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Indian Standard

SPECIFICATION FOR HIGH ABRASION FURNACE (HAF) CARBON BLACK

(First Revision)

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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Indian Standard

SPECIFICATION FOR HIGH ABRASION FURNACE (HAF) CARBON BLACK

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 15 July 1985, after the draft finalized by Rubber Products Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

0.2 This standard was first published in 1974. This has been revised to include No. 5 as a reference black instead of Industry Reference Black (IRB) No. 3 for measuring physical properties of the vulcanizate. Some of the values of the requirements have been changed in this revision and certain requirements namely, acetone extract, sulphur content and *p*H of water extract have been deleted.

0.3 Carbon blacks are added to rubber to develop physical strength properties and, therefore, they are commonly known as reinforcing agents.

0.4 This standard covers the requirement of high abrasion furnace (HAF) carbon black which has been given the nomenclature of N-330 by the American Society for Testing and Materials.

0.5 This standard contains clauses **2.2, 2.2.1, 2.4** and **3.1** which call for agreement between the purchaser and the supplier.

0.6 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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*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard prescribes requirements and the methods of sampling and test for high abrasion furnace (HAF) carbon black for use in rubber industry.

2. REQUIREMENTS

2.1 General — The material shall be free from foreign matter namely, wood, metal and fibres.

2.2 Pelletization — The carbon black shall be in the pelletized form. The pellet hardness shall be controlled to such a degree that satisfactory dispersion is obtained when compounded in a standard mixing equipment as desired by the purchaser.

2.2.1 *Pellet Size Distribution* — Pellet size distribution shall be subject to agreement between the purchaser and the supplier.

2.3 The material shall also comply with the requirements given in Table 1.

TABLE 1 REQUIREMENTS FOR HIGH ABRASION FURNACE (HAF) CARBON BLACK

Sl No.	Characteristic	Requirement	Method of Test, Ref to Cl No. in IS : 7498-1985*
(1)	(2)	(3)	(4)
i)	Iodine absorption, mg of iodine/g of carbon black	76 to 88	5
ii)	Dibutyl phthalate (DBP) absorption, ml/100 g of carbon black	97 to 107	6
iii)	Pour density, g/l	344 to 400	7
iv)	Sieve residue, percent by mass, *Max*:		
	a) On 45 µm IS Sieve	0·100 0	8
	b) On 500 µm IS Sieve	0·001 0	
v)	Loss on heating, percent by mass, *Max*	2·0	9
vi)	Ash content, percent by mass, *Max*	0·75	10
vii)	Staining	Non-staining	12
viii)	Fines content, percent by mass, *Max*	15	13
ix)	Discolouration of toluene, percent transmission, *Min*	80	16

*Methods of sampling and test for carbon blacks (*first revision*). (Under print).

2.4 Compounding — If desired by the purchaser the material may be compounded in natural rubber test recipe following the procedure given in Appendix A and the properties of carbon black assessed relative to Industry Reference Black (IRB) No. 5.

3. PACKING AND MARKING

3.1 The material shall be supplied in bags. The net mass of the bags shall be 25 ± 0·25 kilograms. The bags shall be shaped to facilitate stacking in pallets by slight ironing.

3.2 Marking — The packages shall be marked with the name of the manufacturer, month and year of manufacture, batch number if any, net mass and shall have yellow as the colour code identification.

3.2.1 The packages may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

4. SAMPLING, NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

4.1 The sampling of carbon black shall be done in accordance with **2** of IS : 7498-1985*.

4.2 Number of Tests and Criteria for Conformity — All characteristics of high abrasion furnace (HAF) carbon black given in Table 1 shall be tested on individual samples. The lot shall be declared as conforming to the requirements of the specification if all the test results on each of the individual samples satisfy the corresponding requirements.

*Methods of sampling and test for carbon blacks (*first revision*). (Under print).

APPENDIX A
(*Clause* 2.4)

SCHEDULE FOR COMPOUNDING AND TESTING FOR PHYSICAL EVALUATION OF CARBON BLACK

A-1. GENERAL

A-1.1 This procedure involves the incorporation of the black to be tested in rubber along with the necessary auxiliary agents, to permit vulcanization, followed by testing. Along with each test black, a corresponding stock containing the Industry Reference Black (IRB) No. 5 is included. The differences between the properties obtained in the reference black is simply a device to cancel the inevitable variations in test results which are due to minor variations between laboratories in equipment, materials, procedures and ambient conditions.

