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*Indian Standard*

SPECIFICATION FOR  
STEEL SHOT FOR USE IN FOUNDRIES  
( *First Revision* )

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BUREAU OF INDIAN STANDARDS  
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NEW DELHI 110002

175555/2020/070 D FORME-WI

AMENDMENT NO. 1 OCTOBER 1985

TO

IS:4606-1983 SPECIFICATION FOR STEEL SHOT FOR  
USE IN FOUNDRIES*(First Revision)*

*(Pages 9 and 10, clauses B-3.1 and B-4.1) -*  
Substitute the following for the existing clauses:

'B-3.1 From each of the selected containers as in Column 1 and Column 2 of Table 2, with the help of a suitable sampling instrument, draw 1 kg material if the number of sample containers is less than or equal to 8 and 0.5 kg material when the number of sample containers is greater than or equal to 13. This material shall be taken from the top, centre or bottom of each selected containers. Samples taken from all the selected containers shall be mixed to form a composite sample. From this, 4 kg shall be kept apart as size sample for size analysis and rest of the composite sample shall be reduced by successive coning and quartering division method to give a final sample of 300 g. This final sample 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-4.1 The size sample collected as per B-3.1 shall be used for size analysis and the test sample shall be used for chemical analysis, hardness and microstructure characteristics.'

(SMDC 17)

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# *Indian Standard*

## SPECIFICATION FOR STEEL SHOT FOR USE IN FOUNDRIES ( *First Revision* )

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***Indian Standard***  
**SPECIFICATION FOR**  
**STEEL SHOT FOR USE IN FOUNDRIES**  
**( *First Revision* )**

**0. FOREWORD**

**0.1** This Indian Standard ( First Revision ) was adopted by the Indian Standards Institution on 21 February 1983, after the draft finalized by the Foundry Sectional Committee had been approved by the Structural and Metals Division Council.

**0.2** This standard was first published in 1968. While reviewing this standard, in the light of the experiences gained during these years, the Committee decided to bring it in line with the other Indian Standards in the series of specifications for abrasives for use in foundries.

**0.3** This standard is one in the series of specifications for abrasives for use in foundries in shot blasting machines for cleaning of castings. Other standards are IS : 4683-1968\*, IS : 5873-1970† and IS : 9139-1979‡.

**0.4** In the preparation of this standard, considerable assistance has been derived from B.S.C.R.A specification No. 1 'Specification for steel shot for use in steel foundry blast cleaning process', issued by the British Steel Castings Research Association, Sheffield ( UK ).

**0.5** 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 : 2-1960§. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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\*Specification for chilled iron shot and grit for use in foundries.

†Specification for steel, cut-wire shots for use in foundries.

‡Specification for malleable iron shots and grits for use in foundries.

§Rules for rounding off numerical values ( revised ).

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## **1. SCOPE**

**1.1** This standard covers the requirements for steel shot abrasives for use in foundries as shot blasting machine abrasive.

## **2. DESIGNATION AND GRADING**

**2.1** Steel shot shall be designated as S-S and graded by the shot number which represents the aperture size of the retaining screen in thousandths of a millimetre ( *see* Table 1 ).

## **3. SUPPLY OF MATERIAL**

**3.1** General requirements relating to the supply of steel shot shall be as laid down in IS : 1387-1967\*.

## **4. MATERIAL**

**4.1** The steel shots shall be manufactured by atomizing molten steel into random sizes of steel using a suitable heat treatment procedure.

## **5. SHAPE**

**5.1** The steel shots shall as far as practicable be spherical and solid and shall not contain more than 5 percent of tails and irregular steel shots.

## **6. SIZE**

**6.1** The shot size shall be determined by testing with sieves complying with IS : 460 ( Part I )-1978†. The proportions retained and passed shall comply with the requirements given in Table 1 for each grade of material.

**EXAMPLE** — In case of Shot Grade S-S 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 11 percent passes through 1·00 mm IS Sieve and at most 4 percent is retained on pan.

## **7. CHEMICAL COMPOSITION**

**7.1** The material shall have the following composition:

<i>Constituent</i>	<i>Percent</i>
Carbon	0·6 to 1·25
Silicon	0·2 to 1·1
Manganese, <i>Max</i>	1·25
Sulphur, <i>Max</i>	0·08
Phosphorus, <i>Max</i>	0·08

\*General requirements for the supply of metallurgical material ( *first revision* ).

