**BUREAU OF INDIAN STANDARDS**

**(New Delhi)**

**AGENDA**

**Textiles Protective Clothing Sectional Committee, TXD 32 18th Meeting**

|  |  |  |
| --- | --- | --- |
| **Date/Day** | **Time** | **Venue** |
|  19 November 2023 | 1100 h | Through Video Conferencing |

**CHAIRMAN:** Dr. Arindam Basu, NITRA, Ghaziabad

**MEMBER SECRETARY:** Shri Mayur Katiyar

**Item 0 WELCOME AND INTRODUCTORY REMARKS BY THE CHAIRMAN**

**Item 1 CONFIRMATION OF THE MINUTES OF THE PREVIOUS MEETING**

**1.1** The minutes of the 17th meeting of the TXD 32 held on 05 May 2023 were circulated vide BIS DG letter No. TXD32/A2.17 dated 22 June 2023. The comments received from M/s Foremost Technico Pvt Ltd., New Delhi on the minutes of the meeting are given in **Annex 1 (P-5).**

## 1.1.1 The Committee may DECIDE.

**Item 2 COMPOSITION OF TXD 32**

**2.1** The present composition and scope of TXD 32 is given in **Annex 2 (P-6 to 8).**

**2.1.1** The committee may **DECIDE**.

**2.2** Co-option requests received from the following organizations are given in **Annex 3 (P-9 to 15).**

1. M/s Kaneka India Pvt. Ltd.,
2. M/s 3M India Ltd., Bengaluru
3. M/s Archroma India Pvt Ltd. and
4. M/s Viridian Testing Laboratories LLP, Tirupur

**2.2.1** The committee may **DECIDE**.

**Item 3 ISSUES ARISING OUT OF THE PREVIOUS MEETINGS**

**3.1** Summary of actions taken on the various decisions of the previous meetings are given in **Annex 4 (Page 16).**

**3.1.1** The committee may **NOTE.**

**Item 4 DRAFT STANDARD FOR FINALIZATION**

**4.1** In the 16th meeting, the committee decided that the draft Indian Standard on **‘Specification for Cement work wear’** [**Doc No.: TXD 32 (22344)]** shall be issued under wide circulation for a period of 2 months for eliciting technical comments. The wide circulation draft is given in **Annex 5 (P-17 to 29).** No comments were received.

**4.1.1** The committee may **DECIDE.**

**Item 5 DRAFTS FOR WIDDE CIRCULATION**

**5.1** As decided by the committee in the 16th meeting, BIS has prepared wide circulation drafts for the following standards:

1. IS 11871 : 1986 Methods for determination of flammability and flame resistance of textile fabrics
2. IS 12722 : 1989 Textile floor coverings – Determination of flame resistance by tablet test
3. IS 13501 : 1992 Textiles - Determination of flammability by oxygen index
4. IS 10054 : 1996 Textiles – High density polyethylene (HDPE) monofilament mosquito netting, round mesh – Specification (first revision)

The WC drafts are given in **Annex 6 (P-30 to 75).**

**5.1.1** The committee may **DECIDE.**

**Item 6 COMMENTS ON PUBLISHED STANDARDS**

**6.1** The comments received from Central Mark Department -II through portal on IS 16725 : 2018 Textiles – Tactical 3 points sling universal – Specification and IS 16874 : 2018 Textiles – Protective gloves for firefighters – Specification are given in **Annex 7 (P-76 to 78).**

**6.1.1** The committee may **DECIDE.**

**6.2** The comments received from M/s NITRA, Ghaziabad on IS 15768 : 2008 Textiles – Resistance to ignition of upholstered composites used for non-domestic furniture – Specification are given in **Annex 8 (P-79).**

**6.2.1** The committee may **DECIDE.**

**6.3** The comments received from M/s System 5S on IS 16890 : 2018 on Firefighters’ clothing is given in **Annex 9 (P- 80 to 82).**

**6.3.1** The committee may **DECIDE.**

**Item 7 NEW WORK ITEM PROPOSAL**

**7.1** In the last meeting the draft of Extreme Cold Weather Clothing (ECWC) was circulated to the committee members for eliciting technical comments. Comments received form M/s Ordinance Clothing Factory (OCF), Shahjahanpur on draft ECWC are given in **Annex 10 (P-83 to 91).** The draft of ECWC is given in **Annex 11 (Attached separately).**

**7.1.1** The committee may **DECIDE.**

**7.2** The proposal of formulation of new Indian standards on the following subjects has been received from M/s CFEES:

1. Aluminised Fire proximity suits for fires with high radiant heat, such as in bulk flammable

fuel fires or aeroplane crash fires. Three international standards cover such firefighting

suits viz NFPA 1971, EN1486 and ISO 15538. We may adopt the ISO standard as such as

the Indian standard. We can talk about this in the meeting.

2. Standard for wildland firefighting clothing. ISO 16073 Part 3 Wildland firefighting

personal protective equipment - clothing may be adopted as IS standard.

3. Gloves for wildland firefighting clothing. ISO 16073 Part 4 Wildland firefighting personal

protective equipment - gloves may be adopted as IS standard.

**7.2.1** The committee may **DECIDE.**

**7.3** The proposal of formulation oof new Indian standards on the following subjects has been received from M/s System 5S:

a)     New work item proposal for formulation of Indian Standard on Fire-fighting hoods. We may take guidance from EN 13911:2017 and ISO 11999 Part 9-2016 – on the subject.

b)     New work item proposal for formulation of Indian Standard on wildland protective clothing. We may take guidance from EN 15384 and ISO 16073 Part 3-2019 on the subject.

c)     New work item proposal for formulation of Indian Standard on wildland protective gloves. We may take guidance from ISO 16073 Part 4 – 2019 on the subject.

d)     New work item proposal for formulation of Indian Standard on Aluminised Reflective clothing for Limited Fire Entry purposes. We may take guidance from EN 1486 :2008  this standard covers the Protective clothing + Hood + Gloves + Foot protection. Or ISO 15538-2001. Kindly note that ISO 15538 is for Reflective clothing with an Aluminised surface for Industrial Protection and not for Limited Fire Entry . In addition this standard covers the Protective clothing only and does not cover Hood , Gloves , Foot protections.

e)     New work item proposal for formulation of Indian Standard for Cleaning, inspection and repair of firefighters' personal protective equipment (PPE). We may take guidance from ISO 23616:2022 on the subject.

