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STANDARD

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**Preparation of steel substrates before  
application of paints and related  
products — Specifications for metallic  
blast-cleaning abrasives —**

**Part 3:**  
High-carbon cast-steel shot and grit

*Préparation des subjectiles d'acier avant application de peintures et de  
produits assimilés — Spécifications pour abrasifs métalliques destinés à  
la préparation par projection —*

*Partie 3: Grenaille ronde et angulaire en acier moulé à haut carbone*



Reference number  
ISO 11124-3:1993(E)

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 11124-3 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 12, *Preparation of steel substrates before application of paints and related products*.

ISO 11124 consists of the following parts, under the general title *Preparation of steel substrates before application of paints and related products — Specifications for metallic blast-cleaning abrasives*:

- *Part 1: General introduction and classification*
- *Part 2: Chilled-iron grit*
- *Part 3: High-carbon cast-steel shot and grit*
- *Part 4: Low-carbon cast-steel shot*
- *Part 5: Cut steel wire*

At the time of publication of this part of ISO 11124, part 5 was in course of preparation.

Annexes A and B of this part of ISO 11124 are for information only.

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# Preparation of steel substrates before application of paints and related products — Specifications for metallic blast-cleaning abrasives —

## Part 3:

### High-carbon cast-steel shot and grit

**WARNING** — Equipment, materials and abrasives used for surface preparation can be hazardous if used carelessly. Many national regulations exist for those materials and abrasives that are considered to be hazardous during or after use (waste management), such as free silica or carcinogenic or toxic substances. These regulations are therefore to be observed. It is important to ensure that adequate instructions are given and that all required precautions are exercised.

## 1 Scope

This part of ISO 11124 specifies requirements for 14 grades of high-carbon cast-steel shot and 12 grades of high-carbon cast-steel grit, as supplied for blast-cleaning processes. Values are specified for hardness, density, defect/structural requirements and chemical composition.

The requirements specified in this part of ISO 11124 apply to abrasives supplied in the "new" condition only. They do not apply to abrasives either during or after use.

**Test methods for metallic blast-cleaning abrasives are given in the various parts of ISO 11125.**

High-carbon cast-steel shot and grit are used in both static and site blasting equipment. They are most often selected where a facility exists for the recovery and re-use of the abrasive.

### NOTES

1 Information on commonly referenced national standards for metallic abrasives and their approximate relationship with ISO 11124 is given in annexes A and B.

2 Although this part of ISO 11124 has been developed specifically to meet requirements for preparation of steelwork, the properties specified will generally be appropriate for use when preparing other material surfaces, or components, using blast-cleaning techniques. These techniques are described in ISO 8504-2:1992, *Preparation of steel substrates before application of paints and related products — Surface preparation methods — Part 2: Abrasive blast-cleaning*.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 11124. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 11124 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 439:1982, *Steel and cast iron — Determination of total silicon — Gravimetric method.*

ISO 629:1982, *Steel and cast iron — Determination of manganese content — Spectrophotometric method.*

ISO 4935:1989, *Steel and iron — Determination of sulfur content — Infrared absorption method after combustion in an induction furnace.*

ISO 9556:1989, *Steel and iron — Determination of total carbon content — Infrared absorption method after combustion in an induction furnace.*

ISO 10714:1992, *Steel and iron — Determination of phosphorus content — Phosphovanadomolybdate spectrophotometric method.*

ISO 11125-1:1993, *Preparation of steel substrates before application of paints and related products — Test methods for metallic blast-cleaning abrasives — Part 1: Sampling.*

ISO 11125-2:1993, *Preparation of steel substrates before application of paints and related products — Test methods for metallic blast-cleaning abrasives — Part 2: Determination of particle size distribution.*

ISO 11125-3:1993, *Preparation of steel substrates before application of paints and related products — Test methods for metallic blast-cleaning abrasives — Part 3: Determination of hardness.*

ISO 11125-4:1993, *Preparation of steel substrates before application of paints and related products — Test methods for metallic blast-cleaning abrasives — Part 4: Determination of apparent density.*

ISO 11125-5:1993, *Preparation of steel substrates before application of paints and related products — Test methods for metallic blast-cleaning abrasives — Part 5: Determination of percentage defective particles and of microstructure.*

ISO 11125-6:1993, *Preparation of steel substrates before application of paints and related products — Test methods for metallic blast-cleaning abrasives — Part 6: Determination of foreign matter.*

ISO 11125-7:1993, *Preparation of steel substrates before application of paints and related products — Test methods for metallic blast-cleaning abrasives — Part 7: Determination of moisture.*

### 3 Definitions

For the purposes of this part of ISO 11124, the following definitions apply.

