining factors defining this.

vi) The nominal diameter of the shot used for blast strengthening for hollow necks shall be less than half the radius of the hollow neck. If the shot has to pass through

Dept. 9560 | Document No. HTCT 80155 | Type C | Rev. B | Released 2010-06-23 | Lng. EN | Status Approved

recesses and openings to reach critical zones, the nominal size of the shot shall be less than 1/4 the size of the opening available.

vii) All zones of a part that is to be blasted shall be fully saturated as defined in Sect. 4.2.1 iii) above. Generally, an experienced inspector can verify full coverage or saturation by means of purely optical Inspection under 10 power magnification. Surfaces with hardness greater than 55 Rc may, under purely optical observation, show less than 100% coverage. The surfaces of these pieces shall be blasted for at least twice as long as required for full saturation on the Almen test strip (coverage ≥ 98% is considered to be full coverage).

viii) Whenever possible, blast perpendicular to the surface of the piece, with minimum and maximum angular deviations from the perpendicular 45°.

ix) Zones that are inaccessible for a machine blasting shall be marked for identification and a drawing of the piece showing the location of these zones shall be provided. Submit this sketch, together with a written request for permission to blast these zones manually, to the Engineering Dept. responsible. Only zones or pieces expressly authorized by the Engineering Dept. responsible may be blasted manually.

4.2.2 Inspection

i) Measure the intensity as described in Section 4.2.1 iii) above at least once after every full four hours of traction thereof of uninterrupted operation, and in all cases - regardless of how long the blasting continues -at least once at the start and again at the end of each phase in the work. If the blasting intensity or the coverage does not conform to the requirements in Sect. 4.2.1 iii), discontinue work immediately. Readjust the machine and modify the blasting procedure so as to attain the required intensity.

ii) Mark the Almen test strip produced for each shipment of parts properly and keeps it on file for two years.

iii) The following pieces shall be rejected:

a) Pieces that have not been blasted to the intensity indicated on the design drawing.

b) Pieces that have not been blasted in the zones indicated on the design drawing.

c) Pieces that have not been blasted to full coverage as defined in Sect. 4.2.1 iii) above.

d) Pieces that have been manually blasted or manually blasted in zones without the approval of the Engineering Dept. responsible.

e) Pieces that have stray shot impact marks in zones which, according to the design drawing have to be covered for protection.

iv) A certificate and the pertinent Almen test strips confirming that all requirements of these specifications have actually been fulfilled shall be enclosed with every shipment of shot-peened pieces.

v) Gauges

a) Almen test gauges shall be checked, calibrated and confirmed as reliable for a given period of time by a firm engaged in instrument repair. They shall be inspected and tested according to recognized measurement standards that have a known relationship of validity vis-à-vis national standards.

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
9560	HTCT 80155	C	B	2010-06-23	EN	Approved

b) The compressed air pressure gauges used for the shot-peening shall be rechecked and recalibrated monthly using a calibrated tester. A report showing conformity with these specifications shall be kept on file. The accuracy of measurement of the instruments shall lie within ±5% of the mean accuracy of the calibration instrument.

The calibration tester shall be tested and accepted every six months by a testing laboratory or by a company engaged in the construction of such instruments.

4.2.3 Follow Up Treatment

i) On completion of the shot-blasting, the piece shall be property cleaned and protected against rust and corrosion.

ii) Parts that have been shot-blasted shall not be exposed to temperatures that will diminish the stresses produced by the blasting. For steel, this temperature is 246℃; for titanium alloys, 427℃.

iii) No machining of grinding of blasted zones on a piece is permissible, but polishing, honing, or lapping is allowed. Up to 10% of the pressurized layer produced may be removed by polishing, lapping, or honing in order to improve the quality of the surface or to correct dimensions.

iv) Straightening of blasted parts using procedures other than blast forming is permissible.

4.2.4 Approval

i) Shot or glass bead blasting is permissible only when performed using proper equipment and done by specialists experience in the process. Approval is subject to a testing of the equipment and the familiarity of the staff employed in these installations with the instruments and procedures involved.

ii) A blasting procedure and the saturation curves for it are drawn up for each component. However, written approval from quality assurance in the Engineering Dept. involved is required before the procedure is implemented.