**7.3.1** The committee may **DECIDE.**

**Item 8 REVIEW OF INDIAN STANDARDS**

**8.1** As per procedure of BIS, standards which were published/reaffirmed five years ago or before are required to be reviewed to assess adequacy of the requirements specified. Review is carried out keeping in view the changes in technology, current industrial practices and the needs/ expectations of the consumers/users so as to decide regarding further reaffirmation/revision/ withdrawal/amendment of the standards under review.

**8.1.1** The list of Indian Standards due for review is listed below:

|  |  |  |
| --- | --- | --- |
| **Sl No.** | **IS Number** | **IS Title** |
|  | IS 17286 : 2019 | Textiles – Water-proof multipurpose rain poncho with convertibility as bivouac – Specification  |
|  | IS 17291 : 2019 | Textiles – Flame retardant jute based decorative and cover fabric for temporary structure – Specification  |

**8.1.2** The committee may **DECIDE.**

**Item 9 RESEARCH AND DEVELOPMENT PROJECT**

**9.1** The subject of Hoods for firefighters was taken up by the TXD 32 sectional committee for the formulation of a new standard. It is proposed that this subject may be taken up as an R&D project. The proposed ToR is given in **Annex 12 (P-92 to 94)** for your reference. The guidelines for R&D project is given in **Annex 13 (P- 95 to 118).** M/sSystem 5S has also proposed to take IS 8990 for Code of maintenance and care for industrial safety clothing through R & D guidelines recently instituted by BIS.

**9.1.1** The committee may **DECIDE.**

**Item 10 PROPOSAL FOR P-MEMBERSHIP ISO TC/94/SC/14**

**10.1** The work done by ISO Technical committeeISO TC/94/SC/14 is similar to work done by TXD 32 sectional committee of BIS.The scope of ISO TC/94/SC/14 and TXD 32 is given in **Annex 14 (P-119 to 120)**. It is also informed that TXD 32 has liason with ISO TC 94 / SC 13 - Personnel Safety- Protective Clothing and Equipment - Principle (P).The program of work of the ISO TC/94/SC/14 is given in **Annex 15** **(P-121 to 125).**

**10.1.1** The committee may **DECIDE.**

**Item 11 ANY OTHER BUSINESS**

**ANNEX 1**

**(Item 1.1)**

**COMMENTS RECEIVED ON MINUTES OF THE MEETING FROM FOREMOST TECHNICO**

A small name correction is required in the draft meeting minutes circulated below (This

may pls be incorporated at later stage/s)

**Item 2 COMPOSITION OF TXD 32**

2.1 ( E) The name of Shri Alok Khanna to be corrected to read as Shri Anoop

Khanna

**ANNEX 2**

**(Item 2.1)**

**COMPOSITION OF TEXTILE PROTECTIVE CLOTHING SECTIONAL COMMITTEE, TXD 32**

**SCOPE -** To formulate Indian Standards for testing and specification for textile protective clothing for protection from fire and other health/life hazards