**3.1 high-carbon cast-steel shot:** A metallic blast-cleaning abrasive produced by a casting process in which molten high-carbon steel is formed into shot (see also 3.3) by means of an atomization process.

**3.2 high-carbon cast-steel grit:** A metallic blast-cleaning abrasive obtained by crushing various high-carbon cast-steel shot sizes into sharp-edged angular particles.

**3.3 shot:** Particles that are predominantly round, that have a length of less than twice the maximum particle width and that do not have edges, broken faces or other sharp surface defects.

**3.4 grit:** Particles that are predominantly angular, that have fractured faces and sharp edges and that are less than half round in shape.

**3.5 defect:** A fault or weakness in an abrasive which, if present at or above a given level, may be detrimental to the performance characteristics of the abrasive (see table 3).

**3.5.1 void:** A smooth-surfaced internal cavity considered undesirable when greater than 10 % of the cross-sectional area of a particle.

**3.5.2 shrinkage defect:** An internal cavity with a rough dendritic surface or a zone of microporosity, considered undesirable when greater than 40 % of the cross-sectional area of a particle.

**3.5.3 crack:** A linear discontinuity that has a length-to-width ratio of 3:1 or greater, that extends over more than 20 % of the diameter or shortest dimension of a particle and that is radial in direction.

**3.6 foreign matter:** Any material or particles mixed with the abrasive which are not attached to the abrasive particles and which are nonmagnetic.



#### 4 Designation of abrasives

High-carbon cast-steel shot and grit shall be identified by "Abrasive ISO 11124" and the abbreviation "M/HCS" indicating metallic, high-carbon cast-steel abrasive. The symbol "S" or "G" shall follow to indicate the required particle shape of the shot or grit as purchased. The designation shall be completed by a 3-digit number denoting the grade, or nominal particle size, required. If alternative hardnesses of abrasive are available, the particular Vickers hardness (HV) range required shall be specified (see example 2).

##### EXAMPLE 1

##### **Abrasive ISO 11124 M/HCS/S140**

denotes an abrasive of the metallic, high-carbon cast-steel type, complying with the requirements of this part of ISO 11124, of particle shape shot and grade 140 (i.e. nominal particle size 1,40 mm).

##### EXAMPLE 2

##### **Abrasive ISO 11124 M/HCS/G140/570-710HV**

denotes an abrasive of the metallic, high-carbon cast-steel type, complying with the requirements of this part of ISO 11124, of particle shape grit and grade 140 (i.e. nominal particle size 1,40 mm), and with a hardness range of 570 HV to 710 HV.

It is essential that this full product designation is quoted on all orders.

##### NOTES

3 Grade requirements and codes are specified in tables 1 and 2. The grade code is based on a number indicating the approximate middle of the particle size range, or nominal diameter, for each grade, expressed in millimetres × 100.

4 Annex A provides guidance on approximately equivalent grades and codings in other commonly referenced national standards for cast-metal abrasives.

#### 5 Sampling

Sampling procedures shall be as specified in ISO 11125-1.

#### 6 Requirements for high-carbon cast-steel shot and grit abrasives

The requirements for high-carbon cast-steel shot and grit abrasives shall be as specified in table 3.

#### 7 Package identification and lot traceability

All supplies shall be clearly marked and identified using the designation system specified in clause 4. The unit of sale, i.e. pallet, drum, box, etc., shall be clearly labelled with the full product coding, including hardness range, if applicable.

Sub-units, i.e. bags, shall be marked with the particle shape and grade codes.

NOTE 5 Inclusion of additional marking to allow product traceability to a particular production period or lot is strongly recommended. Traceability references should be included at least at the pallet, drum or box level of package marking.

#### 8 Information to be provided by the manufacturer or supplier

The manufacturer or supplier shall provide, if requested, a test report detailing results for any relevant property as determined by the appropriate method specified in table 3.

**Table 1 — Screening specifications by grade — High-carbon cast-steel shot — Cumulative % retained**

Grade code	Sieve mesh aperture, mm																			
	4,75	4,00	3,35	2,80	2,38	2,00	1,70	1,40	1,18	1,00	0,85	0,71	0,60	0,50	0,425	0,355	0,300	0,250	0,180	0,125
S400	0		> 90	> 97																
S300		0		> 90	> 97															
S280			0		> 90	> 97														
S240				0		> 85	> 97													
S200					0		> 85	> 97												
S170						0		> 85	> 97											
S140						0	< 5		> 85	> 96										
S120							0	< 5		> 85	> 96									
S100								0	< 5		> 85	> 96								
S080									0	< 5		> 85	> 96							
S070										0	< 10		> 85	> 97						
S060											0	< 10		> 85	> 97					
S040												0	< 10		> 85	> 97				
S030														0	< 10		> 80		> 90	
															0	< 10			> 80	> 90

NOTE — For convenience, a similar table is used in most parts of ISO 11124. Not all sieve mesh apertures are relevant in each case.

