भारतीय मानक

Indian Standard

IS 18931 : 2024

वस्त्रादि — कपास, मानव निर्मित फाइबर/तंतुओं और उनके मिश्रणों से बने अग्निरोधी कपड़े — सामान्य और प्रदर्शन अपेक्षाएँ

Textiles — Fire Resistant Fabric Made of Cotton, Man-made Fibres/Filaments and their Blends — General and Performance Requirements

ICS 13.340.10

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

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Textile Protective Clothing Sectional Committee, TXD 32

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Textiles Protective Clothing Sectional Committee had been approved by the Textile Division Council.

Within industries such as oil and gas, welding, aviation, automotives, etc the threat of fire is a constant concern. In such environments, ensuring the safety of workers and infrastructure against fire hazards is of utmost importance. Flame retardant fabrics play a crucial role in reducing the threat posed by fire hazards in various industries. Although, there are several technologies and methods employed to impart fire resistance in textile fabrics, but these methods can broadly be divided into two categories:

a) By chemical treatments

   Chemical treatments are employed to impart flame retardant properties to fabrics. FR chemical finishes utilize compounds like brominated, phosphorus, and nitrogen compounds to impart fire resistance to the fabric. These treatments enhance fabric safety in fire-prone environments.

b) By selection of inherently fire-resistant fibres

   Fibres such as meta-aramid, para-aramid, and modacrylic are inherently flame resistant due to their chemical structure. Fabrics made from these fibres exhibit high resistance to ignition and do not require additional chemical treatments.

The Committee has reviewed the provisions of the following International Standards referred in this standard and has decided that it is acceptable for use in conjunction with this standard:

International Standards	*Title*
ISO 3175-2 : 2017	Textiles — Professional care, drycleaning and wetcleaning of fabrics and garments — Part 2: Procedure for testing performance when cleaning and finishing using tetrachloroethene
ISO 5077 : 2007	Textiles — Determination of dimensional change in washing and drying
ISO 6330 : 2021	Textiles — Domestic washing and drying procedures for textile testing
ISO 9150 : 1988	Protective clothing — Determination of behaviour of materials on impact of small splashes of molten metal
ISO 15797 : 2017	Textiles — Industrial washing and finishing procedures for testing of workwear
ISO 17493 : 2016	Clothing and equipment for protection against heat — Test method for convective heat resistance using a hot air circulating oven
EN 1149-2 : 1997	Protective clothing — Electrostatic properties — Part 2: Test method for measurement of the electrical resistance through a material (vertical resistance)

The composition of the Committee responsible for the formulation of this standard is given in Annex C.

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 (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

TEXTILES — FIRE RESISTANT FABRIC MADE OF COTTON, MAN-MADE FIBRES/FILAMENTS AND THEIR BLENDS — GENERAL AND PERFORMANCE REQUIREMENTS

1 SCOPE

1.1 This standard specifies the general and performance requirements for fire resistant fabric made of cotton, man-made fibres/filaments and their blends.

1.2 This standard covers the following 3 categories of fire resistant fabric:

a) Fire-resistant fabric utilized in the manufacture of clothing for use in the oil and gas sector, foundries, automotive industries, aviation sectors, and allied industries;

b) Fire-resistant fabric used in the manufacture of clothing for use during welding, and allied activities; and

c) Fire-resistant fabric utilized in the manufacture of clothing for use in the construction sites, and allied activities.

2 REFERENCES

The standards listed in Annex A 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 edition of these standards.

3 REQUIREMENTS

3.1 Category 1

Requirements for fire-resistant fabric utilized in the manufacture of clothing for use in the oil and gas sector, foundries, automotive industries, aviation sectors, and allied industries.

3.1.1 *Pre-Treatment by Cleaning*

Before each test specified in 3.1.4 the fabric shall pre-treated by cleaning. If the manufacturer's instructions indicate that cleaning is not allowed, that is single-use fabric, then testing shall be carried out on new fabric. In addition, 3.1.4.3 requires that the limited flame spread tests shall be carried out both before the pre-treatment and after the pre-treatment, if cleaning is allowed.

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 fabric can be washed and dry-cleaned, it shall only be washed. If only dry-cleaning is allowed, the fabric shall be dry-cleaned in accordance with the manufacturer's instructions.