|  |  |  |
| --- | --- | --- |
| **Sl No.** | **NAME OF THE ORGANIZATION** | **REPRESENTED BY**  |
|  | Northern India Textile Research Association, (NITRA)Ghaziabad | Dr. Arindam Basu CHAIRMAN |
|  | Aeronav Industrial Safety Appliances, Noida | Shri Sandeep Hora |
|  | Arvind Limited, Ahmedabab | Shri Satyapriya DashShri Vikas M Kumar (Alternate) |
|  | Border Security Force, New Delhi | Shri Satish ChandraShri Tarun Ravi (Alternate) |
|  | Central Industrial Security Force, New Delhi | Shri Anand SaxenaShri Ravindra Kumar Meel (Alternate) |
|  | Central Reserve Police Force, New Delhi | Shri D.N LalShri Sanjeev Kumar Singh (Alternate) |
|  | Centre for Fire and Explosive Environment Safety, Defence Institute of Fire Research, Delhi | Shri Mahipal MeenaMs Anjlina Kerketta (Alternate) |
|  | Confederation of Indian Industry, New Delhi | Shri Saunak Banerjee |
|  | Defence Bio-Engineering and Electromedical Laboratory, Ministry of Defence, Bengaluru | Dr T M KotreshShri Vinoth. P (Alternate) |
|  | Defence Institute of Physiology and Allied Science (DRDO), New Delhi | Dr. Madhusudan PalShri Sunil Kumar Hota (Alternate) |
|  | Defence Materials and Stores Research and Development Establishment, Kanpur | Shri Mukesh SinhaShri Ajitendra Singh Parihar (Alternate) |
|  | Defence Research and Development Organisation, Terminal Ballistics Research Laboratory, Chandigarh | Smt Ipsita BiswasDr. Debarati Bhattacharjee |
|  | Department of Delhi Fire Services, Govt of NCT of Delhi, Delhi | Atul GargShri Vipin Kental (Alternate) |
|  | Department of Jute and Fibre Technology, University of Kolkata, Kolkata | Prof A. K. SamantaProf D Das (Alternate) |
|  | Directorate General Fire Services, Civil Defence and Home Guards, Ministry of Home Affairs, New Delhi | Shri D. K. Shami |
|  | Directorate General of Quality Assurance, Ministry of Defence, New Delhi | Shri Mahendra SinghShri P De (Alternate) |
|  | DSM Dyneema Limited | Shri Harsh Wardhan SharmaShri Rakesh Gaikwad (Alternate) |
|  | E.I. DuPont India Private Limited, Gurugram | Shri Manoj JhaverSmt. Vedika Kapoor (Alternate) |
|  | Fire Retardant Association of India, Mumbai | Shri P V Murali Mohan |
|  | Foremost Technico Private Limited, New Delhi | Shri Vinay KhannaShri Anoop Khanna (Alternate) |
|  | Indian Institute of Technology Delhi, New Delhi | Prof. Abhijit MajumdarDr Bipin Kumar (Alternate) |
|  | Indian Technical Textiles Association, Mumbai | Dr Anup RakshitShri Sanjay Sathe (Alternate) |
|  | Indo Tibetan Border Police, New Delhi | Shri M KumarShri Uttam Kumar (Alternate) |
|  | JCT Limited, Hoshiarpur | Shri K S DhillonShri Arwinder Singh (Alternate) |
|  | Kusumgar Corporates Private Limited, Vapi | Shri Sidhartha KusumgarDr M K Talukdar (Alternate) |
|  | Ministry of Textiles, New Delhi | Dr Mukesh Kumar Sinha |
|  | Mishra Dhatu Nigam Limited, Hyderabad | Col Ashwani Kumar |
|  | MKU Limited, Kanpur | Shri Vaibhav GuptaShri Rajib Pal (Alternate) |
|  | NBC Equipment Wing, Ministry of Defence (DGQA), Pune | Shri BG ShindeLt. Col RS Jhinkwan (Alternate) |
|  | National Forensic Sciences University, Gandhinagar | Shri S K KhandelwalShri Saurabh Kumar (Alternate) |
|  | Northern India Textile Research Association, Ghaziabad | Dr M S ParmarSmt Shweta Saxena (Alternate) |
|  | National Security Guard, New Delhi | Shri Manu Lochab |
|  | Office of the Textile Commissioner, Mumbai | Shri N. K. SinghShri Sanjay Charak (Alternate) |
|  | Oil Industry Safety Directorate, Noida | Shri Devendra M. MahajanShri Harendra Yadav (Alternate) |
|  | Ordnance Clothing Factory, Shahjahanpur | Shri V MathivananShri Shanmugam B (Alternate) |
|  | Reliance Industries Limited, Mumbai | Shri Rahul SrivastavaShri Vijay Garg (Alternate) |
|  | SGS India Private Limited, Mumbai | Dr. Anitha JeyarajDr. Karthikeyan K (Alternate) |
|  | SMPP Private Limited, New Dehi | Shri Ashish KansalDr. S. C. Kansal (Alternate) |
|  | Star Safety Hub, Faridabad | Shri Pawan Kumar GuptaShri Naveen Gupta (Alternate) |
|  | System 5S Private Limited, Chennai | Shri Sudhir TakkarSmt. Bhavna Sr. Takkar (Alternate) |
|  | Teijin India Private Limited, Gurugram | Shri Ravi KumarShri Sahil Aneja (Alternate) |
|  | Tex Corporation Limited, Gurugram | Shri Vijay ToleyShri Sanjay Aggarwal (Alternate) |
|  | Textiles Committee, Mumbai | Shri Kartikay DhandaSmt Shilpi Chauhan (Alternate) |
|  | The Synthetic and Art Silk Mills Research Association, Mumbai | Shri Premnath SurwaseRavi Prakash Singh (Alternate) |
|  | TUV Rhineland (India) Private Limited, Mumbai | Dr. P. S. SundaramShri Shivendra Parmar (Alternate) |
|  | In Personal Capacity | Dr V. K. Kothari |

**ANNEX 3**

**(Item 2.2)**

1. **CO-OPTION REQUEST FROM KANEKA INDIA PVT LTD**

Sub: Request to be a member of TXD 32-Textiles Protective Clothing Sectional Committee

Dear Sir,

Kaneka Corporation Japan is manufacturer of Modacrylic Fiber (Inherently self-extinguishing FR Fiber) that possesses the characteristics of high flame retardancy (FR) as well as acrylic fiber’s natural attributes of softness and dyability. It makes FR performance even with flammable fibers like Cotton or Polyester which are available in Indian domestic market.

It has applications in FR clothing (O&G Refineries, Chemical, Welding Industries, Electric Power Stations, Railways), Home Textile (Bedding, Upholstery), Automotive flooring, Industries (Battery, Air Filter), Airline Blanket etc.

We would like to propose Mr. Sumit Banik (Senior Manager, Kaneka India Pvt. Ltd.) be a member of TXD 32-Textiles Protective Clothing Sectional Committee to provide his technical inputs / views to add values in Domestic IFR (Inherent Flame retardant) applications.

The membership fees will be borne by Kaneka India Pvt. Ltd.

Therefore, we request you kindly grant this application to accept membership of Mr. Sumit Banik in TXD 32-Textiles Protective Clothing Sectional Committee and oblige.

Thanking you.
Yours Sincerely

Sumit Banik
KANEKA INDIA PVT. LTD.

1. **CO-OPTION REQUEST FROM 3M INDIA PVT. LTD.**

**From:** Sachin Karande

**Sent:** Friday, 12 May, 2023 12:46 PM

**To:** txd@bis.gov.in

**Cc:** Bidyut Chetia bbchetia@mmm.com

**Subject:** Name enrolment in TXD - 32 committee

Dear Committee Member,

Good day. I hope this email finds you well.