**Table 2 — Screening specifications by grade — High-carbon cast-steel grit — Cumulative % retained**

Grade code	Sieve mesh aperture, mm																		
	2,80	2,38	2,00	1,70	1,40	1,18	1,00	0,85	0,71	0,60	0,50	0,425	0,335	0,300	0,250	0,180	0,125	0,075	0,045
G240	0		> 80	> 90															
G200		0		> 80	> 90														
G170			0		> 80	> 90													
G140				0		> 75	> 85												
G120					0		> 75		> 85										
G100						0			> 70			> 80							
G070							0					> 70		> 80					
G050													0	> 65		> 75			
G030														0		> 65	> 75		
G020															0		> 60	> 70	
G010																0		> 55	> 65
G005																	0		> 20

NOTE — For convenience, a similar table is used in most parts of ISO 11124. Not all sieve mesh apertures are relevant in each case.

Table 3

Property	Requirement	Test method												
Grade size	See tables 1 and 2.	ISO 11125-2												
Hardness	<p>90 % of the particles tested shall have a hardness value within one of the ranges specified below:</p> <p><i>Standard hardnesses:</i></p> <table style="margin-left: 40px;"> <tr> <td></td> <td>Hardness</td> </tr> <tr> <td>Shot</td> <td>390 HV to 530 HV</td> </tr> <tr> <td>Grit</td> <td>390 HV to 530 HV</td> </tr> <tr> <td></td> <td>470 HV to 610 HV</td> </tr> <tr> <td></td> <td>570 HV to 710 HV</td> </tr> <tr> <td></td> <td>700 HV minimum</td> </tr> </table> <p><i>Special hardnesses (shot and grit):</i></p> <p>Other hardness ranges can be specified by the purchaser, with a minimum of 90 % of the particles having a minimum range of approximately 140 HV.</p> <p>Metallic abrasives sometimes contain internal shrinkage defects or voids which remain undetected beneath the surface in a mounted and polished sample. These hidden cavities cause a non-uniform hardness indentation and give an erroneous hardness reading. These indentations shall be ignored.</p>		Hardness	Shot	390 HV to 530 HV	Grit	390 HV to 530 HV		470 HV to 610 HV		570 HV to 710 HV		700 HV minimum	ISO 11125-3
	Hardness													
Shot	390 HV to 530 HV													
Grit	390 HV to 530 HV													
	470 HV to 610 HV													
	570 HV to 710 HV													
	700 HV minimum													
Apparent density	min. $7,0 \times 10^3 \text{ kg/m}^3$ ( $7,0 \text{ kg/dm}^3$ )	ISO 11125-4												
Defects (see 3.5)  Particle shape a) Shot b) Grit  Voids Shrinkage defect Cracks a) Shot b) Grit  Total defects a) Shot b) Grit	<p>Defects present in the particles examined shall not exceed the following levels:</p> <table style="margin-left: 40px;"> <tr> <td>max. 5 % non-round</td> </tr> <tr> <td>max. 10 % shot or greater than half-round for grit up to 700 HV, max. 5 % for grit above 700 HV</td> </tr> <tr> <td>max. 10 %</td> </tr> <tr> <td>max. 10 %</td> </tr> <tr> <td>max. 15 %</td> </tr> <tr> <td>max. 40 %</td> </tr> <tr> <td>max. 20 %</td> </tr> <tr> <td>max. 40 %</td> </tr> </table>	max. 5 % non-round	max. 10 % shot or greater than half-round for grit up to 700 HV, max. 5 % for grit above 700 HV	max. 10 %	max. 10 %	max. 15 %	max. 40 %	max. 20 %	max. 40 %	ISO 11125-5				
max. 5 % non-round														
max. 10 % shot or greater than half-round for grit up to 700 HV, max. 5 % for grit above 700 HV														
max. 10 %														
max. 10 %														
max. 15 %														
max. 40 %														
max. 20 %														
max. 40 %														
Particles with more than one of the above defects shall be counted only once in this total.														
Foreign matter (including slag)	max. 1 % (m/m)	ISO 11125-6												

