भारतीय मानक

Indian Standard

IS 9139 : 2023

फाउंड्रीज़ में उपयोग के लिए आघातवर्ध्य लोहे के शॉट्स और ग्रिट्स — विशिष्टि

(पहला पुनरीक्षण)

Malleable Iron Shots and Grits for Use in Foundries — Specification

(First Revision)

ICS 77.180

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

August 2023 **Price Group 7**

Foundry and Steel Castings Sectional Committee, MTD 14

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Foundry and Steel Castings Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1979. This revision has been brought out to bring the standard in the latest style and format of the Indian Standards. It also incorporates 2 amendments issued to the last version of the standard.

In addition, the following changes have been made:

a) Reference clause has been included;
b) Clause **7.1** is modified;
c) For chemical analysis, IS 12308 (relevant parts) are referred in place of IS 228 (relevant parts);
d) In Table 1 and Table 2, sieve sizes were updated as per IS 460 (Part 1); and
e) Packing and marking clauses were modified.

This standard is one of the series of specifications for abrasives for use in foundries in shots blasting machines for cleaning of castings. The other standards are as follows:

IS 4606 : 1983	Specification for steel shots for use in foundries (*first revision*)
IS 4683 : 1968	Specification for chilled iron shot and grit for use in foundries
IS 5873 : 1970	Specification for steel cut-wire shots for use in foundries

Malleable iron abrasives give a less severe abrasive action but a longer life as compared to chilled iron shot and grit. These are cheaper than steel shots having a little less abrasive action and life.

The composition of the Committee responsible for formulation of this standard is given in Annex D.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be same as that of the specified value in this standard.

Indian Standard

MALLEABLE IRON SHOTS ANDGRITS FOR USE IN FOUNDRIES — SPECIFICATION

(First Revision)

1 SCOPE

This standard covers the requirements for malleable iron shot and grit for use in foundries as shot blasting machine abrasive.

2 REFERENCES

The Indian Standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards.

3 DESIGNATION AND GRADING

3.1 Malleable iron shot shall be designated as S-M and graded by the shot number which is the aperture size of the retaining screen in thousandths of a millimetre (*see* Table 1).

3.2 Malleable iron grit shall be designated as G-M graded by the grit number which is the aperture size of the retaining screen in hundredths of a millimetre (*see* Table 2).

4 SUPPLY OF MATERIAL

General requirements relating to the supply of malleable iron shot and grit to this specification shall be as laid down in IS 1387.

5 MANUFACTURE

The malleable iron shot and grit shall be manufactured by malleablising white iron shot and grit using a suitable heat treatment procedure.

6 SHAPE

6.1 Shot

The particle shall as far as practicable be spherical and solid and shall not contain more than 5 percent of ‘tail,’ and irregular particles.

6.2 Grit

The particle shall show good angularity of form with sharp cutting edges and shall be substantially free from ‘half rounds’ (that is, shot split into half only).

7 SIZE

The particle size shall be determined by using test sieves. In Table 1 and Table 2, the test sieves used shall be in accordance with sizes specified in IS 460 (Part 1). The standard test sieve will, after period of time, become less accurate. The sieve shall, therefore, be periodically checked according to IS 460 (Part 3) and the correction factor shall be determined and applied to the result. When IS sieves are not available, equivalent BS or ASTM sieves specified in Annex B may be used. The proportions retained and passed shall comply with the limits given in Table 1 and Table 2.

Example:

1) Shot Grade S-M 1180 — The whole sample passes through 2.00 mm IS Sieve. At most 5 percent is retained on 1.70 mm IS Sieve. At least 80 percent is retained on 1.18 mm IS Sieve. At most 15 percent passes through 1.18 mm IS Sieve. At most 15 percent passes through 1.18 mm IS Sieve and at most 1 percent through 0.85 mm IS Sieve.

2) Grit Grade G-M 60 — The whole sample passes through 1.00 mm IS Sieve. At least 70 percent is retained on 600 micron IS Sieve. At most 15 percent passes through 600 micron IS Sieve and at most 4 percent passes through 425 micron IS Sieve.