My name is Sachin Karande and I represent 3M Scotchlite Reflective Material Business for 3M India Limited. I am reaching out to you as I wish to get myself register with the Textile Protective Clothing Sectional Committee (TXD-32).

3M Scotchlite is a pioneer in developing the science behind retroreflection and has been advancing the technology in new and groundbreaking ways for over 70 years. We continue to make advancements in reflective material innovations and play a longstanding role in on-the-job safety. 3M Scotchlite products are proven to be bright, durable, and high-quality worldwide technical, marketing, and lab support.

Retro-reflectivity helps the eye perceive objects in low-light conditions when illuminated by a light source. In more scientific terms, retroreflection occurs when light rays are returned in the direction from which they came. Retroreflective materials appear brightest to an observer located near the original light source. Since very little light is scattered when the light is returned, retroreflective materials enhance the contrast of the wearer for an observer located near the original light source.

As a subject matter expert, I aim to educate end-consumer on the importance of reflective trim on safety gear (like Hi-Viz Safety Vest, Workwear, Coverall, Turn-out-Gear, Arc Flash suits, etc.), placement of reflective trims on the garment which enhances the visibility of the wearer when viewed from all the directions, making them understand the importance of a performance product over a compliance product, selection of reflective trims based on the end applications, global norms & best practice followed across the industries.

During this journey, various Govt. & Pvt. Institutions across various segments like transportation, mining, ports, aviation, exploration, fire services, automobile, roads &

highways, and state police incorporated reflective solutions in the apparel which enhanced workplace safety.

I seek your approval to include myself in the committee where I can contribute to the

development of standards.

Thank you!

Sincerely,

**Sachin Vilas Karande**

**3M™ Scotchlite™ Reflective Materials Business | Personal Safety Division**

WeWork Prestige Central, Bengaluru – 560001 | India

Time: GMT +5:30

Phone +91 981 987 9797 | svkarande@mmm.com | www.scotchlite.com

Email https://email.gov.in/h/printmessage?id=201821&tz=Asia/Kolkata&xim=1

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1. **CO-OPTION REQUEST FROM ARCHROMA INDIA PVT LTD.**

**TEXTILES DEPARTMENT**

**Committee Name: Textiles Protective Clothing or Technical Textiles for Sportstech applications**

**Committee Number: TXD 32 or TXD37**

**Principal Member**

Member’s Profile, in brief: 34 years in specialty Chemicals Industry with Leading companies like Clariant Chemicals, Dow Corning and Archroma I Pvt. Ltd with focus on functional finishes, their chemistry, application techniques and test methods. Areas of expertise includes Product Management and Development and Innovative interplay between different chemistries. Was also a part of the ITTA training team for Protective Textiles.

Shri/Smt/Dr./Prof. : Sanjay Sathe

Designation : Deputy Sales Director

Name of Organization : Archroma India Pvt Ltd

Address in full for :9th Floor D Bldg ,MBC Park ,Ghodbunder Road ,Kasarvadavali.Thane West 400615

Correspondence

(with PINCODE) : Mars A 603,Vasant Galaxy,Opp Bangaur Nagar,Goregoan West,Mumbai 400104 ,India

City : Mumbai

Telephone No. : 9619921038

E-mail : Sanjay.sathe@archroma.com

1. **COOPTION REQUEST FROM VIRIDIAN TESTING LABORATORIES LLP, TIRUPUR**

VENKATESH A

Tirupur, India 641602

+91 9865698286

venkateshchemac@gmail.com

**SUMMARY** A position with an opportunity for eventual status where I can apply My ISO 17025, 9001, Factory Technical audit, Certification audit, Calibration, Research & Development and manufacturing functional skill with the ultimate goal of developing and proving myself as a Successful professional.

Seeking a challenging position involving my skills in an environment, where I can grow along with the organization with great responsibility.

**SKILLS** • Training and Development • Managing Operations and Efficiency

• Recruitment and Hiring • Performance Evaluations

• Hiring and Training • Goal Setting

• Team Leadership • Employee Development

• Performance Tracking and Evaluation• Time Management

• Technical Proficiency • Decision Making

• Staff Training • Strategic Planning

• Problem Resolution • Computer Skills

• Team Building • Teamwork and Collaboration

**EXPERIENCE** **LAB MANAGER**, 08/2020 - Current

Viridian Testing Laboratories LLP, Tirupur, India

➢ To supervise the over-all functioning of our Laboratory

➢ To guide & coordinate with lab staff in the implementation of the documented laboratory

➢ Management system as per ISO 17025 and to ensure continual improvement of the effectiveness of the management system

➢ To prepare, amend and issue Quality Manual and Quality System Procedures

➢ To review and approve the work instructions and database documents

➢ To review effectiveness of the corrective action taken in respect of complaints received from the Customers

➢ To arrange for conducting internal audit of different sections of the laboratory and to ensure that corrective actions are taken within reasonable period of time

➢ To prepare agenda/minutes of the annual Management review

➢ To initiate action pertaining to laboratory management system as per the decisions of the management review & ensure the actions are taken on all points as per the decisions of the management review

➢ To initiate action for recruitment of staff

➢ To arrange for substitution of the laboratory officials

➢ To identify the training needs of the laboratory personnel

➢ To ensure the revision status of all national and international standards and modifying the various in-house test methods used.