NOTES

1 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.

2 The drying temperature may be 65 °C ± 5 °C.

3.1.2 *Ageing*

In the case that the fabric should be submitted to some treatment to maintain its limited flame spread property as specified in 3.1.4.3, the manufacturer shall indicate the maximum number of cleaning cycles that can be carried out before applying the treatment indicated to maintain the fabric protective performance. Limited flame spread test according to 3.1.4.3 shall be carried out after the last cleaning cycles before any treatment as indicated by the manufacturer; in both cases the fabric shall comply with the requirement.

3.1.3 *Conditioning*

Fabric shall be conditioned for at least 24 h in an atmosphere having a temperature of (27 ± 2) °C and a relative humidity of (65 ± 4) percent. Testing shall be carried out within 5 min of removal from this atmosphere.

3.1.4 *Performance Requirement*

3.1.4.1 *General*

The fabric shall meet the requirements of 3.1.4.2, 3.1.4.3 and shall meet at least one of the heat transmission requirements for letter codes B, C, D, E or F of 3.1.4.4 based on their intended use. The

fabric shall also meet the requirements of 3.1.4.5 to 3.1.4.8.

3.1.4.2 *Heat resistance*

3.1.4.2.1 *Heat resistance at a temperature of* (180 ± 5) °C

The fabric shall be tested according to ISO 17493 at a temperature of (180 ± 5) °C for an exposure time of 5 min. Test samples shall not ignite, melt or drip, and fabrics shall also not shrink by more than 5 percent.

3.1.4.2.2 *Optional requirement — heat resistance at a temperature of* (260 ± 5) °C

The fabric can be optionally tested according to ISO 17493 at a temperature of (260 ± 5) °C for an exposure time of 5 min. The fabric shall not ignite, melt, or drip and shall not shrink by more than 10 percent in addition to meeting the requirements of 3.1.4.2.1.

NOTE — Heat shrinkage has the potential to reduce the thermal protection level of the fabric as it reduces the insulating air pocket between the fabric and the body. Therefore, heat shrinkage in heat and flame protective fabric has to be limited, especially in cases where a heat or flame hazard exists that could hit a large percentage area of the fabric.

3.1.4.3 *Limited flame spread*

Testing of fabric for limited flame spread shall take place in accordance with ISO 15025, to Procedure A (code letter A1) and Procedure B (code letter A2). This test shall be carried out both before and after pre-treatment specified in 3.1.1.

NOTE — For dark coloured fabric specimen, the samples may be tested in dark rooms for easy visibility of afterglow.

3.1.4.3.1 *Testing in accordance with* ISO 15025, *Procedure* A (*code letter* A1)

When tested in accordance with ISO 15025, Procedure A, specimens from fabric shall meet the following requirements (*see* Table 1).

3.1.4.3.2 *Tested in accordance with* ISO 15025, *Procedure* B (*code letter* A2)

When tested in accordance with ISO 15025, Procedure B, specimens from fabric shall meet the following requirements (*see* Table 2).

3.1.4.4 *Heat transmission performance requirements*

3.1.4.4.1 *Convective heat* (*code letter B*)

When tested in accordance with IS 15758 (Part 1), fabrics that are claimed to offer protection against convective heat shall meet at least performance level B1 in Table 3.

3.1.4.4.2 *Radiant heat* (*code letter* C)

When tested in accordance with IS 15758 (Part 2), Method B, at a heat flux density of 20 kW/m^2, fabrics that are claimed to offer protection against radiant heat shall meet at least performance level C1 in Table 4.

Table 1 Limited Flame Spread Performance Requirements, ISO 15025, Procedure A (Code Letter A1)

(*Clause* 3.1.4.3.1)

Sl No.	Properties	Requirement
(1)	(2)	(3)
i)	Flame spread	No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge.
ii)	Flaming debris	No specimen shall give flaming or molten debris.
iii)	Hole formation	No specimen shall give hole formation of 5 mm or greater in any direction, except for an interlining that is used for specific protection other than heat and flame protection.
iv)	Afterglow	Afterglow time shall be ≤ 2 s. Afterglow is a continuation of combustion with the evolution of heat and light but without flame. Some materials absorb heat during the flame application and continue to emit this absorbed heat inside the charred area after removal of the igniting flame. This glowing inside the charred area without combustion shall not be recorded as afterglow.
v)	After flame	After flame time shall be ≤ 2 s.