†Specification for test sieves : Part I Wire cloth test sieves ( *second revision* ).

TABLE 1 SIEVE ANALYSIS OF STEEL SHOT

(Clauses 2.1, 6.1 and 8.1.1)

IS SIEVE DESIGNATION	WIDTH OF APERTURE mm	SHOT NUMBER										
		S-S 2000	S-S 1700	S-S 1400	S-S 1180	S-S 1000	S-S 850	S-S 710	S-S 600	S-S 425		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)		
2-30-mm	2-80	All pass	—	—	—	—	—	—	—	—		
2-36-mm	2-36	—	All pass	—	—	—	—	—	—	—		
2-00-mm	2-00	85 Min	—	All pass	All pass	—	—	—	—	—		
1-70-mm	1-70	12 Max	85 Min	—	5 Max	All pass	—	—	—	—		
1-40-mm	1-40	—	12 Max	85 Min	—	5 Max	All pass	—	—	—		
1-18-mm	1-18	—	—	12 Max	80 Min	—	5 Max	All pass	—	—		
1-00-mm	1-00	—	—	—	11 Max	80 Min	—	5 Max	All pass	—		
850-µm	0-850	—	—	—	—	11 Max	80 Min	—	10 Max	All pass		
710-µm	0-710	—	—	—	—	—	11 Max	80 Min	—	10 Max		
600-µm	0-600	—	—	—	—	—	—	11 Max	75 Min	—		
500-µm	0-500	—	—	—	—	—	—	—	12 Max	—		
424-µm	0-425	—	—	—	—	—	—	—	—	75 Min		
355-µm	0-355	—	—	—	—	—	—	—	—	12 Max		
Pan	—	3 Max	3 Max	3 Max	4 Max	4 Max	4 Max	4 Max	3 Max	3 Max		

NOTE 1 — All figures given under the column, heading shot number refer to percentage retained.

NOTE 2 — When IS Sieves are not available, equivalent BS or ASTM Sieves specified in Appendix A may be used.

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**7.2** The chemical composition shall be determined either by the methods specified in IS : 228 ( Part I )-1972\*, IS : 228 ( Part II )-1972†, IS : 228 ( Part III )-1972‡, IS : 228 ( Part IV )-1974§, IS : 228 ( Part VIII )-1975|| and IS : 228 ( Part IX )-1975¶ or any other established instrumental/chemical method. In case of dispute the procedure in the latest edition of the relevant part of IS : 228\*\* for chemical analysis shall be the referee method.

## 8. HARDNESS

**8.1** The average hardness of cast steel shots shall be within the limits 400-500 HV with the lowest and the highest individual hardness ranging from 375-550 HV.

**8.1.1** In obtaining hardness values, at least 175 steel shots taken from the representative sample ( *see* 13.1 ) shall be mounted in plastic, ground and polished. A minimum of 20 hardness reading shall be taken at random in accordance with the method given in IS : 1501-1968††. A 5-kg load is suitable for all size grades given in Table 1. A 10-kg load is suitable for the larger sizes only.

## 9. MICROSTRUCTURE

**9.1** Steel shots, when examined under microscope at a magnification of 500 X, shall reveal tempered martensite structure. The presence of graphite and free ferrite or excessive hyper-eutectoid carbides shall be considered unsatisfactory. The hyper-eutectoid carbides shall not be more than 15 percent. The abrasives shall be taken as not complying with this standard if over 15 percent of the steel shots have unsatisfactory micro-structure.

**9.1.1** The sample in the plastic mount used for the hardness test ( *see* 8.1.1 ) shall be polished and etched for micro examination.

\*Methods of chemical analysis of steel : Part I Determination of carbon by volumetric method ( for carbon  $\geq 0.1$  percent ) ( *second revision* ).

†Methods of chemical analysis of steel : Part II Determination of manganese in plain carbon and low alloy steels by arsenite method ( *second revision* ).

‡Methods of chemical analysis of steel : Part III Determination of phosphorus by alkalimetric method ( *second revision* ).

§Methods of chemical analysis of steel : Part IV Determination of carbon by gravimetric method ( for carbon  $\geq 0.1$  percent ) ( *second revision* ).

||Methods of chemical analysis of steel : Part VIII Determination of silicon by the gravimetric method ( for silicon  $\geq 0.1$  percent ) ( *second revision* ).