➢ To arrange for the modification, developing and validating new methods

➢ To initiate action for the participation in the Inter-laboratory proficiency testing and inter laboratory comparisons

➢ To arrange for the purchase of chemicals, glassware, certified reference materials and other critical consumables & Arrange the verification of Purchased Product

➢ To select, evaluate and update the list of approved vendors of chemicals, glassware, certified reference materials & other items and service providers

➢ To obtain feedback from the Internal customers, analyze the same and take necessary follow up action for improvement

➢ To maintain and control quality and technical records generated in the laboratory

➢ To initiate action for the disposal of records after the expiry of retention time

➢ To take corrective actions on the non conformities raised in the internal and external audits within reasonable period of time

➢ To arrange for the training or impart training to laboratory officials

➢ To evaluate the effectiveness of the training

➢ To ensure the maintenance of the required environmental conditions and good housekeeping in the laboratory

➢ To ensure timely delivery of accurate test result

**LAB MANAGER**, 12/2019 - 08/2020

Best Corporation Pvt Ltd (Acer designers), Avinashi, Tirupur, India

➢ To supervise the over-all functioning of our Laboratory

➢ To guide & coordinate with lab staff in the implementation of the documented laboratory

➢ To review and approve the work instructions and database documents

➢ To initiate action for recruitment of staff

➢ To arrange for substitution of the laboratory officials

➢ To identify the training needs of the laboratory personnel

➢ To ensure the revision status of all national and international standards and modifying the various in-house test methods used.

➢ To arrange for the modification, developing and validating new methods

➢ To arrange for the purchase of chemicals, glassware, certified reference materials and other critical consumables & Arrange the verification of Purchased Product

➢ To select, evaluate and update the list of approved vendors of chemicals, glassware, certified reference materials & other items and service providers

➢ To maintain and control quality and technical records generated in the laboratory

➢ To initiate action for the disposal of records after the expiry of retention time

➢ To take corrective actions on the non conformities raised in the internal and external audits within reasonable period of time

➢ To arrange for the training or impart training to laboratory officials

➢ To evaluate the effectiveness of the training

➢ To ensure the maintenance of the required environmental conditions and good housekeeping in the laboratory

➢ To ensure timely delivery of accurate test result

**LAB MANAGER**, 03/2013 - 11/2019

Premier Knits Apparel India, Chengapalli, Tirupur, India

➢ To supervise the over-all functioning of our Laboratory

➢ To guide & coordinate with lab staff in the implementation of the documented laboratory

➢ Management system as per ISO 17025 and to ensure continual improvement of the effectiveness of the management system

➢ To prepare, amend and issue Quality Manual and Quality System Procedures

➢ To review and approve the work instructions and database documents

➢ To review effectiveness of the corrective action taken in respect of complaints received from the Customers Ensuring the QA teams implement and follow QMS System & procedure to prevent defects & this system is improving it is effectiveness

➢ Conducting the Internal Audit periodically to ensuring the QM system effectiveness

➢ Advising to take the corrective action in relevant areas, where the problems identified

➢ Conducting the Review meeting periodically with the Management with respect to QMS

➢ Specifying quality requirements of raw materials & Accessories with suppliers & making awareness to them

➢ Ensuring the QMS implemented effectively in all the processes

➢ Preparing and completing action plans where the Issues identified

➢ Identifying and resolving problems coordinates with QA Executives

➢ Assessing customer requirements and ensuring that these are met

➢ Ensuring that manufacturing processes comply with QMS

➢ Determining training needs of QC/QA & Arrange training plan internally

➢ Providing regular internal training to QC/QA & evaluating them

➢ To maintain & renew our certifications like, ISO9001 (QMS), GOTS, OCS, Okeotex Class I.

➢ To Involving in the ISO 9001 (QMS) Audit as a MR, Coordinating with the quality team

➢ To Involving the Technical Audits Coordinating with quality team

➢ To make the awareness to concern Team, if getting any technical updates from Customer

**SECTION INCHARGE**, 03/2012 - 03/2013

Sgs India Pvt Ltd, Bangalore, India

 • Manage the Section to meet quality management system

**LAB INCHARGE**, 08/2009 - 02/2012

AAA Merchandising Pvt ltd, Tirupur, India

 • Testing of TextileMaterials & manage the lab operations

**LAB INCHARGE**, 04/2008 - 08/2009

Ennem Clothing, Tirupur, India

 • Testing of Textile Materials & manage the lab operations

**LAB TECHNICIAN**, 02/2006 - 04/2008

Scm Garments (Mega Laboratory), Avinashi, Tirupur, India

• Testing of Textile materials

**EDUCATION AND TRAINING**

**Ayya Nadar Janaki Ammal College,** Sivakasi, 05/2005

**Bachelor of Arts: Chemistry**

Certificate course in **Information Technology**, By Ayya nadar Janaki ammal College, Sivakasi.

Training course for **ISO 14001** **Environmental Management system as a Lead Auditor**, By Intertek Tirupur.

Training course for **ISO 9001 Quality management System** **as a Lead auditor** By Intertek Tirupur.

Training course for **Laboratory management System & Internal auditor as a Lab manger** (as per ISO/IEC 17025:2005) by CII Bangalore.

Updated Laboratory **management System & Internal auditor Awareness training course** (as per ISO/IEC 17025:2017) by NABL @ Coimbatore.

Training course for **management System & Internal auditor as a Lab manger** (as per ISO/IEC 17025:2017) by Arasi technical Service, Coimbatore