Property	Requirement	Test method										
Structure	<p>Cast-steel shot and grit abrasives shall have a uniform martensite and/or bainite microstructure, tempered to a degree consistent with the hardness range, with fine, well-distributed carbides, if any. Partial decarburization, carbide networks and interdendritic grain boundary segregation with high-temperature transformation products such as pearlite are undesirable.</p> <p>No more than 15 % of the particles tested shall have undesirable microstructure.</p>	ISO 11125-5										
Chemical composition	<table border="0"> <tr> <td>Carbon</td> <td>0,80 % (m/m) to 1,2 % (m/m)</td> </tr> <tr> <td>Manganese</td> <td>0,35 % (m/m) to 1,2 % (m/m)</td> </tr> <tr> <td>Silicon</td> <td>min. 0,4 % (m/m)</td> </tr> <tr> <td>Sulfur</td> <td>max. 0,05 % (m/m)</td> </tr> <tr> <td>Phosphorus</td> <td>max. 0,05 % (m/m)</td> </tr> </table> <p>The manganese content shall be sufficiently high to achieve the required hardness throughout the section of all particles.</p>	Carbon	0,80 % (m/m) to 1,2 % (m/m)	Manganese	0,35 % (m/m) to 1,2 % (m/m)	Silicon	min. 0,4 % (m/m)	Sulfur	max. 0,05 % (m/m)	Phosphorus	max. 0,05 % (m/m)	ISO 9556 ISO 629 ISO 439 ISO 4935 ISO 10714
Carbon	0,80 % (m/m) to 1,2 % (m/m)											
Manganese	0,35 % (m/m) to 1,2 % (m/m)											
Silicon	min. 0,4 % (m/m)											
Sulfur	max. 0,05 % (m/m)											
Phosphorus	max. 0,05 % (m/m)											
Moisture	<p>max. 0,2 % (m/m)</p> <p>NOTE — It is essential that cast-steel shot and grit abrasives are supplied and used in a dry condition. They should be stored indoors in dry surroundings to prevent condensation, rusting and deterioration of the abrasive, rendering it unsuitable for use.</p>	ISO 11125-7										



## Annex A (informative)

### Approximately equivalent codings for shot and grit abrasives

Commonly referenced national standards for metallic abrasives are based on different coding systems for particle size range or grade.

Approximately equivalent codings in some of these national standards are shown in table A.1 and the nearest equivalent codings in ISO 11124 are shown alongside.

This list is purely informative and should not be taken as indicating that grades are equal. It covers the full range of ISO 11124 codings. This part of ISO 11124 may not contain all the codings listed.

ISO 11124 size limits are identical with those specified in SAE J444:1984.

**Table A.1**

	SAE J444: 1984	BS 2451: 1963	DIN 8201 Teil 2: 1985	ISO Coding
<b>Shot</b>	S1320	S1320	—	S400
	S1110	S1110	—	S300
	S930	S950	—	S280
	S780	S800	2,0 to 2,8	S240
	S660	S660	1,6 to 2,24	S200
	S550	S550	1,25 to 2,0	S170
	S460	S470	—	S140
	S390	S390	1,0 to 1,6	S120
	S330	S340	—	S100
	S280	—	0,8 to 1,25	S080
	S230	S240	0,6 to 1,0	S070
	S170	S170	0,4 to 0,8	S060
	S110	S120	0,3 to 0,6	S040
	S70	S070	0,2 to 0,4	S030
	<b>Grit</b>	—	G95	<b>DIN 8201 Teil 3: 1985</b> —
G10		G80	2,0 to 2,8	G240
G12		G66	1,6 to 2,24	G200
G14		G55	1,25 to 2,0	G170
G16		G47	1,0 to 1,6	G140
G18		G39	1,0 to 1,6	G120
G25		G34	0,8 to 1,25	G100
G40		G24/G17	0,6 to 1,0/0,4 to 0,8	G070
G50		G12	0,3 to 0,6	G050
G80		G07	0,2 to 0,4	G030
G120		G05	0,16 to 0,3	G020
G200		G02	0,1 to 0,2	G010
G325		G02	—	G005

NOTE — "S" signifies shot, i.e. round particle form.  
"G" signifies grit, i.e. angular particle form.

## Annex B (informative)

### Bibliography

Commonly referenced national standards for metallic abrasives are as follows:

- [1] BS 2451:1963, *Specification for chilled-iron shot and grit.*
- [2] DIN 8201 Teil 1:1985, *Feste Strahlmittel; Einteilung, Bezeichnung.*
- [3] DIN 8201 Teil 2:1985, *Feste Strahlmittel; metallisch, gegossen, Kornform kugelig.*
- [4] DIN 8201 Teil 3:1985, *Feste Strahlmittel; metallisch, gegossen, Kornform kantig.*
- [5] DIN 8201 Teil 4:1985, *Feste Strahlmittel; Stahldrahtkorn.*
- [6] JIS G5903:1975, *Cast shot and grit.*
- [7] SAE J444:1984, *Cast-shot and grit size specification for peening and cleaning.*
- [8] SAE J827:1990, *Cast steel shot.*
- [9] SAE J441:1987, *Cut wire shot.*

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**Descriptors:** paints, varnishes, substrates, steel products, blast-cleaning, abrasives, metallic abrasives, specifications, designation.

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