Table 2 Limited Flame Spread Performance Requirements, ISO 15025, Procedure B (Code Letter A2)

(*Clause* 3.1.4.3.2)

Sl No.	Properties	Requirement
(1)	(2)	(3)
i)	Flame spread	No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge.
ii)	Flaming debris	No specimen shall give flaming or molten debris.
iii)	Afterglow	Afterglow time shall be ≤ 2 s. Afterglow is a continuation of combustion with the evolution of heat and light but without flame. Some materials absorb heat during the flame application and continue to emit this absorbed heat inside the charred area after removal of the igniting flame. This glowing inside the charred area without combustion shall not be recorded as afterglow.
iv)	After flame	After flame time shall be ≤ 2 s.

Table 3 Performance Levels: Convective Heat Test

(*Clause* 3.1.4.4.1)

Sl No.	Performance Levels	Heat Transfer Factor HTI 24 Values	
		S	
		Min	*Max*
(1)	(2)	(3)	(4)
i)	B1	4.0	< 10.0
ii)	B2	10.0	< 20.0
iii)	B3	20.0	–

NOTE — Heat transfer index, as defined in ISO 9151.

Table 4 Performance Levels: Radiant Heat Test

(*Clause* 3.1.4.4.2)

Sl No.	Performance Levels	Heat Transfer Factor RHTI 24	
		S	
		Min	*Max*
(1)	(2)	(3)	(4)
i)	C1	7.0	< 20.0
ii)	C2	20.0	< 50.0
iii)	C3	50.0	< 95.0
iv)	C4	95.0	–

NOTE — Radiant heat transfer index, as defined in ISO 6942.

3.1.4.4.3 *Molten aluminium splash* (*code letter* D)

When tested in accordance with IS 15758 (Part 5) using molten aluminium, fabrics that are claimed to offer protection against molten aluminium splash shall meet at least performance level D1 in Table 5. Fabrics which ignite during the test do not meet this requirement.

NOTE — The sample shall be considered failed, if the molten metal adheres to the fabric test specimen.

3.1.4.4.4 *Molten iron splash* (*code letter* E)

When tested in accordance with IS 15758 (Part 5) using molten iron, fabrics that are claimed to offer protection against molten iron splash shall meet at least performance level E1 in Table 6. Fabrics which ignite during the test do not meet this test.

NOTE — The sample shall be considered failed, if the molten metal adheres to the fabric test specimen.

3.1.4.4.5 *Contact heat* (*code letter* F)

When tested in accordance with IS 17462 (Part 1) at a temperature of 250 °C, fabrics that are claimed to offer protection against contact heat shall meet at least performance level F1 in Table 7.

Table 5 Performance Levels: Molten Aluminium Splash

(*Clause* 3.1.4.4.3)

Sl No.	Performance Levels	Molten Aluminium Splash G	
		Min	*Max*
(1)	(2)	(3)	(4)
i)	D1	100	< 200
ii)	D2	200	< 350
iii)	D3	350	–

Table 6 Performance Levels: Molten Iron Splash

(*Clause* 3.1.4.4.4)

Sl No.	Performance Levels	Molten Iron Splash G	
		Min	*Max*
(1)	(2)	(3)	(4)
i)	E1	60	< 120
ii)	E2	120	< 200
iii)	E3	200	–

Table 7 Performance Levels: Contact Heat

(*Clause* 3.1.4.4.5)

Sl No.	Performance Levels	Threshold Time S	
		Min	*Max*
(1)	(2)	(3)	(4)
i)	F1	5.0	< 10.0
ii)	F2	10.0	< 15.0
iii)	F3	15.0	–

3.1.4.5 *Tensile strength*

When tested in accordance with ISO 13934-1, woven fabric shall have a minimum tensile strength of 300 N in both the machine and cross directions.

NOTE — For 100 percent cotton woven fabric, the tensile strength shall be 250 N, *Min* in both the machine and cross directions.

3.1.4.6 *Tear strength*

When tested in accordance with ISO 13937-2, woven fabric shall have a minimum tear strength of 10 N in both the machine and cross directions.