**ANNEX 4**

**(Item 3.1)**

**SUMMARY OF ACTIONS TAKEN ON THE MINUTES OF THE**

**LAST MEETINGS OF TXD 32**

|  |  |  |
| --- | --- | --- |
| **ITEM NO.**  | **DESCRIPTION OF ACTION REQUIRED** | **ACTION TAKEN**  |
| **2.1** | **SCOPE AND COMPOSITION OF TXD 32**  | Updated composition is given in **Annex 1**.  |
| **4.1** | **DRAFT AMENDMENT FOR FINALIZATION**In the last meeting the committee finalize the Draft amendment No. 3 to IS 17051 : 2018 Textiles – Bullet Resistant Jackets – Performance Requirements [Doc: TXD 32 (21834)] | Published |
| **5.1** | **COMMENTS ON PUBLISHED STANDARD IS 17051 : 2018**IS 17051 : 2018 Textiles – Bullet Resistant Jackets – Performance Requirements. After deliberation on the comments received form J&K Police the committee also decided that SMPP in consultation with NFSU shall provide input along with proposal for discussion in the next meeting.  | Inputs are awaited |
| **6** | **REVIEW OF PUBLISHED STANDARDS**In the last meeting of TXD 32, the committee decided to prepare WC draft of the following standards in consultation with M/s NITRA, Ghaziabad, M/s System5s Pvt Ltd., Chennai, M/s Foremost Technico Pvt Ltd., New Delhi IS 1143 : 1973 Specification for cotton mosquito netting, square mesh (first revision)IS 8990 : 1978 Code of practice for maintenance and care of industrial safety clothingThe committee decided that the standard of IS 1097 : 1979 shall be circulated to the committee members for their inputs for a period of 15 days. | WC draft under preparationStandard has been circulated, inputs awaited |

**ANNEX 5**

**(Item 4.1)**

**WIDE CIRCULATION DRAFT ON** **WORKWEAR FOR CEMENT WORKWEAR — SPECIFICATION**

**भारतीय मानक ब्यूरो**

**BUREAU OF INDIAN STANDRADS**

*Draft for comments only* Doc No.: TXD 32(22344)

 April 2023

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*भारतीय मानक* मसौदा

**वस्त्रादि —** **सीमेंट कारीगर के लिए वर्कवेयर — विशिष्टि**

Draft *Indian Standard*

**Textiles — Workwear for Cement Workwear — Specification**

ICS : 13.340.10

Textile Protective clothing Last date for receipt of comments is

Sectional Committee, TXD 32 28 June 2023

Textile Protective clothing Sectional Committee, TXD 32

FOREWORD

(*Formal clause will be added later*)

Workwear for cement workers is designed to provide protection and comfort in the challenging work environment of the cement industry. Cement workers face various hazards, such as exposure to dust. Therefore, their workwear needs to be durable, breathable, and resistant to abrasion, punctures, and tears.

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**

**1.1** This standard specifies the test methods and minimum requirement of protective clothing to be worn during working with cement and associated activities. It covers the general clothing design, the minimum performance levels of the materials used and methods of test for determining these performance levels.

**1.2** This standard does not specify the general appearance, colour, feel, etc. of the cloth.

### **2 REFERENCES**

The standards listed in Annex A contain provisions that, 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 the standards.

### **3 MANUFACTURE AND DESIGN REQUIREMENTS FOR CEMENT WORKWEAR**

**3.1** **Cloth** — The material is produced from the lamination of three layers- outer shell, moisture barrier, and inner layer.

**3.1.1** **Outer Shell** — The cloth used for cement workwear shall have one up and one down plain weave/ ripstop weave (*see* IS 13510). It shall be made from polyester multifilament yarn. Oil and water-repellent finish is also done on the outer layer

**3.1.2 The Middle Layer (Moisture Barrier)** — It is a part of multilayered clothing designed to prevent the transfer of liquid water and dust from the environment to the wearer's skin. A PET-based membrane may be used. For the guidance of manufacturers, the thickness of the membrane may be around 18 µm, the melting point around 198oC, and friction coefficient around 0.60.

**3.1.3 Inner Layer** — Layer found next to the wearer’s skin in the multilayer garment. It shall be made out of 100% polyester mesh fabric.

The approximate count for guidance for warp and weft yarns for the outer shell may be 80 and 90 DN respectively. Count for guidance for warp and weft yarns for an inner layer may be 60’s. The selvedges shall be firm and straight. The fabric shall be ‘heat set’ and fully shrunk.

**3.1.4** The cloth may be dyed or printed as per the customer’s requirements. The dyed and printed cloth shall meet the colour fastness properties as given in Table 1. Dyes used for dyeing and printing shall be free from banned amine (*see* IS 15570).

**3.1.5 Freedom from Defects**

The cloth shall be free from major flaws (defects) which shall not exceed 10 per 100 meters in length (*see* Notes 1 and 2). A list of major flaws (defects) is given in Appendix A of IS 14466. The allowance for providing the extra length of cloth in lieu of the flaws (defects) not exceeding the permissible limit may be agreed between the buyer and the seller. It shall also be free from dyeing defects, such as streaks, stains and uneven dyeing, improper printing in case of printed design, etc. The cloth shall be free from any other defect which may significantly mark the appearance or serviceability.

NOTES

**1** The number of defects shall be determined on all pieces under test and converted into the number of defects per 100 meters length.

**2** The workwear shall be free from any defect which may affect performance for example seam strength, Stitch per inch.

**3.2** **Design Specifications**

**3.2.1** The cement workwear shall provide protection for the worker’s upper and lower torso, neck, arm s and legs. It shall consist of an outer two-piece suit consisting of a shirt and a pair of trouser.

**3.2.2 Restriction of Movement**

The workwear shall be designed to minimize restriction of movement. It shall be compatible with other protective equipment which may be necessary i.e., boots, helmets, gloves.

**3.2.3 Seams**

Seams shall be constructed to give the minimum loss in strength and maintained the integrity of the garment. Lockstitch having at least 4 stitches per cm shall be employed for assembling the workwear shirt and trouser. The stitching shall be done with even tension and all loose ends shall be securely fastened off. Sewing thread colour shall match the cloth of the shell fabric of workwear. Seam breaking strength, when tested in accordance with IS/ISO 13935-2, shall have a minimum seam breaking force of 200 N.