Dept. 9560 | Document No. HTCT 80155 | Type C | Rev. B | Released 2010-06-23 | Lng. EN | Status Approved

Table 1: International standards

Strahlmittel-Klasse Norm SAE	Totaler Durchgang v.Schrot durch U.S. Sieb		Max.2% Schrot grösser als U.S. Sieb		Max.50% Schrot grösser als U.S. Sieb		Kumultativ min. 90% Schrot grösser als U.S. Sieb		Max.8% Schrot grösser als U.S. Sieb		Max.akzept.Anzahl deformierter Kugeln		
	1.)	2.)	1.)	2.)	1.)	2.)	1.)	2.)	1.)	2.)	Anzahl Kugeln		Quadrat Zoll
S930 P-93	5	(.157)	6	(.1320)	7	(.1110)	8	(.0937)	10	(.0787)	5	pro	1
S780 P-78	6	(.132)	7	(.1110)	8	(.0937)	10	(.0787)	12	(.0661)	5	pro	1
S660 P-66	7	(.111)	8	(.0937)	10	(.0787)	12	(.0661)	14	(.0555)	12	pro	1
S550 P-55	8	(.0937)	10	(.0787)	12	(.0661)	14	(.0555)	16	(.0469)	12	pro	1
S460 P-46	10	(.0787)	12	(.0661)	14	(.0555)	16	(.0469)	18	(.0394)	15	pro	1
S390 P-39	12	(.0661)	14	(.0555)	16	(.0469)	18	(.0394)	20	(.0331)	20	pro	1
S330 P-33	14	(.0555)	16	(.0469)	18	(.0394)	20	(.0331)	25	(.0280)	20	pro	1/2
S280 P-28	16	(.0469)	18	(.0394)	20	(.0331)	25	(.0280)	30	(.0232)	20	pro	1/2
S230 P-23	18	(.0394)	20	(.0331)	25	(.0280)	30	(.0232)	35	(.0197)	20	pro	1/2
S190 P-19	20	(.0331)	25	(.0280)	30	(.0232)	35	(.0197)	40	(.0165)	20	pro	1/2
S170 P-17	25	(.0280)	30	(.0232)	35	(.0197)	40	(.0165)	45	(.0138)	20	pro	1/2
S130 P-13	30	(.0232)	35	(.0197)	40	(.0165)	45	(.0138)	50	(.0117)	30	pro	1/4
S110 P-11	35	(.0197)	40	(.0165)	45	(.0138)	50	(.0117)	80	(.0070)	40	pro	1/4
S 70 P-7	40	(.0165)	45	(.0138)	50	(.0117)	80	(.0070)	120	(.0049)	40	pro	1/4

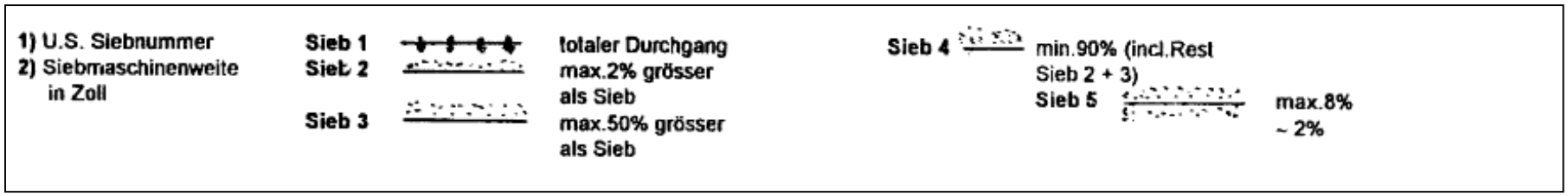

Table 2: Distribution of sphere sizes from steel wire cuttings

Peening agent Class	Wire Diameter in mm	Length of 10 Parts in mm (1)	Weight of 50 Parts in grams (2)
CW-62	1.5875 ± 0.0508	16.510 ± 10.16	1.09 ... 1.33
CW-54	1.3716 ± 0.0508	13.716 ± 10.16	.72 ... .88
CW-47	1.1938 ± 0.0508	11.938 ± 10.16	.48 ... .58
CW-41	1.0414 ± 0.0508	10.414 ± 10.16	.31 ... .39
CW-35	0.8890 ± 0.0254	8.890 ± 7.62	.20 ... .24
CW-32	0.8128 ± 0.0254	8.128 ± 7.62	.14 ... .18
CW-28	0.7112 ± 0.0254	7.112 ± 7.62	.10 … .12
CW-23	0.5842 ± 0.0254	5.842 ± 5.08	.05 ... .07
CW-20	0.5080 ± 0.0254	5.080 ± 5.08	.04 ... .05

(1) To check the length of the spherical parts, they shall be fastened and ground and polished so as to show a center cross-section through their length. The total length of ten parts selected at random shall be within the tolerances shown in Table 2 above.

(2) At the option of the supplier, the parts can be weighed instead of fastening and measuring them as indicated in footnote (1) above. If they are weighed, the weight of 50 parts selected at random shall lie within the limits shown in Table 2 above.

4.3 Records of material / performance tests

4.3.1 Cast Steel Shot: Its Quality and Condition for Blast Strengthening

(Derived from QCO-01-11A)

4.3.1.1 Function

The quality of the shot used is very important for controlled shot-peening. These specifications outline the requirements to be fulfilled with regard to the size, shape, chemical composition, microstructure, specific gravity, and hardness for each size of shot.

