भारतीय मानक ब्यूरो

भारतीय मानक *मसौदा*

वस्त्रादि — सीमित ज्वाला फैलाने की वस्तुओं से बनी ऊष्मा एवं ज्वाला से बचाव करने वाली वस्त्र सामग्री की अपेक्षाएं — विशिष्टि

(IS 15742 का पहला पुनरीक्षण)

BUREAU OF INDIAN STANDARDS

Draft Indian Standard

Textiles — Requirements for Clothing Made of Limited Flame Spread Materials for Protection against Heat and Flame — Specification

(First Revision of IS 15742)

ICS : 13.220.40

Textiles Protective Clothing Sectional Committee, TXD 32	Last date for receipt of comments 16/10/2024

FOREWORD

(*Formal forward to be added later*)

Textile protective clothing made of limited flame spread material are used to reduce the possibility of their burning and thereby itself constituting a fire hazard. These include clothing such as ladies' wear made of synthetic fibres and children wear of all kinds and also other protective clothing where protection against heat and fire mainly due to accidental contact with small igniting flames is required in circumstances where there is no significant heat and fire hazard.

The performance of such clothing is expressed in terms of a limited flame spread index. Following two indexes of performance have been covered:

a) *Index* 1 — Textiles protective clothing do not spread flame and do not form a hole on contact with a flame.

b) *Index* 2 — Textiles protective clothing do not spread flame and do not form a hole on contact with a flame. They also give only limited after flame.

Protective clothing may consist of several, separate dress materials or garments, or it may be a single dress material or garment with one or more layers. Normally it is sufficient for the outer material to have limited flame spread properties, and multi-layer clothing are tested by applying the flame to the outer surface.

This standard was published in the year 2007. It is being revised again to incorporate the following changes:

a) The scope has been modified.
b) The definition of Textiles protective clothing has been incorporated
c) The requirement for limited flame spread index 1 has been removed.
d) The requirement for pretreatment by cleaning, dimensional change, sewing threads.
e) Marking clause has been modified.
f) Amendment has been incorporated.
g) Reference has been updated.

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 '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

1.1 This standard specifies the performance requirements for the limited flame spread properties of textile protective clothing where protection against limited flame spread due to accidental contact with small igniting flames is required in circumstances where there is no significant heat or fire hazard such as clothing used in kitchens of commercial organizations such as office canteens, guest houses, restaurants, hotels, motels, inns, hospitals, etc.

2 REFERENCES

The following standard contains provision which, through reference in the text, constitute provisions of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below:

IS No.	*Title*
15758 (Part 4): 2020	Textiles – Protective clothing Part 4 Method of test for limited flame spread (first revision)

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Limited Flame Spread Index — A number indicating that the textile protective clothing achieved one of the levels given in **8**.

3.2 Hole — A break in the test specimen at least 5 mm × 5 mm in size caused by melting, glowing or flaming.

3.3 Textiles Protective clothing — Clothing which covers or replaces personal clothing and which is designed to provide protection for the wearer's upper and lower torso, neck, arms, and legs against small igniting flames.

4 PRE-TREATMENT BY CLEANING

4.1 All the tests shall be carried out both before the pre-treatment and after the pre-treatment, if cleaning is allowed. If the manufacturer's instructions indicate that cleaning is not allowed, i.e. single-use garments, then testing shall be carried out on new material. The cleaning shall be in line with the manufacturer's instructions, on the basis of standardized processes. If the number of cleaning cycles is not specified, the tests shall be carried out after five cleaning cycles (a cleaning cycle is one wash and one dry cycle). This shall be reflected in the information supplied by the manufacturer. If the garment can be washed and dry-cleaned, it shall only be washed. If only dry-cleaning is allowed, the garment shall be dry-cleaned in accordance with the manufacturer's instructions.

NOTE — Manufacturer's instructions typically indicate one or several of the various methods and processes of ISO 6330, ISO 15797, ISO 3175-2, or equivalent as standardized processes for cleaning.

5 PERFORMANCE REQUIREMENTS

5.1 All textile protective clothing shall have a limited flame spread level 1 or 2 as declared by the manufacturer when tested in accordance with IS 15758 (Part 4) with the flame applied to the outer face.

