VERBAND DER DEUTSCHEN FEDERNINDUSTRIE	**Metallisches Strahlmittel Gerundetes Stahldrahtkorn Güteanforderungen, Prüfungen**	**VDFI 8001** Ausgabe Oktober 1994 Ersatz für VDF 8001 Dezember 1982 Issue: Oktober 1994 Supersedes VDF 8001 of Dezember 1982

Metallic abrasives, cut wire pellets; Quality requirements, tests.

Grenaille métallique; Fil coupé d'acier rodé; Exigences techniques - Controles

Abrasivos, metálicos de proyección; Granallas de alambre de acero redondeadas; Exigencias de calidad, ensayos

1. PURPOSE

Peening media used in the sector of spring industry are generally aimed at improving the mechanical properties of springs under dynamic stress.
Shot Peening (surface hardening) used to this end is a manufacturing process, the result of which directly depends on the type of peening media employed. Consequently that field of application makes it necessary to specify for peening media particular requirements that are more detailed and more stringent than those laid down in the standard sheet DIN 8201 Part 4 - Solid Metallic Abrasives; Cut Wire Blasting Shot.

2. SCOPE

The present specification applies to Shot that are made from patented drawn steel wire and supplied conditioned in the sizes listed in Table 1.

3. DEFINITIONS

Conditioned (rounded) Cut Wire Shot shall mean the state in which peening media are used for Shot Peening (surface hardening). The degree of conditioning is more or less pronounced depending on the intended application.
The standard abbreviation for that grain shape is, according to DIN 8201 Part 1: G.
For further definitions, see the standard sheet DIN 8200.

4. DESIGNATION

With reference to DIN 8201 Part 4 the designation of any type of Cut Wire Shot consists of the following data:
· the denomination
· the abbreviation for the type of Cut Wire Shot
· the abbreviation for the grain shape of the Cut Wire Shot
· the degree of conditioning
· the nominal diameter of the Cut Wire Shot
· the abbreviation for the range of Vickers hardness
· and the abbreviation for the present specification.

Example:
Cut Wire Shot that were rounded according to the standard series, picture 1, nominal diameter of the cut wire 0.9 mm, hardness range 610 to 670 HV1, with reference to the present specification:
Metallic abrasive StD-G1 0.9 HV 640 - VDFI 8001.

5. REQUIREMENTS

5.1 Material
The raw material used for the manufacture of Cut Wire Shot is wire rod to DIN 17140.

5.2 Steel wire
The base material of Cut Wire Shot is generally patented, drawn steel wire to DIN 17223 Part 1. Tensile strength shall be adjusted so as to reach the hardness values stated in Table 1. The raw material to be used is steel wire that shall be new and shall not show any deep cracks, grooves or scales on its surface. Moreover, that surface shall be dry and free of any oil or corrosion traces. Any anticorrosive coatings such as cadmium, tin, zinc and paints are not permissible, unless otherwise specifically agreed upon. Steel wire with phosphatized surface may be used.

5.3 Grain shape and size
5.3.1 Visual inspections
The pictures shown in section 8 are meant to represent a standard series. Variations from the states shown are possible. The acceptability of such variations shall be negotiated between the supplier and the purchaser. The percentage of defective grains determined according to paragraph 6.2.2 shall not exceed 2 ‰. If the percentage of defective grains determined during the first inspection is found to be between 2 ‰ and 4 ‰, it is permissible to carry out a second test, the result of which must be inferior to the 2 ‰ limit. A percentage of defective grains superior to 4 ‰ directly results in the rejection of the batch.

5.3.2 Measurement test
The grain size of Conditioned Cut Wire Shot is determined by carrying out a screening analysis according to paragraph 6.2.3. Test sifting shall yield the following rejects:

1st sieve: ≤ 5 % 2nd sieve: ≥ 85 % 3rd sieve: ≤ 10 % Percentage of dust: ≤ 0.5 %

5.4 Vickers hardness
Vickers hardness HV 0.5 or HV 1 shall be determined according to paragraph 6.2.4 and yield an arithmetic mean that is within the range of tolerance stated in Table 1. None of the measured values shall exceed, or be inferior to, the limit values stated in Table 1 by more than 30 HV 0.5 or HV 1.

5.5 Durability
The durability of the tested Cut Wire Shot shall be determined according to paragraph 6.2.5 and expressed using the number of cycles performed in the Ervin tester; the durability obtained shall not be inferior to the numerical values stated in Table 1.

6. TESTING

6.1 Sampling
The quantity of Conditioned Cut Wire Shot required to carry out all tests is taken from the batch according to DIN 50310, and divided following the standardized partition procedure to perform the various tests.