4.3.1.2 Specifications

These specifications are in agreement with the following specifications which apply or go beyond their provisions:

Table 3: Specifications

Standard	Title
SAE-J 827	Cast steel shot
MIL S-13165B	Shot-Peening of Metal Parts
SAE-J 444	Measuring the Size of Shot and Grit
MIL S-851B	Steel Grit, Shot, and Shot from Wire Cuttings; Cleaning and Blasting with Iron and Steel Grit
SAE-J 808a	Shot-Peening

Dept. 9560 | Document No. HTCT 80155 | Type C | Rev. B | Released 2010-06-23 | Lng. EN | Status Approved

The detailed specifications shall pertain in all sectors not dealt with herein.

4.3.1.3 Requirements

i) Unless otherwise specified, the shot shall be of the sizes indicated in Table 1 (Page 7):

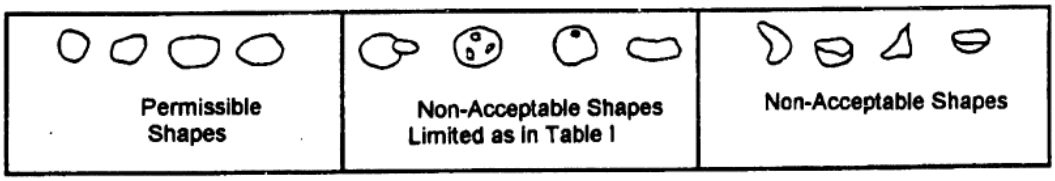

Figure 1: Permissible and Non Acceptable Shapes

ii) Unless otherwise specified, the shot shall be spherical or elliptical in shape. The maximum number of deformed shot shall not exceed the limits Indicated in Table 1 (Page 7). By deformed shot are meant broken, sharp-edged, drop-shaped, hollowed out, or long shot (with a ratio of length to diameter greater than 2 to 1).

iii) Specimens of shot: The specimen shall comprise the number of shot grains in a layer that cover completely a surface area of 1 square inch (645.16 square mm), ½ square inch (322.58 square mm), or ¼ square inch (161.29 square mm), as shown in Table 1. The random sample is to be taken from a 22.68 kg sack selected at random from the shipment by the vendor. This specimen shall be broken down to the definitive testing lot using a Type SS-50 Tyler sorting device or the equivalent.

iv) The shot shall be clean and free of rust, dirt, sand, oil, grease, and other contaminants.

v) Every sack confirming the above requirements shall be identified with a test label containing: the number of these specifications, the code for shot size, the Initials of the inspector, the sate of the inspection, and the purchase order number.

4.3.1.4 Hardness, Chemical Composition, Microstructure, Specific Gravity

i) Unless otherwise specified, the shot shall have the following hardness:

Cast steel shot: 45 to 55 Rc in at least 90% of 20 readings taken with the TUKON test device under a 500 gram load

The following hardness is available on special order

Special hardness: 58 to 65 Rc in at least 90% of 20 readings taken with the TUKON test device under a 500 gram load

ii) Chemical Composition

Carbon	85 to 1.20 %
Manganese	80 to 1.20 %
Silicon	at least .40 %
Phosphorus	maximum .05 %
Sulphur	maximum .05 %

iii) Microstructure

Uniformly hardened Martensite, with fine, evenly distributed carbides.

A crack is a linear irregularity with the length of which is three or more times its diameter and max. 0.2 times the diameter of the shot. If more than 15% of the shot is split, the shot is unacceptable.

iv) Specific Gravity

Density not less than 7 gram per cubic centimeter shall not be hollowed out more than 10%. A hollowing out is a hollow space at the center covering more than 10% of the surface of the shot.

4.3.1.5 Preparatory Treatment

All shot shall be pretreated to remove any unevenness in it.

4.3.2 Glass Beads: Their Quality and Condition for Blast Strengthening

(Derived from QCS-EC-007)

4.3.2.1 Scope of Application

The quality of the glass beads used is very important for controlled shot-peening. These specifications outline the requirements to be fulfilled with regard to the size, shape, chemical composition, and specific gravity for each size of glass bead used.

4.3.2.2 Pertinent Specifications

These specifications are in agreement with the following other specifications which apply, or go beyond their provisions:

Table 4: Specifications

Standard	Title
MIL-G-9954-A	Military Specifications: Glass Beads for Cleaning and Blast Strengthening
MIL-S-13165-B	Military Specifications: Blast Strengthening of Metal Parts
MIL-STD-852	(USAF) Procedure for Blast Strengthening with Glass Beads
UU-S-48	Federal Specifications: Bags, Packing Paper
MIL-D-3464	Military Specifications: Drying Agents, activated, bagged: Use of Packing and Static Removal of Moisture
MIL-STD-105	Military Specifications: Sampling Procedure and Tables for Inspection by Management Offices
MIL-STD-129	Military Specifications: Identification for Shipment and Storage
MIL-STD-147	Military Specifications: Unit Charges Shipped in Special Packages (1016 mm x 1219.2 mm)
ASTM-C-169-65-T	Procedure for Chemical Analysis of Crown Glass for ceous Anhydride
ASTM-D-1214-58	Sieve Analysis of Glass Balls
ASTM-B11-61	US Sieve Filter Series