5.2 For testing of seams of the textiles protective clothing, three specimens containing seam shall be tested in accordance with ISO 15025, Procedure A. Specimens shall be oriented with the seam running up the centreline of the outer surface of the test specimen so that the burner flame impinges directly upon the seam. Seams shall not separate.

5.3 DIMENSIONAL CHANGE OF TEXTILE PROTECTIVE CLOTHING

5.3.1 The Dimensional change shall be measured before and after the samples have undergone five cleaning cycles according to clause 4.1.

5.3.2 The change in dimensions of woven, and non-woven sheet materials shall not exceed ± 3 % in either length or width direction when measured in accordance with ISO 5077. The change of dimensions of knitted materials shall not exceed ±5 % when measured in accordance with ISO 5077.

5.3.3 The Dimensional change shall be measured after the specimen has been uncreased and flattened on a plane surface. Dimensional change does not apply to single-use garments.

5.4 Durability of Fire-Retardant Property

The textile protective clothing shall conform to the durability requirements for limited flame spread index after minimum 50 laundering cycles as per the standard washing procedure (*see* **A-5**) or reduced washing procedure (*see* **A-6**) depending upon the type of textile protective clothing under test, as specified in Annex A.

6 SAMPLING

6.1 Lot

The number of pieces of textile protective clothing of identical type and composition delivered to a buyer against one dispatch note shall constitute a lot.

6.2 The number of pieces of textile protective clothing to be selected at random shall be according to col 2 and 3 of Table 1.

Table 1 Sample Size
(*Clause* 6.2 and 7.1)

Sl No.	Lot Size	Sample Size
(1)	(2)	(3)
i)	Up to 50	3
ii)	51 – 150	5
iii)	151 – 300	5
iv)	301 – 500	8
v)	501 – 1000	10
vi)	1001 and above	10

7 CRITERIA FOR CONFORMITY

7.1 All the samples selected according to col 3 of Table 1 shall be tested for the requirements specified in **5.1** to **5.4**. The lot shall be declared conforming to the requirements of this standard, if all the samples meet the requirements as specified in this standard.

8 CLASSIFICATIONS

8.1 Requirements for Limited Flame Spread Index 1

The textile protective clothing shall meet the following requirements:

a) No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge.
b) No specimen shall give flaming or molten debris;
c) Any afterglow shall not spread from the carbonized area to the undamaged area after the cessation of flaming.
d) No specimen shall give hole formation.

8.2 Requirements for Limited Flame Spread Index 2

The textile protective clothing shall meet the following requirements:

a) No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge.
b) No specimen shall give flaming or molten debris;
c) Any afterglow shall not spread from the carbonized area to the undamaged area after the cessation of flaming.
d) No specimen shall give hole formation.
e) Mean after flame time of any set of six specimens shall not exceed 2 s.

9 MARKING

9.1 Each piece of the textile protective clothing shall carry a permanently stitched and clearly readable cloth label with the following information:

a) Description of the textile protective clothing, for example, a one layer of a woven, knitted or coated fabric (polyester/viscose saree, shirting, etc.) or multi layered cothing such as a laminated or quilted fabric;
b) Mass, in g/m^2;
c) Name and address of the manufacturer or his trade-mark(s);
d) The Flame Spread Index 1 or 2 and the words '**FIRE RESISTANT**'; and
e) Any other information as required by the law in force.

9.2 The minimum size of the graphic part of the label shall be 50 mm × 80 mm. The colour of the label shall be white with a blue border and the words '**FIRE RESISTANT**' shall be white and of minimum height 5 mm.

9.2.1 The letters of the wording shall be easily legible and of minimum height 2 mm.

9.3 BIS Certification Marking

The textile protective clothing may also be marked with the Standard Mark.

9.3.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act,* 2016 and Rules and Regulations made thereunder. The details of the conditions

under which a license for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

10 PACKING

10.1 The textile protective clothing shall be packed as per the relevant material specification or as agreed to between the buyer and the seller.