3.1.4.7 *Burst strength for knitted materials*

When tested in accordance with ISO 13938-1 or ISO 13938-2, knitted fabric shall have a minimum burst strength of 100 kPa, when using 50 cm^2 test area, or of 200 kPa, when using a 7.3 cm^2 test area.

3.1.4.8 *Dimensional change*

Dimensional change shall be measured after the samples have undergone five cleaning cycles according to 3.1.1. The change in dimensions of woven fabric shall not exceed ± 3 percent in either length or width direction when measured in accordance with ISO 5077. The change of dimensions of knitted materials shall not exceed ± 5 percent when measured in accordance with ISO 5077. Dimensional change shall be measured after the fabric has been uncreased and flattened on a plane surface. Dimensional change does not apply to single use fabric.

3.1.4.9 *p*H *evaluation*

When tested in accordance with the IS 1390, the fabric shall have the *p*H from 6.0 to 8.0.

3.2 Category 2

Requirements for fire-resistant fabric used in the manufacture of clothing for use during welding, and allied activities.

3.2.1 *Pre-Treatment of Material*

Before each test specified in 3.2.5 to 3.2.12, the test materials and test specimens shall be pre-treated by cleaning. If the manufacturer's instructions indicate that cleaning is not allowed, that is single use fabric, then testing will be carried out on new material. In addition, 3.2.9 requires that the limited flame spread tests shall be carried out both before the pre-treatment and after the pre-treatment. 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 fabric can be washed and dry-cleaned, it shall only be washed. If only dry-cleaning is allowed, the fabric shall be dry-cleaned in accordance with the manufacturer's instructions.

NOTES

1 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.

2 The drying temperature may be 65 °C ± 5 °C.

3.2.2 *Ageing*

In the case that the fabric should be submitted to some treatment to maintain its limited flame spread property as specified in 3.2.9, the manufacturer shall indicate the maximum number of cleaning cycles that can be carried out before applying the treatment indicated to maintain the fabric protective performance. Limited flame spread test according to 3.2.9 shall be carried out after the last cleaning cycles before any treatment as indicated by the manufacturer, in both cases, the fabric shall comply with the requirement.

3.2.3 *Conditioning*

Fabric shall be conditioned for at least 24 h in an atmosphere having a temperature of (27 ± 2) °C and a relative humidity of (65 ± 5) percent. Leather specimens shall be conditioned for at least 48 h in an atmosphere having a temperature of (27 ± 2) °C and a relative humidity of (65 ± 5) percent. Testing shall be carried out within 5 min of removal from this atmosphere. Samples for electrical resistance testing specified in 3.2.12 shall be conditioned and tested in an atmosphere having a relative humidity of (85 ± 5) percent and a temperature of (27 ± 2) °C.

3.2.4 *Classification*

This standard specifies the performance requirements of two types of fabrics used in the manufacture of clothing for use during welding, and allied activities as given below:

a) Class 1 is protection against less hazardous welding techniques and situations, causing lower levels of spatter and radiant heat (*see* Annex B and Table 13); and

b) Class 2 is protection against more hazardous welding techniques and situations, causing higher levels of spatter and radiant heat (*see* Annex B and Table 13).

3.2.5 *Tensile Strength*

When tested in accordance with ISO 13934-1, woven outer fabric shall have a minimum tensile strength of 400 N in both the machine and cross directions.

3.2.6 *Tear Strength*

When tested in accordance with ISO 13937-2, woven outer fabric shall have a minimum tear strength of 15 N in both the machine and cross directions for Class 1 welders clothing and 20 N in both the machine and cross directions for Class 2 welders clothing.

3.2.7 *Burst Strength of Knitted Materials*

When tested in accordance with ISO 13938-1 or ISO 13938-2, knitted outer fabric shall have a minimum burst strength of 100 kPa, when using 50 cm^2 test area, or 200 kPa, when using a 7.3 cm^2 test area.

3.2.8 *Dimensional Change of Textile Materials*

Dimensional change shall be measured after the samples have undergone five cleaning cycles according to **3.2.1**. The change in dimensions of woven fabric shall not exceed ± 3 percent in either length or width direction when measured in accordance with ISO 5077. The change of dimensions of knitted materials shall not exceed ± 5 percent when measured in accordance with ISO 5077. Dimensional change shall be measured after the fabric has been uncreased and flattened on a plane surface. Dimensional change does not apply to single use fabric.

