FOREWORD
(Adoption clause would be added later)

With the growth of indigenous manufacture of cigarette filters and their export and development of special filters, it became necessary to upgrade the standard. It is hoped that this standard would serve the need to regulate the quality of filters that are indigenously produced and used and also exported.

This standard was originally published in 1983 and revised in 2009. This second revision is being undertaken to update the provisions of this standard in light of the current trade practices, advances in science and technology of filters and filtration and their testing methodologies. This has been possible due to harmonization of relevant ISO standards into Indian standards under dual numbering system. Consequently, the definition and description of many of the terms and conditions have been brought on par with international terminology and a number of internationally recognised methods have also been incorporated. This has led to the deletion of many of the terms and annexes.

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 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1 SCOPE

This standard specifies the requirements and methods of sampling and test for cigarette filters.

2 REFERENCES

The standards given below 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 editions of these standards.

<table>
<thead>
<tr>
<th>IS No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>4905 : 1968</td>
<td>Methods for random sampling</td>
</tr>
<tr>
<td>12942 : 2008</td>
<td>Cigarettes — Sampling (second revision)</td>
</tr>
<tr>
<td>/ISO 8243 : 2006</td>
<td></td>
</tr>
<tr>
<td>15795 : 2008</td>
<td>Cigarette and filter rods — Determination of nominal diameter —</td>
</tr>
<tr>
<td>16121 : 2013</td>
<td>Tobacco and tobacco products — Atmosphere for conditioning and testing</td>
</tr>
<tr>
<td>/ ISO 3402 : 1999</td>
<td></td>
</tr>
<tr>
<td>16023 : 2012</td>
<td>Cigarettes — Determination of total and nicotine-free dry particulate matter</td>
</tr>
<tr>
<td>/ISO 4387 : 2000</td>
<td>using a routine analytical smoking machine</td>
</tr>
<tr>
<td>Doc: FAD 04 (2134)</td>
<td>Cigarettes — Determination of alkaloid retention of filters —</td>
</tr>
<tr>
<td></td>
<td>Spectrometric method (adoption of ISO 3401 : 1991) (under print)</td>
</tr>
</tbody>
</table>
3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply, in addition to the terms and definitions described in IS 16023 and Doc: FAD 04(2571).

3.1 Filter — Filter is a cylindrical air permeable device attached to a tobacco rod on a cigarette making machine to produce a filter cigarette. The cigarette filter may be mono (single filtering material), dual (two segment containing different filtering materials) or multi-segmented with or without cavity. The filters with cavity are called cavity filters. Cigarette filter also acts as barrier for tobacco to fall out from mouth-end of cigarette and improves the aesthetic of the cigarette.

3.1.1 Filter Rod and Plug — Filter made on a filter making machine is called a filter rod as it is 4 to 6 times longer than the filter tip to be used on a cigarette. The filter rods are cut into smaller pieces on a cigarette making machine for attaching to the tobacco rod to make a filter cigarette. Filter piece attached to a cigarette is called filter plug.

3.1.2 Filtration/Retention — It is retention of a certain amount of smoke components by the filter from the cigarette smoke.

3.1.3 Retention Index/Filtration Efficiency — It is the percentage of smoke components retained by a filter as smoke passes through it. The retention index is specific to the smoke component which is being analysed for retention. If the retention of smoke condensate is determined, it is called smoke condensate retention index (R\textsubscript{c}). Similarly, if the retention of alkaloids is determined, it is called nicotine alkaloids retention index (R\textsubscript{nic}).

3.2 Diameter — The arithmetical mean value of \( n \) apparent diameters measured on a test piece following the method specified in IS 15795. This represents the diameter of a circle that has the same circumference as the perimeter of the sample being measured, provided that the boundary of its cross section is convex.

NOTES
1. The result of the measurement can be affected by \( n \), the number of readings taken.
2. Diameter can be converted into circumference by a simple formula. Electronic instruments used give direct circumference value.

3.3 Pressure Drop — Static pressure difference between the two ends of the test piece completely encapsulated in a measuring device such that no air can pass through the outer membrane (or wrapping); or a pneumatic circuit when it is traversed by an air flow under steady conditions in which the measured volumetric flow, under standard conditions, at the output end is 17.5 ml/s at standard test conditions as specified in 7.