ANNEX A

(*Clause* 5.4)

METHOD FOR DETERMINATION OF DURABILITY OF FIRE-RETARDANT PROPERTY OF TEXTILE PROTECTIVE CLOTHING

A-1 GENERAL

The method shall be used for assessing the possible effect of repeated commercial laundering on the fire retardant property of textile protective clothing. The effect of laundering is simulated using an automatic horizontal drum washing machine.

A-2 APPARATUS AND REAGENTS

A-2.1 Washing Machine

A-2.1.1 *Automatic Washing Machine,* equipped with a horizontal rotating drum with reversing action. The drum shall have a diameter of 480 mm to 610 mm and shall be fitted with three or four lifters. It shall rotate at 30 rev/min to 52 rev/min and reverse its direction every 10 revolutions to 20 revolutions. The liquor level shall be capable of being controlled to both low and high levels, giving liquor volumes of 0.3V, and 0.54V, where V is the volume of the rotating drum. Means shall be provided for heating and controlling the water temperature. This automatic washing machine shall be used in accordance with the procedures specified in **A-5**.

A-2.2 Soft Water, with a maximum hardness, expressed as calcium carbonate, of 20 mg/l.

A-2.3 Ballast, consisting of rectangular pieces in single layers of woven 100 percent bleached cotton or 100 percent polyester. Each piece shall measure at least 350 × 500 mm and shall be hemmed along the cut edges to prevent unraveling.

A-2.4 Low-foaming Detergent, with perborateas specified in **A-2.4.1**, may be used. Other similar detergents may also be used. Sodium perborate is added to the detergent immediately before use in the ratio of one part per borate to four parts of detergent. All detergent quantities quoted in **A-5** are for the detergent plus perborate.

A-2.4.1 *Composition of the Reference Detergent (Informative)*

As the names and compositions of reference detergents are constantly changing, it is not possible to specify the use of a fixed detergent. A recommended detergent is the ECE or IEC TAED reference detergent. This is a zeolite built detergent. Alternative detergents may be agreed upon between the interested parties.

The TAED reference detergent is supplied as three separate components which are mixed in the following mass fractions immediately before use:

Parameters	*Nominal Composition* (as percent mass)
Spray-dried powder with enzyme prills	77.0
Sodium perboratetetrahydrate	20.0
Bleach activator, tetraacetylethylenediamine	3.0

Due to the variability of the manufacturing process and to ageing, the composition of the spray-dried powder may vary.

A typical composition of the ECE spray-dried powder is:

Component	Nominal Composition (as mass fraction)
Alkylbenzenesulfonate	7.5
C_{12}-18 alcohol + 7 ethylene oxide	4.0
Soap (65 percent C_{12-18}, 35 percent C_{20-22})	2.8
Sodium aluminium silicate (zeolite 4A)	25.0
Sodium carbonate	10.0
Sodium salt of acrylic/maleic acid copolymer	4.0
Sodium silicate ($Si0_2$: Na_20 = 3, 3 : 1)	3.0
Carboxymethylcellulose	1.0
Sodium ethylenediaminetetraacetate	0.2
Sodium sulphate	9.4
Water	9.6
Protease enzyme prills	0.5

NOTE — The IEC TAED detergent contains 0.2 percent of stilbene-type optical whitener with the quantity of sodium sulfate reduced to 9.2 percent.

A-2.5 Iron, or Press, capable of being used at a temperature appropriate for the material being tested.

A-3 COMPOSITION OF LOAD

The test specimens shall be of sufficient size for the subsequent ignitability testing. The total dry mass of the load shall be as calculated in **A-4.2** and at least half the load shall consist of material under test or material of similar fibre type, the remainder consisting of polyester ballast (*see* **A-2.3**).

A-4 PRELIMINARY CALCULATIONS

A-4.1 Drum Volume

If it is not specified, calculate the volume V_1, expressed in litres, of the rotating drum to the nearest litre, ignoring any space occupied by lifters, using the equation:

$$V_1 = lr^2\pi \times 10^{-6}$$

where

l = length of drum, in mm; and
r = radius of drum, in mm.