8 CHEMICAL COMPOSITION

The chemical composition of the material shall be determined either by the methods specified in relevant parts of IS 12308 or any other established instrumental/chemical method. In case of dispute, the procedure given in the relevant Parts of IS 12308 shall be the referee method. The material shall have the following composition:

Sl No.	*Constituent*	*Percent*
(1)	(2)	(3)
i)	Carbon	2.0 to 3.0
ii)	Silicon	0.8 to 2.0
iii)	Manganese	1.0 *Max*
iv)	Sulphur	0.2 *Max*
v)	Phosphorus	0.2 *Max*

Table 1 Shot Grade Numbers

(*Foreword*, *Clauses* 3.1 *and* 7)

Sl No.	IS Sieve Designation	Width of Aperture mm	Shot Number												
			S-M3350	S-M2800	S-M2360	S-M2000	S-M1700	S-M1400	S-M1180	S-M1000	S-M850	S-M600	S-M425	S-M300	S-M180
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
i)	4.75 mm	4.75													
ii)	4.00 mm	4.00													
iii)	3.55 mm	3.55	90/10							All pass					
iv)	2.60 mm	2.60		90/10											
v)	2.36 mm	2.36			90/10										
vi)	2.00 mm	2.00				85/10									
vii)	1.70 mm	1.70					85/15		5 % *Max* ON						
viii)	1.40 mm	1.40						85/15		5 % *Max* ON					
ix)	1.18 mm	1.18							80/15		5 % *Max* ON				
x)	1.00 mm	1.00								80/15					
xi)	850 micron	0.850									80/15	10 % *Max* ON			
xii)	710 micron	0.710											10 % *Max* ON		

Table 1 (*Concluded*)

<table>
<tr><th rowspan="2">Sl No.</th><th rowspan="2">IS Sieve Designation</th><th rowspan="2">Width of Aperture
mm</th><th colspan="12">Shot Number</th></tr>
<tr><td>S-M 3350</td><td>S-M2800</td><td>S-M2360</td><td>S-M2000</td><td>S-M1700</td><td>S-M1400</td><td>S-M1180</td><td>S-M1000</td><td>S-M850</td><td>S-M600</td><td>S-M425</td><td>S-M300</td><td>S-M180</td></tr>
<tr><td>(1)</td><td>(2)</td><td>(3)</td><td>(4)</td><td>(5)</td><td>(6)</td><td>(7)</td><td>(8)</td><td>(9)</td><td>(10)</td><td>(11)</td><td>(12)</td><td>(13)</td><td>(14)</td><td>(15)</td><td>(16)</td></tr>
<tr><td>xiii)</td><td>600 micron</td><td>0.600</td><td></td><td></td><td colspan="7" rowspan="2">None pass, except 1 percent, Max allowed for fines</td><td></td><td></td><td>75 / 15</td><td></td><td></td><td></td></tr>
<tr><td>xiv)</td><td>500 micron</td><td>0.500</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>10 % Max ON</td><td></td></tr>
<tr><td>xv)</td><td>425 micron</td><td>0.425</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>75 / 15</td><td></td><td></td></tr>
<tr><td>xvi)</td><td>355 micron</td><td>0.355</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3" rowspan="3">None pass, except 2 percent, Max allowed for fines</td><td></td><td></td><td>10 % Max ON</td></tr>
<tr><td>xvii)</td><td>300 micron</td><td>0.300</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>75 / 20</td><td></td></tr>
<tr><td>xviii)</td><td>180 micron</td><td>0.180</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>75 / 20</td></tr>
<tr><td>xix)</td><td>90 micron</td><td>0.090</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Table 2 Grit Grade Numbers

(*Foreword*, *Clauses* 3.2 *and* 7)

Sl No.	IS Sieve Designation	Width of Aperture mm	Grit Number												
			G-M236	G-M200	G-M170	G-M140	G-M118	G-M100	G-M85	G-M60	G-M42	G-M30	G-M18	G-M09	G-M05
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	
i)	3.55 mm	3.55													
ii)	2.60 mm	2.60													
iii)	2.36 mm	2.36	80/10							All pass					
iv)	2.00 mm	2.00		80/10											
v)	1.70 mm	1.70			80/10										
vi)	1.40 mm	1.40				80/10									
vii)	1.18 mm	1.18					75/10								
viii)	1.00 mm	1.00						75/15							
ix)	850 micron	0.850							75/15						
x)	710 micron	0.710													
xi)	600 micron	0.600								75/15					
xii)	500 micron	0.500	None pass, except 2 percent, *Max* allowed for fines												
xiii)	425 micron	0.425									75/15				

Table 2 (*Concluded*)

xiv)	355 micron	0.355						None pass, except 4 percent, *Max* allowed for fines							
xv)	300 micron	0.300										65/20			
xvi)	180 micron	0.180											65/20		
xvii)	90 micron	0.090												60/25	

9 HARDNESS

9.1 The average hardness of the particles when tested in accordance with IS 1501 (Part 1) shall be 200 HV to 300 HV.

9.1.1 In obtaining average hardness values, at least 100 particles taken from the representative sample shall be mounted in plastic, ground and polished. A minimum of 20 hardness readings shall be taken at random in accordance with the method given in IS 1501 (Part 1) using a 5 kg load.