#

Vent at yoke centre

Inside chest pocket

No shoulder and armhole seam

Slide fastener for utility purpose

Hook & Loop for cuff adjustment

Hook & Loop fastener for leg bottom adjustment

Throughout slide fastener at waist for joining upper and lower parts

**Front**  **Back**

FIG 1 DESIGN OF CEMENT WORKWEAR

**3.2.4 Special Design Features** —Two-piece ensembles with throughout slide fastener at waist belt for joining shirt and trouser, Mandarin collar, double-layered back yoke, center front flapped slide fastener placket further secured with Hook and Loop fastener, front inside chest pockets with slide fastener, adjustable Hook and Loop fastener tabs at sleeve hem and leg bottom (*see* Fig 1).

**3.2.5 Seams** —Fusible and lined collar, no shoulder and armhole seam; seam sealing is used to finish all seams.

**3.2.6 Fasteners** — Slide fastener at center front placket flapped with snap fasteners for better dust prevention. Both pieces are attached to each other with a slide fastener concealed with flaps to avoid any penetration of dry or wet cement.

**3.2.7 Size Designation** —The size of the protective clothing shall bedesignation by chest and length. The size range for different size designations shall be as given in Table 1.

**Table 1 Suggestive Measurement Chart for Shirt and Trouser**

(*Clause* 3.2.7)

|  |  |  |
| --- | --- | --- |
| **Sl** | **Measuring Point** | **Size, cm** |
| **No.** | **38** | **40** | **42** | **44** |
|   | **S** | **M** | **L** | **XL** |
| (1) | (2) | (3) | (4) | (5) | (6) |
| 1. **Measurements for Shirts**
 |
| 1.
 | Body length (HSP to Bottom) | 72 | 74 | 76 | 78 |
| 1.
 | Chest width (2.5 cm below from armhole) | 116 | 120 | 124 | 128 |
| 1.
 | Bottom width | 112 | 116 | 120 | 124 |
| 1.
 | Shoulder | 16 | 17 | 18 | 19 |
|  | Sleeve length | 64 | 66 | 68 | 70 |
| 1.
 | Cuff length | 22 | 24 | 26 | 28 |
| 1.
 | Cuff height | 3 | 3 | 3 | 3 |
| 1.
 | Arm hole | 27.5 | 28.5 | 29.5 | 30.5 |
| 1.
 | Collar width  | 6 | 6 | 6 | 6 |
| 1.
 | Chest pocket from HPS | 22 | 23 | 24 | 25 |
| 1.
 | Chest pocket from Placket edge | 6 | 6 | 6.5 | 6.5 |
| 1.
 | Sleeve patch length from HPS | 30 | 30 | 31 | 31 |
| 1. **Measurements for Trousers**
 |
|  | Waist | 80 | 85 | 90 | 95 |
|  | Hip  | 99 | 104 | 109 | 114 |
|  | Out seam (including waistband)  | 100 | 102 | 105 | 105 |
|  | Inseam (Crotch to hemline) | 77 | 79 | 81 | 83 |
|  | Crotch  | 30 | 31 | 32 | 33 |
|  | Bottom opening  | 30 | 35 | 35 | 40 |
|  | Waist band width  | 3 | 3 | 3 | 3 |
| NOTE — Dimensional tolerances for 0-25 cm shall be ± 0.5 cm and for above 25 cm, it shall be ±1.0 cm |

**3.2.8 Clothing Mass** —The clothing shall be as light as possible while still maintaining the required performance level.

**3.2.9 Ease of Cleaning** —The workwear shall be designed to promote ease of cleaning.

**4 PERFORMANCE REQUIREMENT**

**4.1** The workwear cloth shall conform to the requirements given in Table 2.

**4.2** If in order to illustrate or specify the indeterminable characteristics, such as general appearance, luster, feel and shade of the cloth, a sample has been agreed upon and sealed, the supply shall be in conformity with the sample in such respect.

**4.3** The custody of the sealed sample shall be a matter of prior agreement between the buyer and the seller.

**Table 2 Requirements of Cloth used for cement work wear**

(*Clauses* 4.1 *and* 7.2.2)

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl No.** | **Characteristic** | **Requirement** | **Test Method** |
| (1) | (2)  | (3) | (4) |
| 1. **Outer shell**
 |
| i) | Identification of fibre | Polyester | IS 667  |
| ii) | Weave | plain /Rip stop | Visual |
| iii) | End/dm, *Min* | 110 | IS 1963  |
| iv) | Picks/dm, *Min* | 80 | IS 1963  |
| v) | Width, cm | 135 – 140 | IS 1954  |
| vi) | Mass, g/m2 | 180 ± 10 | IS 1964  |
| vii) | Taber Abrasion resistance, No. of cycles till the first thread breaks, *Min* |  1000 | ASTM D 3884 (Load: 250 grams, CS- 10) |
| viii) | Colour fastness to washing C(3) |  | IS/ISO 105 C-10  |
| a) Change in colourb) Staining on adjacent fabric | 4 or better4 or better |
| ix) | Colour fastness to perspiration |  | IS/ISO 105 E04 |
| a) Change in colourb) Staining on adjacent fabric | 4 or better4 or better |
| x) | Colour fastness to rubbing |  | IS/ISO 105 X12 |
| a) Dryb) Wet | 4 or better4 or better |
| xi) | Colour fastness to light | 5 or better | IS/ISO 105 B02 |
| xii) | Dimensional change due to washing in a complete garment,both directions, percentage, *Max* (*see* Note) | 2.0 | IS 15370 |
| xiii) | Pilling (after 5 h of test), *Min* | 4 | IS 10971 (Part 1) |
| xiv) | *P*h Value | 6.0 -8.0 |  IS 1390 |
| 1. **Inner layer (mesh)**
 |
|  |  Mass, g/m2 | 50 ± 10 | IS 1964 |
|  |  Bursting strength, N, *Min* | 6.8 | IS 1966 (Part 1) |
|  |  Total number of holes on Base & Bias within 6.25 cm2 | 24 – 26 | Appendix A of IS 1431 |
| 1. **Multilayer combine fabric (outer shell + Moisture barrier + Inner layer)**
 |
| xviii) | Tearing strength, N, *Min* |  | IS 7016 (Part 3)  |
|  a) Warp b) Weft | 2020 |
| xix) |  Tensile strength, N, *Min* |  | IS 7016 (Part 2) |
|  a) Warp b) Weft | 400400 |
| xx) | Air permeability, cc/sec/cm2, *Min* | Nil | IS 11056  |
| xxi) | Water vapour permeability, mg/cm2/hour, *Min* | 5 | Annex F of IS 16390 |
| xxii) | Hydrostatic pressure head,Cm/H2O (mBar), *Min* | 750 | IS 391 |
| xxiii) | Dust resistance property, Numbers of 1.0-micron size particles pass through the specimen | Nil | Annex B |
| NOTE — Washing shall be done as per IS 15370, procedure 2A at (60 ± 3) °C and drying by procedure E (tumble drying), measurement, and marking shall be carried out as per ISO 5077 |