3.2.9 *Limited Flame Spread*

Testing of fabric for limited flame spread shall take place in accordance with ISO 15025, to Procedure A (code letter A1) and Procedure B (code letter A2). This test shall be carried out both before and after pre-treatment specified in **3.2.1**.

NOTE — For dark coloured fabric specimen, the samples may be tested in dark rooms.

3.2.9.1 *Testing in accordance with* ISO 15025, *Procedure* A (*code letter* A1)

When tested in accordance with ISO 15025, Procedure A, specimens from fabric shall meet the following requirements (*see* Table 8).

3.2.9.2 *Tested in accordance with* ISO 15025, *Procedure* B (*code letter* A2)

When tested in accordance with ISO 15025, Procedure B, specimens from fabric shall meet the following requirements (*see* Table 9).

Table 8 Limited Flame Spread Performance Requirements, ISO 15025, Procedure A (Code Letter A1)

(*Clause* 3.2.9.1)

Sl No.	Properties	Requirement
(1)	(2)	(3)
i)	Flame spread	No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge.
ii)	Flaming debris	No specimen shall give flaming or molten debris.
iii)	Hole formation	No specimen shall give hole formation of 5 mm or greater in any direction, except for an interlining that is used for specific protection other than heat and flame protection.
iv)	Afterglow	Afterglow time shall be ≤ 2 s. Afterglow is a continuation of combustion with the evolution of heat and light but without flame. Some materials absorb heat during the flame application and continue to emit this absorbed heat inside the charred area after removal of the igniting flame. This glowing inside the charred area without combustion shall not be recorded as afterglow.
v)	After flame	After flame time shall be ≤ 2 s.

Table 9 Limited Flame Spread Performance Requirements, ISO 15025, Procedure B (Code Letter A2)

(*Clause* 3.2.9.2)

Sl No.	Properties	Requirement
(1)	(2)	(3)
i)	Flame spread	No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge.
ii)	Flaming debris	No specimen shall give flaming or molten debris.
iii)	Afterglow	Afterglow time shall be ≤ 2 s. Afterglow is a continuation of combustion with the evolution of heat and light but without flame. Some materials absorb heat during the flame application and continue to emit this absorbed heat inside the charred area after removal of the igniting flame. This glowing inside the charred area without combustion shall not be recorded as afterglow.
iv)	After flame	After flame time shall be ≤ 2 s.

3.2.10 *Impact of Spatter* (*Small Splashes of Molten Metal*)

When tested according to ISO 9150, the fabric shall require:

a) at least 15 drops of molten metal to raise the temperature behind the test specimen by 40 K for Class 1; and

b) at least 25 drops of molten metal to raise the temperature behind the test specimen by 40 K for Class 2.

Fabric samples which ignite during the test do not meet this requirement.

3.2.11 *Heat Transfer* (*Radiation*)

When tested in accordance with ISO 6942, Method B, at a heat flux density of 20 kW/m^2, fabrics shall meet a radiant heat transfer index (RHTI for 24 °C) of:

a) for Class 1 — RHTI 24 ≥ 7.0; and

b) for Class 2 — RHTI 24 ≥ 16.0.

3.2.12 *Electrical Resistance*

Conditioning and testing of the samples shall be carried out at a temperature of (27 ± 2) °C and relative humidity of (85 ± 4) percent. When the fabric is tested in accordance with the test method specified in EN 1149-2 and under an applied potential of (100 ± 5) V, the electrical resistance shall be greater than 10^5 Ω (corresponds to less than 1 mA leakage current).

3.2.13 *p*H *Evaluation*

When tested in accordance with the IS 1390, the fabric shall have the *p*H from 6.0 to 8.0.

3.3 Category 3

Requirements for fire-resistant fabric utilized in the manufacture of clothing for use in the construction sites, and allied activities.

3.3.1 *Pre-Treatment by Cleaning*

Before each test specified in 3.3.4, the fabric shall pre-treated by cleaning. If the manufacturer's instructions indicate that cleaning is not allowed, that is single-use fabric, then testing shall be carried out on new fabric. In addition, 3.3.4.3 requires that the limited flame spread tests shall be carried out both before the pre-treatment and after the pre-treatment, if cleaning is allowed.