9.1.2 None of the hardness values shall be lower than 170 HV or higher than 345 HV.

10 MICROSTRUCTURE

10.1 Malleable iron shot and grit shall have a microstructure consisting of nodules of temper carbon in a matrix predominantly pearlitic or tempered martensitic. The free ferrite content in the matrix shall not exceed 10 percent. Free cementite shall not exceed 10 percent and it shall be distributed as isolated particles and not a continuous network. The abrasives shall be taken as not complying with this standard, if over 15 percent of particles have unsatisfactory microstructure.

10.2 The microstructure of the malleable iron shots and grits shall be prepared as per the procedure given in IS 7739 (Part 1) and IS 7739 (Part 5) and examined.

11 SPECIFIC GRAVITY

Specific gravity of malleable iron shots shall not be less than 6.6 g/ml nor contain more than 10 percent hollow shots. The method for determining the specific gravity may be the displacement method or on actual count of hollow shots in a mounted polished specimen.

12 SAMPLING

Representative samples drawn and the criteria for conformity for various requirements shall be as given in Annex C.

13 PACKAGING

Unless otherwise specified, the material shall be packed and supplied in bags each containing 50 kg, in any of the following bags:

a) Jute sacking bags;
b) Multi-wall paper sacks conforming to IS 11761;
c) HDPE/PP woven sacks conforming to IS 11652;
d) Jute synthetic union bags conforming to IS 12174; and
e) Any other approved composite bag.

Bags shall be in good condition at the time of inspection.

14 MARKING

14.1 Each bag shall be clearly marked with the following information:

a) Manufacturer’s name or trade-mark;
b) Size and type designation of the material; and
c) Date of manufacture.

14.2 BIS Certification Marking

The products(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the product may be marked with the Standard Mark.

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 460	Test sieves — Specifications:
(Part 1) : 2020	Wire cloth test sieve (*fourth revision*)
(Part 3) : 2020	Methods of examination of apertures of test sieves (*fourth revision*)
IS 1387 : 1993	General requirements for the supply of metallurgical materials (*second revision*)
IS 1501 (Part 1) : 2020/ISO 6507-1 : 2018	Metallic Materials — Vickers hardness test: Part 1 Test method (*fifth revision*)
IS 4905 : 2015/ ISO 24153 : 2009	Random sampling and randomization procedures (*first revision*)
IS 7739	Code of practice for preparation of metallographic specimens:
(Part 1) : 1975	General features
(Part 5) : 1976	Iron and steel and their examination
IS 11652 : 2017	Textiles — High density polyethylene (HDPE)/ polypropylene (PP) woven sacks for packaging of 50 kg cement — Specification (*third revision*)
IS 11761 : 1997	Multi — Wall paper sacks for cement — Specification (*first revision*)
IS 12174 : 1987	Specification for jute synthetic union bags for packing cement
IS 12308	Methods for chemical analysis of cast iron and pig iron:
(Part 1) : 1987	Determination of total carbon by thermal conductivity method (for carbon 1.00 to 4.50 percent)
(Part 2) : 1987	Determination of sulphur by iodimetric titration after combustion (for sulphur 0.005 to 0.25 percent)
(Part 3) : 1987	Determination of manganese by periodic spectrophotometric method (for manganese 0.1 to 2.5 percent)
(Part 5) : 1991	Determination of phosphorus (0.01 to 0.50 percent) by alkalimetric method
(Part 6) : 1991	Determination of silicon by gravimetric method (for silicon 0.1 to 6.0 percent)

ANNEX B

(*Clause* 7)