4 REQUIREMENTS

4.1 Materials

4.1.1 Filtering Material

Filtering materials in cigarette filters are essentially fibrous or webbed structure, made from wood pulp, a renewable cellulosic material. Secondary cellulose acetate tow, a fibrous material, is the largest filtering material used followed by paper (cellulosic web). These materials are specially manufactured for cigarette filters and are white and odourless unless specified otherwise.

Granular filtering materials like activated carbon, zeolites, etc are also used in special filters either filled in the cavity of a cavity filter or embedded in the fibrous filtering material. Flavouring materials such as menthol or any other flavour can also be introduced in the filter as per the requirements of the buyer.

4.1.2 Filter Wrapper

The filter rod wrapper shall be made of paper of adequate substance and strength to hold the compressed filtration material together. The shade/colour and porosity of the wrapping paper shall be as approved by the buyer.

4.1.3 Adhesives

Different types of adhesives are used in making filters for two different applications, one to stick the longitudinal edges of the wrapping paper (side seam) to hold the roll of compressed filter material together to
form the filter rod and the other for the glue line to anchor the filter material to the wrapping paper. The adhesive should not bleed through porous plug wrapping paper.

4.1.4 Binder

A suitable odourless binder is applied to the filter material to bond the fibrous material together to impart firmness to the filter rod. Binders can be solvents or special adhesives. Triacetin is used as a binder in secondary cellulose acetate filters.

4.2 Characteristics

4.2.1 Length

4.2.1.1 The length of the primary filter rods shall be a convenient multiple of the actual length of filter plugs to be attached to cigarettes on a cigarette making machine. The normal trade requirement is 54 to 150 mm. The length shall be measured by a scale with a resolution of 0.5 mm.

4.2.1.2 The variation on filter rod length shall be within ±0.5 mm, or as agreed between the vendor and the buyer.

4.2.2 Diameter

4.2.2.1 Since the diameter of filter rods has to suit the diameter of cigarettes to which these are to be attached, the mean diameter specification is set by the buyer. The diameter of the filter is kept slightly smaller than the cigarette to accommodate the thickness of the wrapping paper to produce a uniformly cylindrical filter cigarette. The normal trade requirement is 5.0 to 10.5 mm. It shall be determined as prescribed in IS 15795.

4.2.2.2 The variation in filter rod diameter shall be within ±0.09 mm or as agreed between the buyer and vendor.

NOTE — Diameter can be converted into circumference by a simple formula:

\[ \text{Circumference} = \pi \times \text{diameter} \text{ or } 3.14 \times \text{diameter} \]

The electronic instruments can directly give diameter and/or circumference reading.

4.2.3 Firmness

The firmness, also called hardness, of the filter shall be as agreed between the buyer and the vendor and shall be tested in accordance with the method prescribed in Annex A. The normal trade requirement for firmness is a mean value of 90 percent \( \min \) with no single value less than 86 percent.

4.2.4 Pressure Drop

4.2.4.1 The pressure drop specification of filter rods shall be set by the buyer to suit the filtration required. The normal trade requirement is 60 to 350 mm water gauge (mmWG) for a 66 mm filter rod.

4.2.4.2 The variation in pressure drop of filters shall be within ±15 percent or as agreed between the vendor and the buyer. Pressure drop shall be determined in accordance with method prescribed in Annex B.

4.2.5 Retention Index

4.2.5.1 The retention index of a filter is dependent on the type and quality of filter materials used, adherence to the set quality parameters and most importantly on the cigarette design. The normal trade requirement is between 15 to 40 percent for a 11 mm plug.

4.2.5.2 The retention index of cigarette filters shall be determined as nicotine alkaloid retention index (\( R_{\text{nic}} \)) in accordance with any of the methods prescribed in Doc: FAD 04 (2134) (under print).

4.2.6 Mass

The mean mass of filter rods shall be as agreed between the buyer and the vendor. The variation in mass between the rods shall be not more than ±6 percent.
4.2.7 Formation

The filter rods shall be round, firm and uniformly filled without soft pockets.

4.2.8 Wrapping

The filter wrapping paper shall be bonded with the filter material with one or more glue lines and shall be without creases and slackness. The side seam shall be clean, wrinkle-free and firmly bonded.

4.2.9 Filter Rod Ends

The filter rod shall be smooth and cut straight. The ends will not be recessed.

4.2.10 Odour

The filter rods shall be free of any extraneous odour, unless designed otherwise since such odour could taint the smoke of cigarettes.

5 PACKING AND MARKING

5.1 Packing

The filters should be packed in suitable containers as agreed to between the vendor and the buyer.