A-4.2 Test Load

Calculate the total dry mass m_1, expressed in kilograms, of the test load to the nearest 0.1 kg using the equation.

$$m_1 = (0.060 \pm 0.004)\ V_1$$

A-4.3 Detergent Quantity

Calculate the mass m_2, expressed in gram, of detergent to be added, to the nearest 0.5 g using the equation.

$$m_2 = (0.30 \pm 0.02)\ V_1$$

A-4.4 Low Dip Level (*L*)

Determine the volume of water V_2, expressed in litres, required to fill the machine to the low dip level (L) to the nearest 0.5 litre with no load present and with a stationary drum, using the equation.

$$V_2 = (0.30 \pm 0.02)\ V_1$$

A-4.5 High Dip Level (*H*)

Determine the volume of water V_3, expressed in litres, required to fill the machine to the high dip level (H) to the nearest 0.5 litre with no load present and with a stationary drum, using the equation:

$V_3 = (0.54 \pm 0.04)\ V_1$

A-4.6 Parameters for Typical Automatic Washing Machines (Informative)

Type	*A*1	*A*2
Volume, V_1, (litres)	70	45
Load, m_1, (kg)	4.2±0.3	2.7±0.2
Low dip volume, V_2, (litres)	21.0±1.5	13.5±1.0
High dip volume, V_3 (litres)	38.0±3.0	24.5±2.0
Detergent, m_2 (g)	21±1.5	13.5±1.0

NOTE — For some machines the dip levels are preset. Other machines require the dip levels to be adjusted to give the specified volumes.

A-5 STANDARD WASHING PROCEDURE

A-5.1 Load the machine with a load of m1 as calculated in **A-4.2** and of the specified composition (*see* **A-3**). Start the machine with reduced agitation and fill with soft water (*see* **A-2.2**) at a temperature of 15°C to 40°C to the low dip level (*L*), at the same time adding the mass m_2 of detergent (*see* **A-2.4**) as calculated in **A-4.3**.

A-5.2 If the inlet water temperature is below 37°C, heat to 40 ± 3°C with no agitation. Heat to 75 ± 3°C in (15±3) min with reduced agitation. Switch to normal agitation and run at 75 ± 3°C for 15 ± 0.5 min and then drain.

A-5.3 Fill with cold soft water to the high dip level (*H*). Run for 3 min and then drain. Repeat three times to give a total of four rinses in all. Centrifuge for 6 min.

A-5.4 Repeat the washing, rinsing and centrifuging cycles 49 times, giving a total of 50 cycles.

NOTE — If the number of wash cycles specified cannot be completed without interruption, the load may be left wet after centrifuging for a maximum of 18 h.

A-5.5 Dry the specimens in air for the material. Press them (*see* **A-2.5**) at an appropriate temperature to remove creases (if the material is suitable for pressing).

A-6 REDUCED WASHING PROCEDURE

A-6.1 Load the machine with a load of mass m1, as calculated in **A-4.2** and of the specified composition (*see* **A-3**). Start the machine with reduced agitation and fill with soft water (*see* **A-2.2**) at a temperature of 15°C to 40°C to the low dip level (*L*), at the same time adding the mass m2of detergent (*see* **A-2.4**) as calculated in **A-4.3**.

A-6.2 If the inlet water temperature is below 37 °C, heat to 40 ± 3°C with no agitation. Run at 40 ± 3°C with reduced agitation for 15 ± 0.5 min and then drain.

A-6.3 Fill with cold soft water to the high dip level (*H*). Run for 3 min then drain. Repeat three times to give a total of four rinses in all. Centrifuge for 3 min.

A-6.4 Repeat the washing, rinsing and centrifuging cycle 49 times, giving a total of 50 cycles.

NOTE — If the number of wash cycles specified cannot be completed without interruption, the load may be left wet after centrifuging for a maximum of 18 h.

A-6.5 Dry the specimens in air. Press them (*see* **A-2.5**) at an appropriate temperature to remove creases (if the material is suitable for pressing).

A-7 REPORT

The test report on the fire retardant property of textile protective clothing tested after washing by these procedures shall contain the following:

a) Type of washing machine used i.e. automatic washing machine and its drum volume;
b) Type of detergent used;
c) Washing procedure employed (standard or reduced); and
d) Any deviation from the procedure specified.