COMPARATIVE SIEVE DESIGNATIONS OF IS, BS AND ASTM SIEVES

Sl No.	*IS Sieve*	*BS Sieve*	*US Standard Sieve (ASTM Sieve)*
(1)	(2)	(3)	(4)
i)	4.75 mm	—	4.76 mm (4)
ii)	4.00 mm	—	4.00 mm (5)
iii)	3.55 mm	5	3.36 mm (6)
iv)	2.60 mm	6	2.83 mm (7)
v)	2.36 mm	7	2.38 mm (8)
vi)	2.00 mm	8	2.00 mm (10)
vii)	1.70 mm	10	1.63 mm (12)
viii)	1.40 mm	12	1.41 mm (14)
ix)	1.18 mm	14	1.19 mm (16)
x)	1.00 mm	16	1.00 mm (18)
xi)	850 micron	18	841 µ (20)
xii)	710 micron	22	707 µ (25)
xiii)	600 micron	25	595 µ (30)
xiv)	500 micron	30	500 µ (35)
xv)	425 micron	36	420 µ (40)
xvi)	355 micron	44	354 µ (45)
xvii)	300 micron	52	297 µ (50)
xviii)	180 micron	85	177 µ (80)
xix)	90 micron	170	88 µ (170)

ANNEX C

(*Clause* 12)

SAMPLING AND CRITERIA FOR CONFORMITY

B-1 LOT

B-1.1 In any consignment, all the containers containing material of the same quality and manufactured under similar conditions of manufacture shall be grouped together to constitute a lot.

B-1.1.1 Samples shall be taken and tested from each lot for ascertaining the conformity.

B-2 SCALE OF SAMPLING

B-2.1 The number of containers, to be selected, shall be according to col (2) and col (3) of Table 3.

Table 3 Scale of Sampling

(*Clauses* B-2.1 *and* B-3)

Sl No.	No. of Containers to be in the Lot	No. of Containers to be Selected
	N	*n*
(1)	(2)	(3)
i)	Up to 100	5
ii)	101 to 300	8
iii)	301 to 500	13
iv)	501 and above	20

B-2.1.1 The containers shall be selected at random. For this purpose, the provisions given in IS 4905 shall be used.

B-3 PREPARATION OF TEST SAMPLES

From each of the selected containers, as in col (2) and col (3) of Table 3, with the help of a suitable sampling instrument 0.5 kg material shall be taken. This material shall be taken from the top, centre and bottom of each selected containers. Samples taken from each container shall be mixed to form a composite sample of 25 kg. By coning and quartering division method the 2.5 kg shall be reduced to give a final test sample of 300 g. The sample, thus obtained shall be divided into three equal portions, one for the purchaser, the second for the manufacturer and the third shall be kept as a referee sample.

B-4 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

B-4.1 The sample prepared as per **B-3** shall be used to test for chemical size, hardness and microstructure characteristics.

B-4.2 If the sample fails to meet any one of the relevant requirements (*see* **B-4.1**) two further samples taken and tested for the requirement in which the sample has failed. If the material tested conforms to the relevant requirement while retesting two samples, the lot shall be declared as conforming to the specification, otherwise not.

ANNEX D

(*Foreword*)

COMMITTEE COMPOSITION

Foundry and Steel Castings Sectional Committee, MTD 14

Organization	*Representative(s)*
BHEL (CFFP), Haridwar	SHRI V. K. RAIZADA **(*Chairperson*)**
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BEML Limited, Bengaluru	SHRI MAHENS KULKARNI SHRI A.S PHANEEDRA (*Alternate*)
Bharat Heavy Electrical Limited, New Delhi/Haridwar	SHRI A. N. SUDHAKAR SHRI RANJITH LAKRA (*Alternate* I) SHRI ABHINAV AGRAWAL (*Alternate* II)
Bhilai Engineering Corporation Limited, Bhilai	SHRI AKHIL DUBEY SHRI SHIV DUTT MISHRA (*Alternate*)
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Forace Polymers Private Limited, Haridwar	SHRI D. K. GHOSH
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Indian Institute of Technology, Kharagpur	PROF SHIV BRAT SINGH PROF DEBALAY CHAKRABARTI (*Alternate*)
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Ministry of Science & Technology, New Delhi	MS TAMANNA ARORA SHRI K. S. P. RAO (*Alternate*)

Organization	*Representative(s)*
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NIT Manipur, Langol, Imphal	PROF (DR) GOUTAM SUTRADHAR DR ANIL KUMAR BIRRU (*Alternate* I) DR SABINDRA KACHHAP (*Alternate* II)
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Member Secretary
SHRI KUNAL KUMAR
SCIENTIST 'D'/JOINT DIRECTOR
(METALLURGICAL ENGINEERING), BIS

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
Eastern	: 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	2367 0012 2320 9474
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