6.2 Testing procedures
6.2.1 Determination of the carbon content
The carbon content is determined using the incineration method.

6.2.2 Determination of the grain shape and percentage of defective grains
Cut Wire Shot taken from a subsample are spread on a level surface to form a dense layer of grains from which one takes a further subsample using a piece of adhesive tape measuring 100 mm x 30 mm, the grains on the tape being subjected to visual inspection.
The grain shape is assessed using a magnification of 20 to 25 times by comparing with pictures 1 to 3 of the standard series. The same magnification is used to determine the percentage of defective grains.
On the testing surface of 3000 mm² there may be found, as a function of the Shot size, at most the following numbers of defective grains, defective meaning here not rounded grains or grains showing another degree of rounding:

Diameter of the Cut Wire Shot	Acceptable percentage of defective grains	
mm	2‰	4‰
0.3	21	42
0.4	18	36
0.6	14	28
0.7	11	22
0.8	8	16
0.9	6	12
1.0	5	10

6.2.3 Screening analysis

The quantity required to carry out the test sifting will be taken from a subsample of Cut Wire Shot. That sifting is performed using a set of test sieves [1]). The quantity of grains remaining on each sieve shall be weighted and expressed as ponderal percentage of the total quantity of Shot used for the sifting. Only hand sifting is permissible.

Mesh size of test sieves:

1st sieve = Nominal diameter of the Shot + 0.1 mm
2nd sieve = Nominal diameter of the Shot
3rd sieve = Nominal diameter of the Shot - 0.1 mm

6.2.4 Vickers hardness

Approximately 50 grains are taken from a subsample of cut wire pellets, spread to form one layer, and mounted in epoxy resin showing a setting temperature below 140°C. After setting, the test piece is to be wet-ground and then polished using diamond powder of 3 µm average grain size. Grinding and polishing of the surface shall be performed down to one third of the nominal diameter of the grains used.
The exposed polished surface of the grains has to be **most gently** etched using a 3% nitric acid solution in alcohol. Hardness measurement is taken to DIN 50311 at the centre of 20 grains, the microstructure of which clearly indicates that they have been cut along their longitudinal axis, and the arithmetic mean calculated. Test load shall be: 4.9035 N (HV 0.5) for cut wire pellets with 0.3 mm nominal diameter, and 9.807 N (HV 1) for Cut Wire Shot with a nominal diameter ranging from 0.4 to 1.0 mm inclusive.

6.2.5 Durability test

Take 220 g from a subsample of Cut Wire Shot. From that quantity a further portion of 100 g is used to fill the Ervin tester. One cycle consists of 500 revolutions. After each cycle the operating mix is put through a separating sieve of 0.3 mm [2]) mesh size to eliminate the smaller particles, the quantity thus lost being replaced by the same weight of new Shot. Perform as many cycles as are necessary for the total quantity lost to exceed 100 g. Using interpolation you can deduct the number of revolutions corresponding to a total loss of exactly 100 g. That number of revolutions is the durability.

6.2.6 Rejection

If the requirements laid down in section 5 are not met, the supply can be rejected. The manufacturer shall be informed of the intended rejection, and be given the opportunity of convincing himself of the justification of the complaint.

7. QUOTED STANDARDS

DIN 8200	Abrasive blasting process technology; definitions, classification of blasting procedures
DIN 8201	Part 1 Solid abrasives; classification, designation
DIN 8201	Part 4 Solid abrasives; cut wire blasting Shot
DIN 17140	Wire rods made from ordinary low carbon steels and unalloyed high-grade steels; quality requirements
DIN 17223	Part 1, Round spring steel wire; patented, drawn spring wire made from unalloyed steels; technical specifications
DIN 50133	Part 2, Testing of metallic materials; Vickers hardness test; test load range 1.96 to 49 N (0.2 to 5 kp) (low load range)
DIN 50310	Testing of metallic abrasives; sampling
DIN 50311	Testing of metallic abrasives; hardness test on metallic abrasives
ISO 3310-1	Sieves for test sifting; requirements and tests; Part 1: Test sieves and metal wire cloth (English text)
DIN ISO 11 125 [3])	Method of testing metallic abrasives; Part 2: Determination of grain size distribution Part 3: Determination of hardness

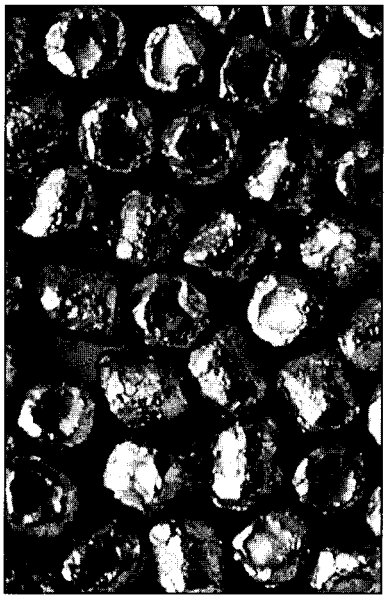
[1]) A list of suppliers of test sieves is available from the Verband der Deutschen Federnindustrie (German Spring Manufacturers Association), Haßleyer Straße 37, D-58093 Hagen on request.