Dept. 9560 | Document No. HTCT 80155 | Type C | Rev. B | Released 2010-06-23 | Lng. EN | Status Approved

4.3.2.3 Requirements

i) Composition

Beads shall be made of high-quality soda-lime glass.

ii) Appearance

The beads shall be free-flowing, free of flaws, and free of foreign contaminants. They shall be white or crystalline in colour.

iii) Air inclusions

No more than 10% of the balls shall include air inclusions which when projected with 20 power magnification through a FAX-film apparatus cover more than 20% of the side surface.

iv) Coatings of Deposits

No coatings with silicone or traces of silicone are acceptable. In order to conform to these specifications, the beads shall disperse as follows when water is poured over them:

Slowly fill 50 grams of the beads into a 250 ml glass beaker containing 200 ml of distilled water. It is permissible to have a small number of the beads floating on the water, but no clotting--an indication of silicone coating--is permissible.

v) Specific Gravity

Dry and carefully weight a 60 gram specimen of beads, taken as described in Sect. 4.3.2.4 i) below and fill them into a 100 ml measuring beaker containing 50 ml of distilled water. The total volume occupied in millilitres, minus 50, is the volume of the beads.

The specific gravity is:

Weight of the specimen (in grams)

Volume of the specimen, in millilitres

The specific gravity shall not be less than 2.3 kg/dm3.

vi) Iron Content

Three 500 gram specimens, taken as described in Sect. 4.3.2.4 i) below, are to be used for testing for magnetite. The specimens are to be spread out repeatedly on an inclined magnetic surface, as described in MIL-G-9954-A until no more magnetic particles of any kind are being retained on the inclined surface. Brush all magnetic particles captured carefully into a tared weighing tray each time the beads are spread out. When there are no longer any magnetic particles to be seen on the magnetic surface, weigh the iron particles that have been collected.

The proportion of free iron shall not exceed 0.1%.

vii) Content in Silicon Oxide

The guarantee that soda lime glass will have a low chemical reactivity is based on its silicon oxide content. Test for silicon oxide as called for in ASTM-C-169-57T. The silicon content shall be greater than 62%.

Note: This is not free silicon oxide and therefore does not represent a threat to health due to silicosis.

Dept. 9560 | Document No. HTCT 80155 | Type C | Rev. B | Released 2010-06-23 | Lng. EN | Status Approved

viii) Shape

Unless otherwise specified, the beads shall be spherical or elliptical in shape. The percentage of "correct shapes" shall conform a least to the data in Column 9 of Table 5. Cracked, broken or angular particles cause sharp or angular surface shapes on impact and would therefore result in a erosion of metal or unsatisfactory or irregular surfaces. An actual count is to be taken for a lot of approx. 100 beads using a 20-power microscope with shadow-free illumination or a sample fastened to a FAX Film apparatus and a projector. The maximum permissible proportion of notched, broken or angular particles determined in counting shall not exceed 3%.

ix) Size

Unless otherwise specified, the sizes of the glass beads shall conform to those shown In Table 5.

x) Hardness

Unless otherwise specified, the glass beads shall be of the following hardnesses: 5 to 6 on Mohs scale, or 500 to 550 DPH using a 50 gram weight or 525 to 575 KHN using a 100 gram weight

4.3.2.4 Quality Certificate

i) Specimen of beads

A type specimen for a shipment is to comprise a full 22.68 kg bag selected at random from the shipment. This specimen shall be broken down to the definitive testing lot using a Type SS-50X Tyler sorting device or the equivalent.

4.3.2.5 Packing

i) Receptacles

As receptacles, use 22.68 kg multi-walled bags reinforced with coarse woven linen, conforming to MIL-G-9954-A . "Grade A", and an inner plastic bag with a permeability to moisture of less than 0.5 gram water per 24 hours.

Dept. 9560 | Document No. HTCT 80155 | Type C | Rev. B | Released 2010-06-23 | Lng. EN | Status Approved

Table 5: Dimensionen von Glasperlen sowie Kontrolle mittels Sieben

Klassen-nummer von Glasperlen	Nominalgrösse von Glasperlen			Siebgrössen (U.S Siebklasse Nummer)				Min Anzahl von Glas-perlen mit korrekter Form in %
	U.S. Sieb-klassen	Durchmesser Zoll	Durchmesser µm	Totaler Durchgang von Glas-perlen durch U.S. Sieb	Min. 95% Glasperlen durch U.S. Sieb	Max.10% Glasper-len durch U.S. Sieb	Max. 3% Glasperlen durch U.S. Sieb	
GP-331	16-20	.033	840	14	16	20	25	65
GP-234	20-30	.023	590	18	20	30	40	65
GP-165	30-40	.016	420	25	30	40	50	70
GP-100	40-50	.010	250	35	40	50	60	70
GP-83	50-70	.008	210	45	50	70	80	80
GP-70	60-80	.007	177	50	60	80	100	80
GP-60	70-100	.006	149	60	70	100	120	80
GP-50	80-120	.005	125	70	80	120	140	80
GP-41	100-140	.004	105	80	100	140	200	85
GP-35	120-170	.0035	88	100	120	170	230	90
GP-30	140-200	.003	74	120	140	200	270	90
GP-25	170-230	.0025	62	140	170	230	325	90
GP-20	200-270	.002	53	170	200	270	400	90