5.2 Marking

5.2.1 The following particulars shall be legibly and indelibly marked on bulk container in addition to declarations as required under any applicable statutory Rules and Regulations:

a) Description of content;
b) Name and address of the manufacturer;
c) Net quantity;
d) Date of manufacture or date code;
e) Type of filter;
f) Length;
g) Circumference;
h) PD; and
j) Firmness.

5.2.2 The product may also be marked with the Standard Mark.

5.2.2.1 The use of standard mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and regulations made there under. The details of conditions under which a license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

6 SAMPLING AND CRITERIA FOR CONFORMITY

6.1 The sampling and criteria for conformity of the filters shall be done in accordance with Annex C or as agreed between the buyer and the vendor.

6.2 The sampling of cigarettes for retention index determination shall be done as prescribed in IS 12942 or as agreed between the buyer and the vendor.

7 CONDITIONING AND TEST ATMOSPHERE

Conditioning and test atmosphere shall be maintained as prescribed in IS 16121.

7.1 Conditioning Atmosphere

a) Temperature 22±1°C, and
b) Relative humidity 60±3 percent.
7.2 Test Atmosphere

a) Temperature 22±2°C, and
b) Relative humidity 60±5 percent.

ANNEX A
(Clause 4.2.3)
DETERMINATION OF FIRMNESS OF FILTERS

A-1 PRINCIPLE

The firmness of filter rod is tested with the use of a firmness tester. This tester is designed to measure accurately the deformation in diameter that takes place when a filter rod is subjected to a standard load of 300 g for 15 s, applied through an anvil of 12.7 mm diameter, with vibration.

NOTE — Alternatively, a suitable electronic instrument may be used by following the user instructions provided by the supplier.

A-1.1 Procedure

A-1.1.1 Mark each filter rod in the test sample with a number sequentially and condition the sample as prescribed in 7.

A-1.1.2 Determine the diameter of each rod individually by the method prescribed in IS 15795 and record (reading A) against the individually numbered rods.

A-1.1.3 Place the filter rod one by one in the holder on the tester. The anvil with the load is allowed to rest on the filter for 15 s, the impression reading is taken (reading B) and the anvil lifted.

A-1.1.4 Record the reading a against the diameter of individually numbered rods.

A-2 CALCULATION

A-2.1 The firmness is calculated for individual rods using the following formula. Individual data analysis can give a statistical report.

\[
\text{Firmness percentage} = \left( \frac{A - B}{A} \right) \times 100
\]

where

\( A \) = diameter of filter rod in mm;
\( B \) = impression under 300 g load in mm

A-2.2 Data analysis

Collate all the individual firmness values (A-2.1) and calculate the average firmness rounded to the nearest 1 percent and standard deviation.

NOTE — In case an electronic instrument is used, the data and statistical report is printed out automatically.

A-3 TEST REPORT

The test report shall show the method, instrument and instrument configuration used. It shall also mention any operating conditions not specified in this standard or regarded as optional, as well as any circumstances that might have influenced the results. The test report shall state, in particular, the following:

a) Complete identification of the sample;
b) Date of sampling;
c) Date of test;
d) Type of instrument used;
e) Total number of test pieces tested; and
f) Test results – Mean firmness percent, range and SD.
ANNEX B
(Clauses 4.2.4.2)

DETERMINATION OF PRESSURE DROP OF FILTER

B-1 APPARATUS

B-1.1 The instrument consists essentially of an air compressor, an air filter set to remove water and oil from the compressed air, flow controller and flow meter, a water manometric column and a suitable holder for the filter rod, connected in line.

B-1.1.1 The specimen holder is so designed that when the filter is inserted into the holder it makes air-tight connection with the instrument without distortion of the rod due to excessive pressure.

NOTE — Alternatively, a suitable electronic instrument may be used. Two types of instruments are available, ones which maintain constant air mass flow at the exit of the test piece and the others which maintain constant volumetric flow, the later is recommended for this method. The calibration and measurements shall be carried out in accordance with the instrument vendor's instructions.

B-2 PROCEDURE

B-2.1 Condition the test sample as prescribed in 7.

B-2.2 Adjust the volumetric air flow on the pressure drop apparatus to the prescribed value of 17.5 ml/s at the standard conditions of test atmosphere prescribed in 7.

B-2.3 Calibration shall be carried out by means of a soap bubble flow meter or standard pressure drop capillaries, if available.