¶Methods of chemical analysis of steel : Part IX Determination of sulphur in plain carbon steels by evolution method ( *second revision* ).

\*\*Methods of chemical analysis of steel.

††Method for Vickers hardness test for steel ( *first revision* ).

## **10. DENSITY**

**10.1** Density of steel shots shall not be less than 7 g/ml nor contain more than 10 percent hollow shots. The method for determining the density may be the displacement method or on actual count of hollow shots in a mounted polished specimen.

## **11. SOUNDNESS**

**11.1** Steel shots shall be free from slag and for grades below S-S 1180 the number containing voids\* or large cracks shall not exceed 10 percent of the steel shots exposed on the plastic mount for hardness and microexamination. For grades S-S 1180 and larger, the permissible number of defective steel shots shall be 15 percent.

## **12. GENERAL APPEARANCE AND FREEDOM FROM FOREIGN MATTER**

**12.1** Steel shots shall be as nearly spherical as is commercially possible with a minimum of elongated or compound shots, tails, hollows and broken pieces, and shall be free from foreign matter. The maximum content of foreign matter shall not exceed one percent of the weight of the sample taken.

## **13. SAMPLING**

**13.1** Representative samples drawn and criteria for conformity for various requirements shall be as given in Appendix B.

## **14. RETEST**

**14.1** If the sample selected fails to meet the requirements given under 5, 6, 7, 8, 9, 10, 11 and 12, two further samples shall be taken for each retest. Should the two retests satisfy the requirements of this standard the lot shall be accepted. - Should either of the samples fail, the material shall be taken as not complying with the requirements of this standard.

## **15. PACKING**

**15.1** Unless otherwise specified the material shall be supplied in waterproof double gunny bags or polyethylene lined gunny bags each containing 50 kg.

## **16. MARKING**

**16.1** Each container shall be clearly marked with the following information:

- a) Manufacturer's name or trade-mark, and
- b) Size designation of the material.

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\*A cavity covering an area greater than about one-tenth of that of the section of particle exposed.

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**16.1.1** The product may also be marked with Standard Mark.

**16.1.2** The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

**APPENDIX A**

( Note 2 in Table 1 )

**COMPARATIVE SIEVE DESIGNATIONS OF IS, BS AND ASTM SIEVES**

IS SIEVES	BS SIEVES MESH NO.	US STANDARD SIEVE ( ASTM SIEVE )
2·80-mm	6	2·83 mm (7)
2·36-mm	7	2·38 mm (8)
2·00-mm	8	2·00 mm (10)
1·70-mm	10	1·68 mm (12)
1·40-mm	12	1·41 mm (14)
1·18-mm	14	1·19 mm (16)
1·00-mm	16	1·00 mm (18)
850- $\mu$ m	18	841 $\mu$ m (20)
710- $\mu$ m	22	707 $\mu$ m (25)
600- $\mu$ m	25	595 $\mu$ m (30)
500- $\mu$ m	30	500 $\mu$ m (35)
425- $\mu$ m	36	420 $\mu$ m (40)
355- $\mu$ m	44	354 $\mu$ m (45)

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**APPENDIX B**

( Clause 13.1 )

**SAMPLING AND CRITERIA FOR CONFORMITY****B-1. LOT**

**B-1.1** In any consignment, all the containers containing material of the same quality grade 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 1 and 2 of Table 2.

**TABLE 2 SCALE OF SAMPLING**

No. OF CONTAINERS TO BE IN THE LOT <i>N</i>	No. OF CONTAINERS TO BE SELECTED <i>n</i>
(1)	(2)
Up to 100	5
101 to 300	8
301 to 500	13
501 and above	20

**B-2.1.1** The containers shall be selected at random. For this purpose, the provisions given in IS : 4905-1968\* shall be used.

**B-3. PREPARATION OF TEST SAMPLES**

**B-3.1** From each of the selected containers, as in col 1 and 2 of Table 2, 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. By successive coning and quartering division method the composite sample 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.

\*Methods for random sampling.

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**B-4. NUMBER OF TESTS AND CRITERIA FOR CONFORMITY**

**B-4.1** The sample prepared as per **B-3.1** shall be used to test chemical analysis, 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 shall be 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.

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