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 fabric can be washed and dry-cleaned, it shall only be washed. If only dry-cleaning is allowed, the fabric shall be dry-cleaned in accordance with the manufacturer's instructions.

NOTES

1 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.

2 The drying temperature may be 65 °C ± 5 °C.

3.3.2 *Ageing*

In the case that the fabric should be submitted to some treatment to maintain its limited flame spread property as specified in 3.3.4.3, the manufacturer shall indicate the maximum number of cleaning cycles that can be carried out before applying the treatment indicated to maintain the fabric protective performance. Limited flame spread test according to 3.3.4.3 shall be carried out after the last cleaning cycles before any treatment as indicated by the manufacturer; in both cases the fabric shall comply with the requirement.

3.3.3 *Conditioning*

Fabric shall be conditioned for at least 24 h in an atmosphere having a temperature of (27 ± 2) °C and a relative humidity of (65 ± 4) percent. Testing shall be carried out within 5 min of removal from this atmosphere.

3.3.4 *Performance Requirement*

3.3.4.1 *General*

The fabric shall meet the requirements as given in 3.3.4.2 to 3.3.4.6.

3.3.4.2 *Heat resistance*

3.3.4.2.1 *Heat resistance at a temperature of* (180 ± 5) °C

The fabric shall be tested according to ISO 17493 at a temperature of (180 ± 5) °C for an exposure time of 5 min. Test samples shall not ignite or melt, drip and fabrics shall also not shrink by more than 5 percent.

3.3.4.2.2 *Optional requirement — Heat resistance at a temperature of* (260 ± 5) °C

The fabric can be optionally tested according to ISO 17493 at a temperature of (260 ± 5) °C for an exposure time of 5 min. The fabric shall not ignite or melt and shall not shrink by more than 10 percent in addition to meeting the requirements of 3.3.4.2.1.

NOTE — Heat shrinkage has the potential to reduce the thermal protection level of the fabric as it reduces the insulating air pocket between the fabric and the body. Therefore, heat shrinkage in heat and flame protective fabric has to be limited, especially in cases where a heat or flame hazard exists that could hit a large percentage area of the fabric.

3.3.4.3 *Limited flame spread*

Testing of fabric for limited flame spread shall take place in accordance with ISO 15025, to Procedure A (code letter A1) and Procedure B (code letter A2). This test shall be carried out both before and after pre-treatment specified in 3.3.1.

NOTE — For dark coloured fabric specimen, the samples may be tested in dark rooms.

3.3.4.3.1 *Testing in accordance with* ISO 15025, *Procedure* A (*code letter* A1)

When tested in accordance with ISO 15025, Procedure A, specimens from fabric shall meet the following requirements (*see* Table 10).

Table 10 Limited Flame Spread Performance Requirements, ISO 15025, Procedure A (Code Letter A1)

(*Clause* 3.3.4.3.1)

Sl No.	Properties	Requirement
(1)	(2)	(3)
i)	Flame spread	No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge.
ii)	Flaming debris	No specimen shall give flaming or molten debris.
iii)	Hole formation	No specimen shall give hole formation of 5 mm or greater in any direction, except for an interlining that is used for specific protection other than heat and flame protection.
iv)	Afterglow	Afterglow time shall be ≤ 2 s. Afterglow is a continuation of combustion with the evolution of heat and light but without flame. Some materials absorb heat during the flame application and continue to emit this absorbed heat inside the charred area after removal of the igniting flame. This glowing inside the charred area without combustion shall not be recorded as afterglow.
v)	After flame	After flame time shall be ≤ 2 s.

3.3.4.3.2 *Tested in accordance with* ISO 15025, *Procedure* B (*code letter* A2)

When tested in accordance with ISO 15025, Procedure B, specimens from fabric shall meet the following requirements (*see* Table 11).

3.3.4.4 *Tensile strength*

When tested in accordance with ISO 13934-1, woven fabric shall have a minimum tensile strength of 300 N in both the machine and cross directions.

NOTES

1 The requirement of tensile strength is not applicable for knitted fabric.

2 For 100 percent cotton woven fabric, the tensile strength shall be 250 N, *Min* in both the machine and cross directions.

3.3.4.5 *Tear strength*

When tested in accordance with ISO 13937-2, woven fabric shall have a minimum tear strength of 10 N in both the machine and cross directions.