1) Die Klassennummer von Glasperlen entspricht dem 10000fachen Glasperlendurchmesser in Zoll.

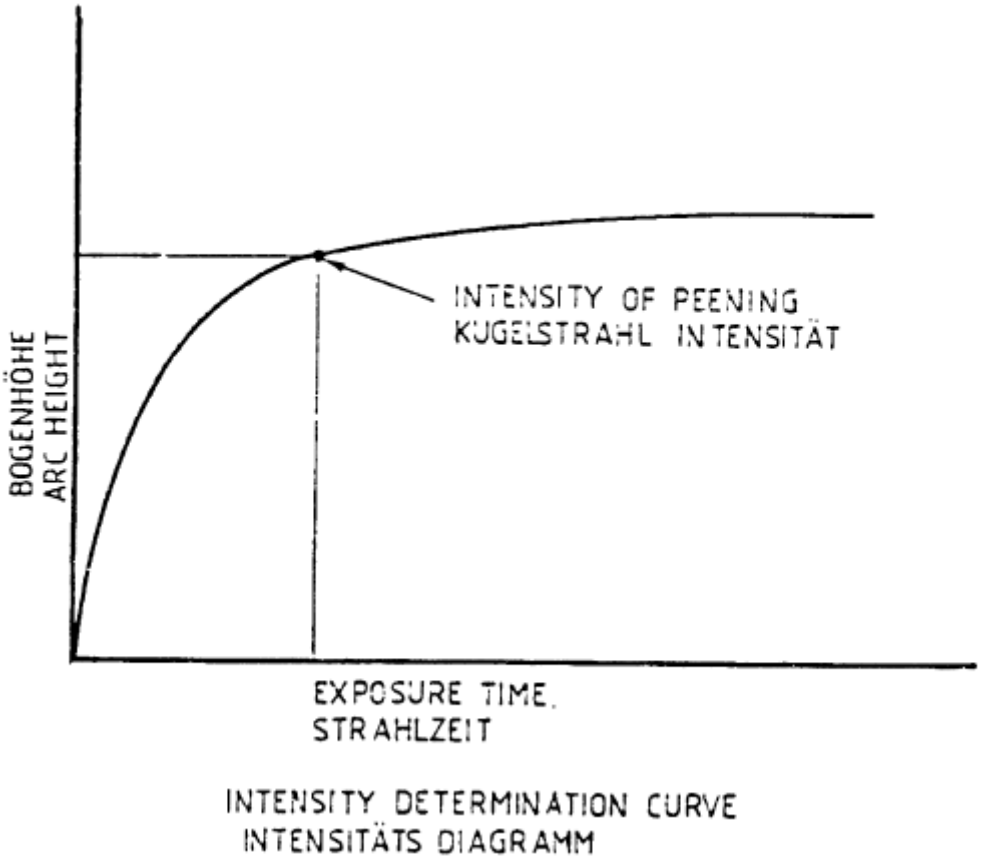

Figure 2: Intensity Determination Curve.

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
9560	HTCT 80155	C	B	2010-06-23	EN	Approved