[2]) For cut wire Shot of 0.3 mm nominal diameter the mesh size of the separating sieve to be used is 0.2 mm.

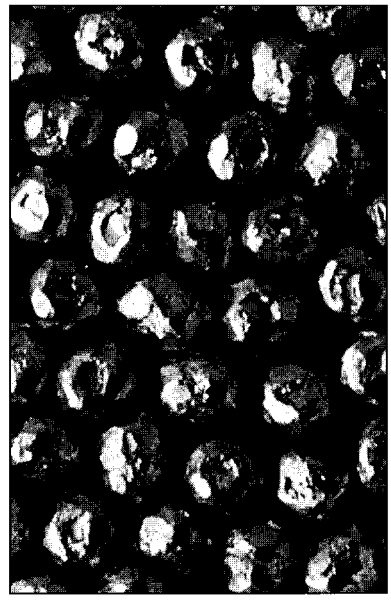
[3]) Currently draft standard.

8. STANDARD SERIES OF GRAIN SHAPES

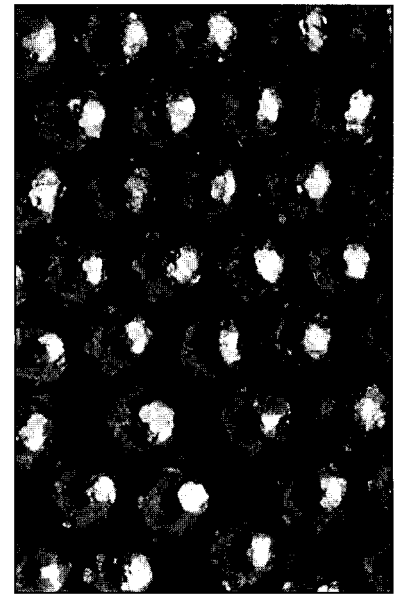
Magnification 25 times



G1



G2



G3

Table 1
Quality requirements for Conditioned Cut Wire Shot

Nominal diameter of Cut Wire Shot (mm)	Nominal value HV1 [4])	Hardness Limit values HV1 [4])	Class of material	Durability Minimum number of revolutions G1	G2	G3
0,3	640	610 - 670	D 75-2	4600	4500	4400
	670	640 - 700	D 75-2	4500	4400	4300
	700	670 - 730	D 85-2	4600	4500	4400
0,4	640	610 - 670	D 75-2	4400	4300	4200
	670	640 - 700	D-75-2	4300	4200	4100
	700	670 - 730	D 85-2	4400	4300	4200
0,5	640	610 - 670	D 75-2	4200	4100	4000
	670	640 - 700	D 75-2	4100	4000	3900
	700	670 - 730	D 85-2	4200	4100	4000
0,6	640	610 - 670	D 75-2	4000	3900	3800
	670	640 - 700	D 75-2	3900	3800	3700
	700	670 - 730	D 85-2	4000	3900	3800
0,7	640	610 - 670	D 75-2	3700	3600	3500
	670	640 - 700	D 75-2	3600	3500	3400
	700	670 - 730	D 85-2	3700	3600	3500
0,8	640	610 - 670	D 75-2	3500	3400	3300
	670	640 - 700	D 75-2	3400	3300	3200
	700	670 - 730	D 85-2	3500	3400	3300
0,9	640	610 - 670	D 75-2	3300	3200	3100
	670	640 - 700	D 75-2	3200	3100	3000
	700	670 - 730	D 85-2	3300	3200	3100
1,00	640	610 - 670	D 75-2	3100	3000	2900
	670	640 - 700	D 75-2	3000	2900	2800
	700	670 - 730	D 85-2	3100	3000	2900

[4]) For Cut Wire Shot of 0,3 mm nominal diameter, use HV 0,5.

VERBAND DER DEUTSCHEN FEDERNINDUSTRIE

Verband der Deutschen Federnindustrie — Haßleyer Str. 37 — D-58093 Hagen
Telephone: (0 23 31) 5 30 36-38 — Telefax: (0 23 31) 58 74 84