NOTE — Standard pressure drop capillaries, sometimes provided with equipment for quicker calibration, are calibrated at sea level barometric pressure of 1 013 m bar. If the equipment is used at an altitude, the pressure drop value of the standard should be recalibrated, adjusting the flow rate to 17.5 ml/s by means of soap bubble flow meter.

B-2.3 The position of the test piece during testing may be either horizontal or vertical, a commonly used position is horizontal. In case it is vertical, this fact shall be mentioned in the test report.

B-2.4 The test pieces shall be completely inserted into a suitable totally encasing holder provided on the equipment so that no passage of air can be produced through the filter wrapper.

B-2.5 The static pressure differential shall be read on the water gauge manometer when it has steadied.

B-2.6 The temperature and relative humidity and atmospheric pressure within the testing environment will be recorded.

NOTE — The temperature and relative humidity of the measurement air shall be measured at a point in close proximity to the air entering the standard, within the confines of the draught screen enclosing the standard under test.

B-2.7 Data analysis

Collate all the pressure drop values recorded and calculate the average pressure drop rounded to the nearest 0.1 mmWG and standard deviation.

NOTE — In case an electronic instrument is used, the data and statistical report is printed out automatically.

B-3 TEST REPORT

The test report shall show the method, instrument and instrument configuration used. The test report shall include all details required for the complete identification of the sample and the results obtained. It shall state, in particular, the following:

a) Complete identification of the sample;
b) Date of sampling;
c) Date of test;
d) Type of instrument used;
e) Total number of test pieces tested;
f) Position of test piece during test- horizontal or vertical;
g) Test results average PD in mmWG and SD; and
h) Test atmosphere:
   i. Room temperature in degrees Celsius (°C) during testing;
   ii. Relative humidity in percentage during testing.

j) Atmospheric pressure.

ANNEX C
(Clause 6.1)

SAMPLING AND CRITERIA FOR CONFORMITY OF CIGARETTE FILTERS

C-1 SCALE OF SAMPLING

C-1.1 Lot

All the bulk containers in a single consignment of the filters constitute a lot.

NOTE — If the consignment is declared to consist of different types of filter rods, the bulk containers belonging to the same kind shall be grouped together to constitute separate lot.

C-1.2 Samples shall be tested from each lot for ascertaining conformity of the material to the requirements as agreed between the supplier and the user.

C-1.3 Number of bulk containers to be selected from a lot shall depend on the size of the lot and shall be in accordance with Table 1.

C-1.4 The containers to be selected for sampling shall be chosen at random from the lot and for this purpose, a random number table (see IS 4905) shall be used. If such a table is not available the following procedure shall be adopted:

C-1.4.1 Arrange all the bulk containers in the lot in systematic manner and starting from any container count 1, 2, 3, ..., etc., up to r and so on. Every rth bulk container so counted shall be withdrawn to give a sample for the test, where \( r = N/n \), \( N \) being the number of bulk containers in a lot, and \( n \) being the number of bulk containers to be chosen according to Table 1. If \( r \) comes out to be a fractional number, its value shall be taken as equal to the integral part of it.

NOTE — In case the bulk container has secondary containers, choose one random secondary container as sample.

C-1.5 From the quantity of bulk containers selected, pick up 200 filter rods at random, representing the total number of bulk containers and divide this quantity into two equal sub-samples (A and B). Subsample A should be used for the determination of mass, circumference, pressure drop and firmness. Subsample B should be kept for reference.

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Lot Size (N)</th>
<th>No. of Bulk Containers to be Selected for Sampling (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>( \leq 20 )</td>
<td>2</td>
</tr>
<tr>
<td>i)</td>
<td>21-50</td>
<td>3</td>
</tr>
<tr>
<td>ii)</td>
<td>51-200</td>
<td>4</td>
</tr>
<tr>
<td>iii)</td>
<td>201-500</td>
<td>5</td>
</tr>
<tr>
<td>iv)</td>
<td>501-750</td>
<td>6</td>
</tr>
<tr>
<td>v)</td>
<td>751-1000</td>
<td>8</td>
</tr>
<tr>
<td>vi)</td>
<td>1001 and above</td>
<td>10</td>
</tr>
</tbody>
</table>

C-2 CRITERIA FOR CONFORMITY

A lot of filter rods shall be declared as conforming to the specification when each of the test satisfies the requirements as mentioned in 4.2 or as agreed between the vendor and buyer.