3.3.4.6 *Burst strength for knitted materials*

When tested in accordance with ISO 13938-1 or ISO 13938-2, knitted fabric shall have a minimum burst strength of 100 kPa, when using 50 cm^2 test area, or of 200 kPa, when using a 7.3 cm^2 test area.

NOTE — The requirement of bursting strength is not applicable for woven fabric.

3.3.4.7 *p*H *evaluation*

When tested in accordance with the IS 1390, the fabric shall have the *p*H from 6.0 to 8.0.

4 MARKING

4.1 Each fabric shall be marked with the following information:

a) Name of the material, for example, FR treated/FR proban treated fabric or in case of blended/mixed FR treated/FR proban treated fabric, the full name of fibres in the mixture and their composition;

b) Length and width;

c) Mass in g/m^2;

d) Batch/lot no.;

e) Manufacturer's name, initials or trade-mark;

f) Month and year of manufacture; and

g) Any other information required by the law in force.

4.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the product may be marked with the Standard Mark.

5 PACKING

The fabrics shall be packed in bales or cases in accordance with the procedure laid down either in IS 2194 or in IS 2195 or as agreed upon between the buyer and the seller.

6 SAMPLING

6.1 Lot

The rolls of fabrics for same type of application, produced in one facility, using the same production processes and materials and being offered for delivery at one time to buyer against a dispatch note shall constitute a lot.

6.2 Unless otherwise agreed between the buyer and the seller, the number of rolls selected at random for inspection shall be as per col (3) of Table 12.

6.3 The lot shall be declared as conforming to the requirements of this standard, if no defective protective clothing is found.

Table 11 Limited Flame Spread Performance Requirements, ISO 15025, Procedure B (Code Letter A2)

(*Clause* 3.3.4.3.2)

Sl No.	Properties	Requirement
(1)	(2)	(3)
i)	Flame spread	No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge.
ii)	Flaming debris	No specimen shall give flaming or molten debris.
iii)	Afterglow	Afterglow time shall be ≤ 2 s. Afterglow is a continuation of combustion with the evolution of heat and light but without flame. Some materials absorb heat during the flame application and continue to emit this absorbed heat inside the charred area after removal of the igniting flame. This glowing inside the charred area without combustion shall not be recorded as afterglow.
iv)	After flame	After flame time shall be ≤ 2 s.

Table 12 Sample Size

(*Clause* 6.2)

Sl No.	Number of Rolls of Fabric in the Lot	Sample Size (No. of rolls)	Permissible No. of Defectives
(1)	(2)	(3)	(4)
i)	Up to 90	3	0
ii)	91 to 150	3	0
iii)	151 to 280	5	0
iv)	281 to 500	5	0
v)	501 and above	5	0

ANNEX A

(*Clause 2*)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 667 : 1981	Methods for identification of textile fibres (*first revision*)
IS 1390 : 2022/ ISO 3071 : 2020	Textiles — Determination of *p*H of aqueous extract (*third revision*)
IS 1954 : 2024/ ISO 22198 : 2006	Textiles — Fabrics — Determination of width and length (*third revision*)
IS 1964 : 2001	Textiles — Methods for determination of mass per unit length and mass per unit area of fabrics (*second revision*)
IS 1966	Textiles — Bursting properties of fabrics:
(Part 1) : 2022/ ISO 13938-1 : 2019	Hydraulic method for determination of bursting strength and bursting distension (*third revision*)
(Part 2) : 2022/ ISO 13938-2 : 2019	Pneumatic method for determination of bursting strength and bursting distension (*third revision*)
IS 1969 (Part 1) : 2018/ISO 13934-1 : 2013	Textiles — Tensile properties of fabrics: Part 1 Determination of maximum force and elongation at maximum force using the strip method (*fourth revision*)
IS 2194 : 1963	Code for seaworthy packaging of man-made fibre fabrics
IS 2195 : 1964	Code for inland packaging of man-made fibre fabrics and man-made fibre yarns
IS 6489 (Part 2) : 2011/ISO 13937-2 : 2000	Textiles — Tear properties of fabrics: Part 2 Determination of tear force of trouser shaped test specimens (single tear method) (*second revision*)
IS 15370 : 2023/ ISO 6330 : 2021	Textiles — Domestic Washing and drying procedures for textile testing (*second revision*)
IS 15758	Textiles — Protective clothing:
(Part 1) : 2020/ ISO 9151 : 2016	Determination of heat transmission on exposure to flame (*first revision*)
(Part 2) : 2007/ ISO 6942 : 2002	Assessment of material assemblies when exposed to source of radiant heat
(Part 4) : 2020/ ISO 15025 : 2016	Method of test for limited flame spread (*first revision*)
(Part 5) : 2020/ ISO 9185 : 2007	Assessment of resistance of materials to molten metal splash (*first revision*)
IS 17462 (Part 1) : 2020/ISO 12127-1 : 2015	Clothing for protection against heat and flame — Determination of contact heat transmission through protective clothing or constituent materials: Part 1 Contact heat produced by heating cylinder
IS 17468 : 2020/ ISO 17493 : 2016	Clothing and equipment for protection against heat — Test method for convective heat resistance using a hot air circulating oven