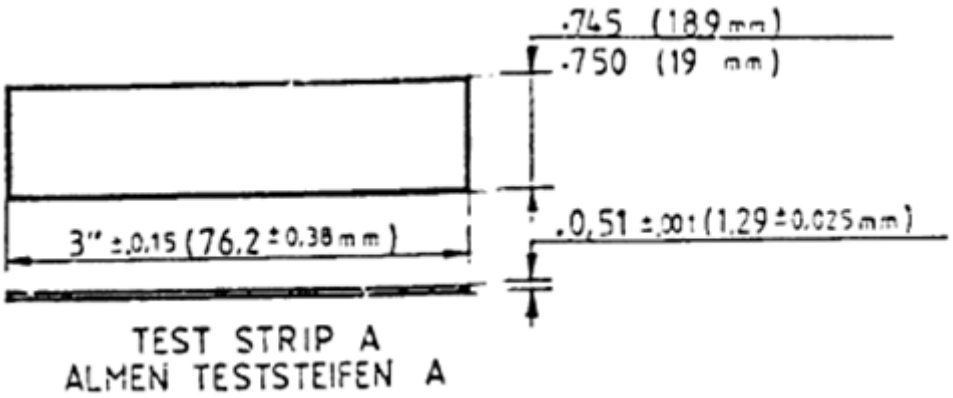

Figure 3: Test Strip A

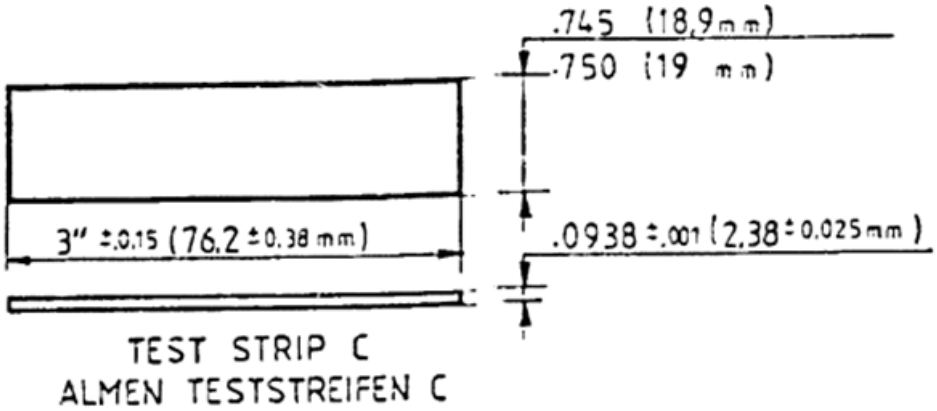

Figure 4: Test Strip C

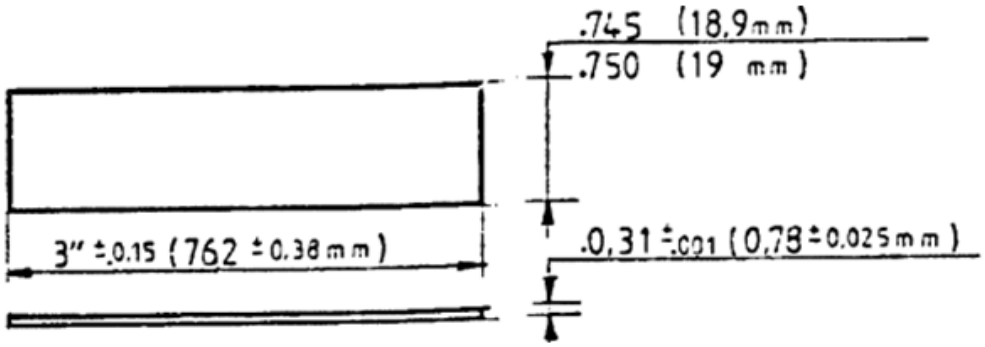

Figure 5: Test Strip N

Test strip specifications:

Analysis if stock: Cold-rolled spring steel, square edge number one (on 76.2 mm):

finish: tempered blue (or bright; uniformly hardened and tem-pered to 44-50 Rc.

Flatness: ± 0.0381 mm arc height as measured on the gauge shown in Figure 8

Test Strip A is used for arc heights up to 0.024 A. Test Strip C should be used for greater blasting Intensities. Test Strip N Is used whenever the Intensity if less than 0.004 A

(Arc height, 0.024 A =0.6096 mm).