A-2. STANDARD FORMULA

A-2.1 The standard formula for testing carbon black is given below:

Material	*Parts by Mass*
Natural rubber grade IS NR 5 (*see* IS : 4588-1977*)	100
Zinc oxide (*see* IS : 3399-1973†)	5
Stearic acid (*see* IS : 1675-1971‡)	3
Dibenzothiazyl disulphide (*see* IS : 8483-1976§)	0·6
Sulphur (*see* IS : 8851-1978‖)	2·5
High abrasion furnace (HAF) carbon black	50

A-3. MIXING METHOD

A-3.1 The method of mixing is given in **A-3.1.1** to **A-3.1.10**.

A-3.1.1 Use a two roll laboratory mill having 150 mm outside diameter and 260 to 270 mm working distance between the guides. The speed of the slow roll shall be 24 ± 0·5 rev/min and the gear ratio shall be 1·4 to 1. Adjust and maintain roll temperature at 70 ± 5°C and set mill opening at 1·4 ml.

*Specification for rubber, raw, natural (*second revision*).
†Specification for zinc oxide for rubber industry (*first revision*).
‡Specification for stearic acid, technical (*first revision*).
§Specification for dibenzothiazyl disulphide.
‖Specification for sulphur for rubber industry.

A-3.1.2 The carbon black shall be conditioned before weighing by heating in an oven at 100 to 110°C for one hour.

A-3.1.3 Weigh out the ingredients for a batch size which is 4 times of the parts by mass in grams given under **A-2.1.**

A-3.1.4 Add rubber and band on mill on front roll, make two 3/4 cuts from each side (time 2·0 minutes).

A-3.1.5 Add stearic acid and cut once each way (time 2·5 minutes).

A-3.1.6 Add sulphur, accelerator and zinc oxide and cut twice each way (time 2 minutes).

A-3.1.7 Add black. Open mill gradually to maintain approximately constant bank. Cut three times each way after all carbon black is in (time 7·5 minutes).

A-3.1.8 Cut stock, roll, and weigh. If the mass is outside the tolerance of the ±0·6 percent, reject the batch (time 1 minute).

A-3.1.9 Pass end-wise six times at 0·8 mm opening, and sheet off at 2·2 mm finished gauge cool on metal table top, and prepare specimen for cure (time 2·5 minutes).

A-3.1.9.1 Total mixing time is about 17·5 minutes.

A-3.1.10 Condition the stock for 1 to 24 hours at 27 ± 2°C, and cut out suitable slabs for vulcanization.

NOTE — In due course a cross reference shall be made to NR 9 of IS : 3660 (Part 1)-1972*. Mixing and vulcanizing in a Standard compound, which is at present under revision.

A-4. VULCANIZATION

A-4.1 The test pieces are vulcanized for 15 and 30 minutes at 145°C in a standard 4-cavity mould, which gives sheet of dimensions 150 × 150 × 2 mm. The curing press shall be capable of exerting a minimum pressure of 3·5 MN/m² (approximately 35 kgf/cm²) on the cavity areas of the mould during vulcanization. After vulcanization, the sheets shall be cooled immediately in water. The time interval between curing and testing shall be a minimum of 1 hour and maximum of 72 hours.

*Methods of test for natural rubber: Part 1 Determination of dirt, volatile matter, ash, total copper, manganese iron, rubber hydrocarbons viscosity (shearing disc viscometer), and mixing and vulcanizing of rubber in a standard compound (*first revision*).

A-5. TESTING

A-5.1 The vulcanized sheets are tested for 300 percent modulus, and tensile strength in accordance with IS : 3400 (Part 1)-1977*.

A-6. PHYSICAL REQUIREMENTS

A-6.1 The difference in physical requirements of vulcanizates containing high abrasion furnace (HAF) carbon black as compared from Industry Reference Black (IRB) No. 5 shall be as given in Table 2.

TABLE 2 DIFFERENCE IN PHYSICAL PROPERTIES OF VULCANIZATES CONTAINING HIGH ABRATION FURNACE (HAF) CARBON BLACK AS COMPARED WITH INDUSTRY REFERENCE BLACK (IRB) NO. 5

Cure Conditions	Tensile Strength *Min* (MN/m^{2}*)	300 Percent Modulus (Mn/m^{2}*)	Ultimate Elongation Percent, *Min*
(1)	(2)	(3)	(4)
15 min cure at 145°C	− 3·0	− 1·9 to + 1·5	− 55
30 min cure at 145°C	− 2·8	− 2·0 to + 1·2	− 40

*1 MN/m^{2} = 1 MPa = approximately 10·2 kgf/cm^{2}.

*Methods of test for vulcanized rubbers: Part 1 Tensil stress-strain properties (*first revision*).

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1}
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2