ANNEX B

(*Clause* 3.2.4)

GUIDANCE FOR THE SELECTION OF THE TYPE OF FABRIC FOR WELDERS' CLOTHING (CLASS 1/CLASS 2)

Table 13 Selection Criteria for Fabric for Clothing for Use in Welding or Allied Processes (Reference Points)

(*Clause* 3.2.4)

Sl No.	Type of Welders' Clothing	Selection Criteria Relating to the Process	Selection Criteria Relating to the Environmental Conditions
(1)	(2)	(3)	(4)
i)	Class 1	Manual welding techniques with light formation of spatters and drops, for example: a) Gas welding b) TIG welding c) MIG welding (with low current) d) Micro plasma welding e) Brazing f) Spot welding g) MMA welding (with rutile-covered electrode)	Operation of machines, for example: a) oxygen cutting machines b) plasma cutting machines c) resistance welding machines d) machines for thermal spraying e) bench welding
ii)	Class 2	Manual welding techniques with heavy formation of spatters and drops, for example: a) MMA welding (with basic or cellulose-covered electrode) b) MAG welding (with CO_2 or mixed gases) c) MIG welding (with high current) d) self-shielded flux cored arc welding e) plasma cutting f) gouging g) oxygen cutting h) thermal spraying	Operation of machines, for example: a) in confined spaces b) at overhead welding/ cutting or in comparable constrained positions

ANNEX C

(*Foreword*)

COMMITTEE COMPOSITION

Textiles Protective Clothing Sectional Committee, TXD 32

Organization	*Representative(s)*
Northern India Textile Research Association, Ghaziabad	DR ARINDAM BASU **(*Chairperson*)**
Aeronav Industrial Safety Appliances, Noida	SHRI SANDEEP HORA
Arvind Limited, Ahmedabad	SHRI PABITRA SAHOO SHRIMATI PALAK KAKKAR (*Alternate*)
Avient Protective Materials Limited, Pune	SHRI HARSH WARDHAN SHARMA SHRI RAKESH GAIKWAD (*Alternate*)
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Central Industrial Security Force, New Delhi	SHRI ANAND SAXENA SHRI RAVINDRA KUMAR MEEL (*Alternate*)
Central Reserve Police Force, New Delhi	SHRI D. N. LAL SHRI SANJEEV KUMAR SINGH (*Alternate*)
Centre for Fire and Explosive Environment Safety, Defence Institute of Fire Research, Delhi	SHRI MAHIPAL MEENA SHRI P. K. ROY (*Alternate*)
Confederation of Indian Industry, New Delhi	SHRI SAUNAK BANERJEE
Defence Bio-Engineering and Electromedical Laboratory, Ministry of Defence, Bengaluru	DR T. M. KOTRESH SHRI VINOTH P. (*Alternate*)
Defence Institute of Physiology and Allied Science (DRDO), New Delhi	DR MADHUSUDAN PAL SHRI SUNIL KUMAR HOTA (*Alternate*)
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Indian Institute of Technology Delhi, New Delhi	PROF ABHIJIT MAJUMDAR DR BIPIN KUMAR (*Alternate*)

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SCIENTIST 'B'/ASSISTANT DIRECTOR
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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
Eastern	: 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	2367 0012 2320 9474
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