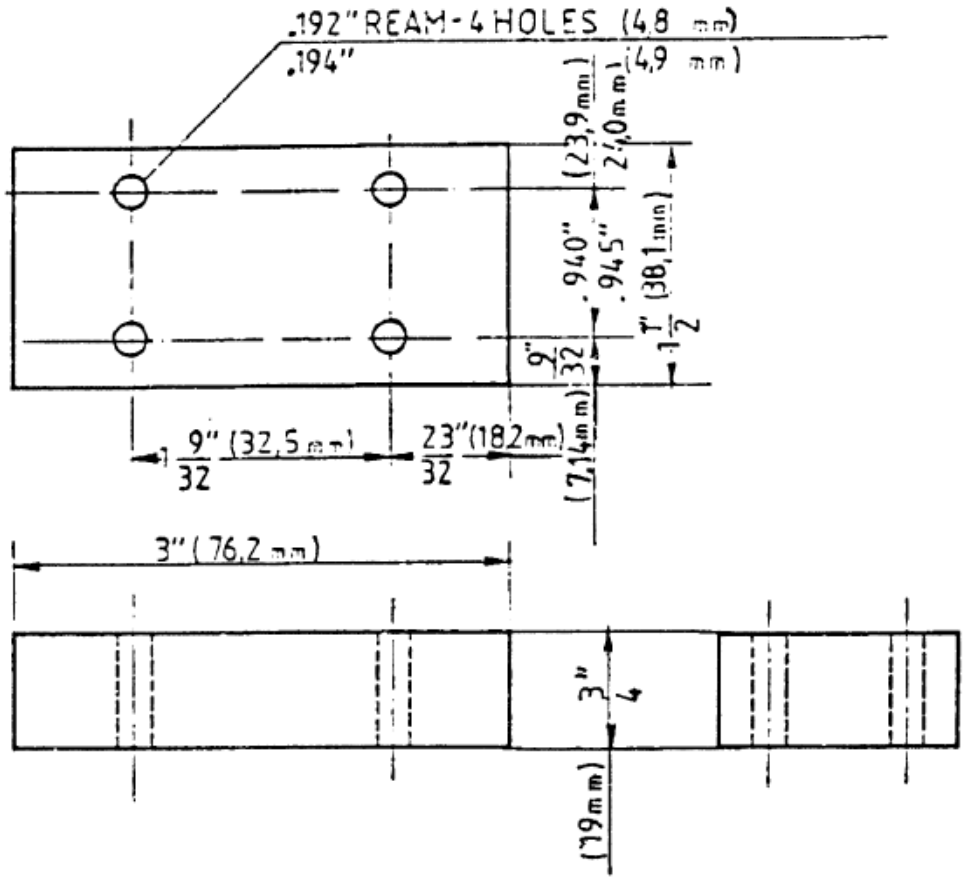

Figure 6: holding Fixture

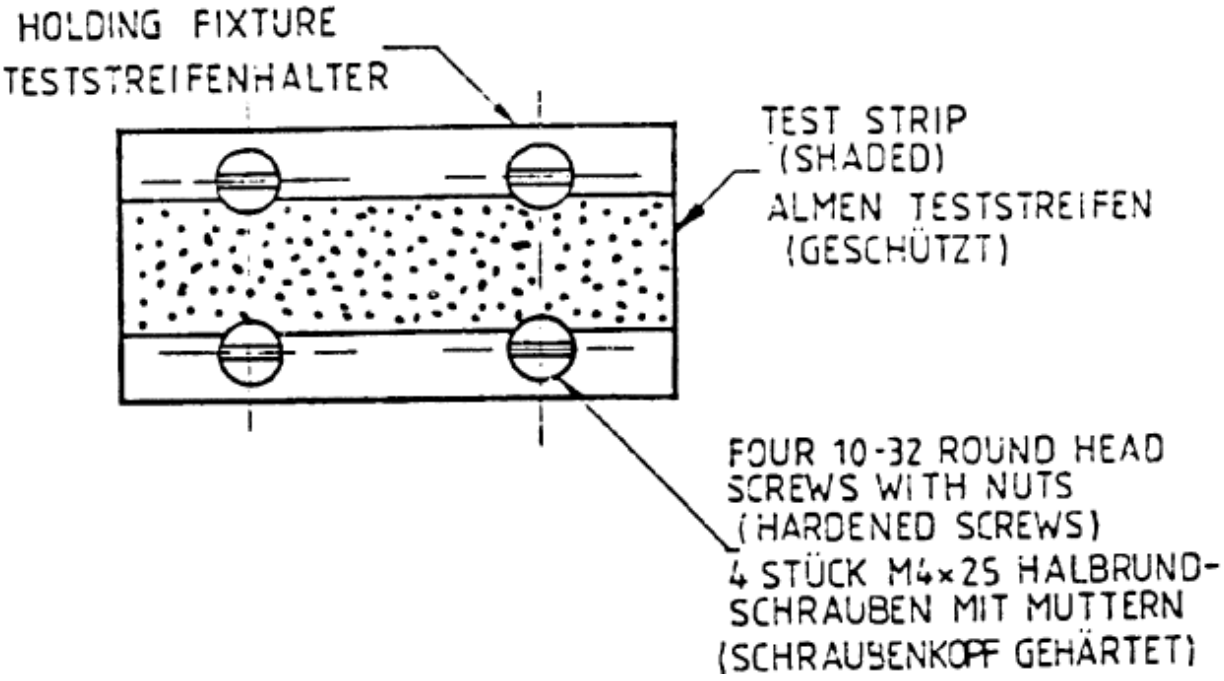

Figure 7: Assembled test Strip and Holding Fixture

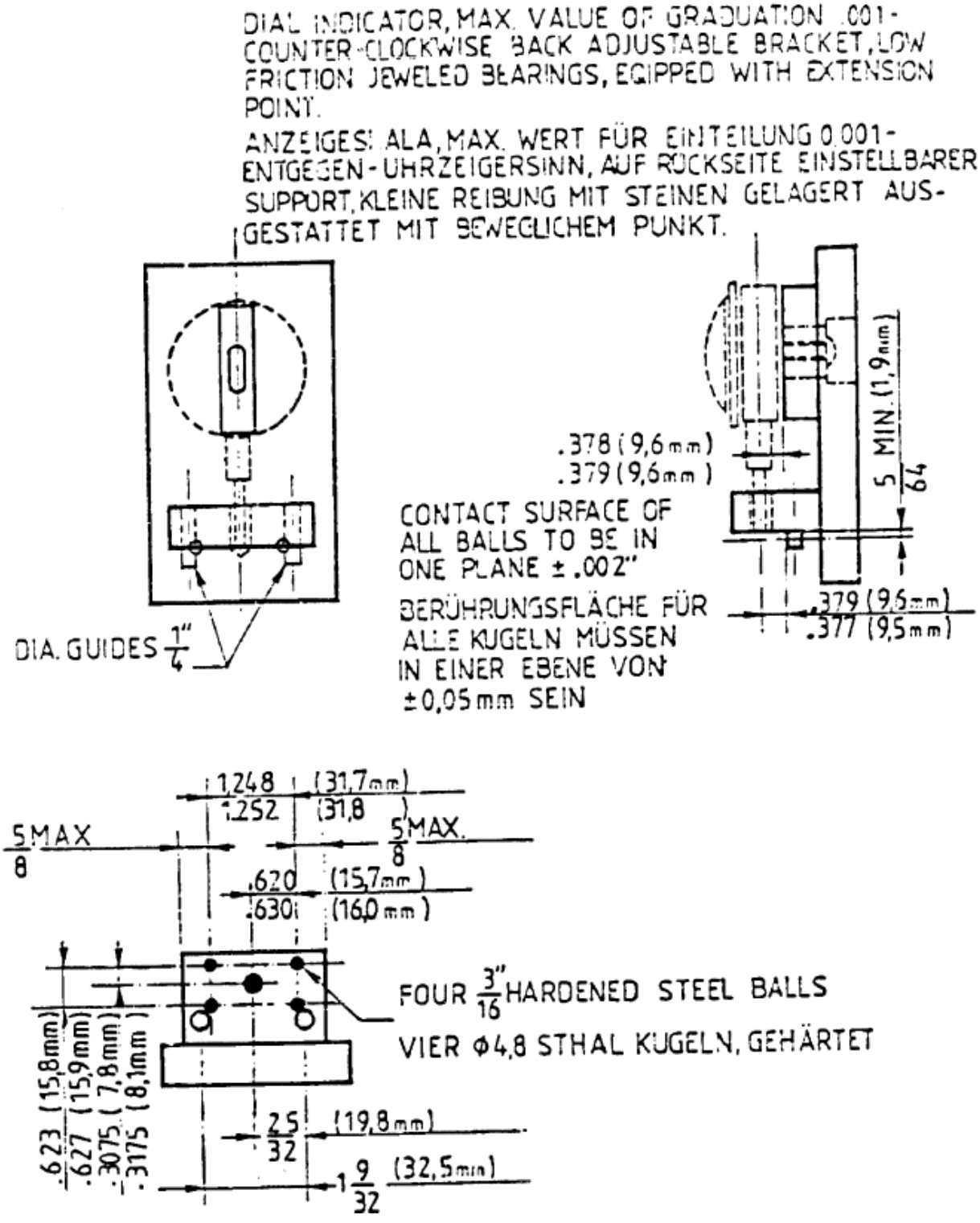

Figure 8: Test Gauge

5 Process requirements

5.1 Specific process requirements

5.1.1 Specifications to be followed

(1) MIL-S-13165B "Blast Strengthening (Shot-Blasting) of Parts Made of Iron"

(2) AMS 2430H "Blast Strengthening (ShotBlasting)"

(3) MIL M-851 "Steel Grit, Shot, and Shot from Wire CuHings"

(4) MIL A-9954 "Glass Beads"

5.1.2 Equipment

(1) The machine for shot-blasting shall have a mechanical drive and be capable of producing the blast intensities required for the shot-peening. It shall be so equipped that dry metal shot can be directed in an even flow against the piece, which is being guided either under compressed air control or by directed centrifugal force. Mechanisms shall also be provided so that the piece can be moved or guided through the flow of shot, or so that the flow of shot across the piece can be directed either longitudinally or rotationally, or both, depending on requirements, to attain the degree of coverage called for. In addition, the equipment shall contain some device that makes it possible to remove broken and damaged shot during the blasting process.

(2) The machine used for shot-blasting with glass beads shall fulfill the same requirements as indicated in Sect 5.1.2 (1) above, using glass beads instead of metal shot. Take every possible precaution to see that broken glass beads are removed during the blasting process. Otherwise, there is danger of erosion and the removal of metal. When using wet glass for strengthening, check the slurries every 15 minutes using a measuring flask or a burette and maintain a proportion of 35 to 45% by volume of glass. If the calibration should drop below 35%, the machine shall be cleaned in order to bring the glass back into the solution state.

6 Associated standards

Refer to Table 3 and Table 4.

7 Transportation and logistic requirements

This section is not applicable to this specification.

8 Notes

8.1 Identification of changes

Revision	Date	Changes made
B	2010-06-07	Contents copied to new Alstom format and content refined.

Note: Triangles to indicate changes are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

9 Appendices

This section is not applicable to this specification.

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
9560	HTCT 80155	C	B	2010-06-23	EN	Approved