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*Indian Standard*

# SPECIFICATION FOR FAST EXTRUSION FURNACE ( FEF ) 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 FAST EXTRUSION FURNACE ( FEF ) CARBON BLACK

## *( First Revision )*

## 0. FOREWORD

**0.1** This Indian Standard ( First Revision ) was adopted by the Indian Standards Institution on 4 August 1986, after the draft finalized by the Rubber Products Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

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

**0.3** This specification is for the market grades of fast extrusion furnace ( FEF ) carbon black used by the rubber industry and which has been given the nomenclature N 550 by the American Society for Testing and Materials.

**0.4** This standard was first published in 1976. In this revision, Industry Reference Black ( IRB ) No. 5 has been included as reference black instead of IRB No. 3 for measuring physical properties of the vulcanizate. Also, the requirement for benzene discoloration has been substituted by toluene discoloration and certain other requirements like acetone extract, sulphur content and *p*H of water extract have been deleted.

**0.5** This standard contains clauses **2.2** and **2.4** 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.

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

## 1. SCOPE

**1.1** This standard prescribes the requirements, methods of sampling and test for fast extrusion furnace ( FEF ) carbon black for use in rubber industry.

## 2. REQUIREMENTS

**2.1** The material shall be free from foreign matter and any visible impurities.

**2.2 Pelletization** — The material shall be delivered in the pelletized form. Pellet hardness shall be controlled to such a degree that satisfactory dispersion is obtained on its being compounded in standard mixing equipment as desired by the purchaser.

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

**2.4 Compounding** — If desired by the purchaser, the material may be compounded in natural rubber test recipe and the properties of carbon black assessed relative to IRB No. 5. Recommended method for compounding and the test recipe is given in Appendix A.

## 3. PACKING AND MARKING

**3.1** The material shall be supplied in bags. The net mass of each bag shall be $25{\cdot}0 \pm 0{\cdot}5$ kg. The bags shall be shaped to facilitate stacking of pellets by slight ironing.

**3.2 Marking** — Each package shall be clearly and indelibly marked with the following information:

a) Manufacturer's name and trade-mark, if any;

b) Month and year of manufacture;

c) Batch/lot number;

d) Net mass;

e) Grade identification; and

f) Shall have blue colour as a 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 quility 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

**4.1** The sampling of carbon black shall be done in accordance with **2** of IS : 7498-1986*.

**TABLE 1 REQUIREMENTS FOR FAST EXTRUSION FURNACE ( FEF ) CARBON BLACK**

( *Clause* 2.3 )

| Sl No. | Characteristic | Requirement | Method of Test, Ref to Clause No. in IS : 7498-1985* |
|---|---|---|---|
| (1) | (2) | (3) | (4) |
| i) | Iodine adsorption, mg of iodine ( as $I_2$ )/g of carbon black | 38 to 48 | 5 |
| ii) | Dibutyl phthalate ( DBP ) absorption, ml/100 g | 115 to 125 | 6 |
| iii) | Pour density, g/l | 320 to 380 | 7 |
| iv) | Sieve residue, percent by mass, *Max*: | | 8 |
| | a) On 45-micron IS Sieve | 0·100 0 | |
| | b) On 500-micron IS Sieve | 0·001 0 | |
| v) | Loss on heating, percent by mass, *Max*: | | 9 |
| | a) Bulk deliveries | 1·0 | |
| | b) Bag deliveries | 1·5 | |
| vi) | Ash content, percent by mass, *Max* | 0·75 | 10 |
| vii) | Fines content, percent by mass, *Max* | 15·0 | 13 |
| viii) | Toluene discoloration, percent transmission, *Min* | 80 | 16 |

*Methods of sampling and test for carbon black ( *first revision* ).

**4.2 Number of Tests and Criteria for Conformity** — All the characteristics of FEF 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 shall satisfy the corresponding requirements.

*Methods of sampling and test for carbon black ( *first revision* ).

# APPENDIX A

( *Clause* 2.4 )

## SCHEDULE FOR COMPOUNDING AND TESTING FOR PHYSICAL EVALUATION OF CARBON BLACK

### A-1. GENERAL

**A-1.1** These procedures involve 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 No. 5 is included. The difference between the properties obtained on 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 | 100 |
| Zinc oxide | 5 |
| Stearic acid | 3 |
| Benzothiazyl disulphide | 0·6 |
| Sulphur | 2·5 |
| Carbon black | 50 |

### A-3. MIXING METHOD

**A-3.1** The mixing method 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 250 to 280 mm working distance between the guides. The roll speed ratio should be 1 to 1·4. Adjust and maintain roll temperature at 70 ± 5°C and set mill opening at 1·4 mm.

**A-3.1.2** The carbon black shall be conditioned before weighing, by heating in an oven at 100 to 110°C for 1 hour.

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

**A-3.1.4** Add rubber on mill and band ( time 2·0 minutes ).

**A-3.1.5** Add stearic acid and 3/4th cut once each way ( time 2·5 minutes ).

**A-3.1.6** Add remaining pigments and 3/4th cut twice each way ( time 2 minutes ).

**A-3.1.7** Add carbon black. Open mill gradually to maintain constant bank. 3/4th 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 beyond the tolerance of ± 1·0 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 ( time 2·5 minutes ).

Total mixing time is about 17·5 minutes.

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

## 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 sheets of dimensions 150 × 150 × 2 mm. The curing press shall be capable of exerting a minimum pressure of 3·5 $MN/m^2$ ( approx 35 $kgf/cm^2$ ) on the cavity areas of the mould during vulcanization. After vulcanization, the sheets shall be cooled immediately in water. Condition the vulcanized test slab for 16 hours at 27 ± 2°C before testing.

## 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 PROPERTIES

**A-6.1** The maximum difference in physical properties of vulcanizates containing FEF carbon black as compared to IRB No. 5 shall be as given in Table 2.

**TABLE 2 DIFFERENCE IN PHYSICAL PROPERTIES OF VULCANIZATES CONTAINING FEF CARBON BLACK AS COMPARED TO IRB NO. 5**

| Cure Conditions | Tensile Strength, *Min* | 300 Percent Modulus |
|---|---|---|
| (1) | (2) | (3) |
| | $MN/m^2$* | $MN/m^2$* |
| 15 min at 145°C | − 5·1 | − 1·5 to + 1·5 |
| 30 min at 145°C | − 5·1 | − 2·0 to + 1·0 |

*1 $MN/m^2$ = 10·2 $kgf/cm^2$ approx.

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

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