**5 MARKING**

**5.1** Each piece of workwear shall have a label permanently and conspicuously attached. It shall label-

a) Name of the material of multilayer cloth, polyester as the outer shell, PET membrane as the middle layer, and cotton as inner lining material.

b) Manufacturer’s name, initials, or trademark; and

c) Any other information required by the law in force and/or by the buyers.

 **5.2** *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(s) may be marked with the Standard Mark

**6 PACKAGING AND PACKING**

The workwear shall be packed in polyethylene or polypropylene bags and/or in the box, as required by the buyer (*see* IS 2194 and IS 2195). Each box, the following shall be indicated:

1. Name of the material
2. Size in cm
3. Quantity per box
4. Indication of the source of manufacture; and
5. any other information required by the buyer or the law in force.

**7 SAMPLING AND CRITERIA FOR CONFORMITY**

**7.1 Lot**

In any consignment, all workwear of the same size and manufacture of the same designation, same quality, composition and constructional particulars delivered to a buyer against one dispatch note shall constitute a lot.

**7.2** **Number of Tests and Criteria for Conformity**

**7.2.1** The number of pieces to be selected for major flaws shall be in accordance with column 3 of Table 3. For constructional details, such as count of yarn, threads per decimetre, mass in g/m2, length, width and manufacture and finish, the number of pieces selected shall be in accordance with column 5 of Table 3. For all other tests, the number of pieces selected shall be as given in column 6 of Table 3.

**7.2.2** All the pieces selected from the lot shall be visually examined for major flaws and tested for all other requirements as specified in **3.1** to **3.5** and Table 2. A piece shall be declared defective if it contains one or more major flaws or it does not meet any of the requirements specified in Table 2. The lot shall be declared conforming to the requirements of this standard if the total number of defective pieces does not exceed the value given in column 4 of Table 3.

**Table 3 Sample Size**

(*Clauses* 7.2.1, and7.2.2)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl No.** | **Lot Size** | **Sample Size** | **Permissible Number of Non-conforming Pieces** | **Sub-sample Size** | **Sub-sample Size** |
| (1) | (2) | (3) | (4) | (5) | (6) |
| i) | Upto 50 | 5 | 0 | 3 | 2 |
| ii) | 51 to 150 | 8 | 0 | 5 | 3 |
| iii) | 151 to 300 | 13 | 1 | 5 | 3 |
| iv) | 301 to 500 | 20 | 1 | 8 | 5 |
| v) | 501 to 1 000 | 32 | 3 | 10 | 7 |
| vi) | 1 001 and above | 50 | 3 | 10 | 7 |

**ANNEX A**

(*Clause* 2)

### LIST OF REFERRED INDIAN STANDARDS

*IS No. Title*

391 : 2020 Textile fabrics — Determination of resistance to water penetration — Hydrostatic pressure test (*second revision*)

667 : 1981 Methods for identification of textile fibres (*first revision*)

1431 : 1973 Specification for cotton mosquito netting, round mesh (*first revision*)

1390 : 2022 Textiles — Determination of *p*H of aqueous extract (*third revision*)

1954 : 1990 Determination of length and width of woven fabrics (*second revision*)

1963 : 1981 Methods for determination of threads per unit length in woven fabric (*second revision*)

1964 : 2001 Textiles — Methods for determination of mass per unit length and mass per area of fabrics (*second revision*)

1966 (Part1) : 2022 Textiles — Bursting properties of fabrics: Part 1 Hydraulic method for determination of bursting strength and bursting distension (*third revision*)

7016 (Part 2) Methods of test for coated and treated fabrics, Part 2: Determination of tensile

: 2015 strength and elongation at break (*second revision*)

7016 (Part 3/Sec 1) Methods of test for coated and treated fabrics: Part 3 Determination of tear

: 2017 resistance: section 1 constant rate of tear methods (*second revision*)

2005 : 1988 Methods for quantitative chemical analysis of binary mixtures of nylon 6 or nylon 6,6 fibres and certain other fibres (*first revision*)

2977 : 1989 Fabrics (other than wool) — Method for determination of dimensional changes on soaking in water (*first revision*)

4905 : 2015 Random sampling and randomization procedures (*first revision*)

10971 (Part 1) : 2022 Textiles — Determination of fabric propensity to surface pilling, fuzzing or matting: Part 1 Pilling box method (*second revision*)

11056 : 2013 Textiles — Determination of permeability of the fabrics to air (*first revision*)

14466 : 1997 Fabrics — Description of defects — Vocabulary

15370 : 2020 Textiles — Domestic washing and drying procedures for textiles testing (*first revision*)

16390 : 2015 Agro textiles — Nylon knitted seamless gloves for tobacco harvesters — Specification

IS/ISO 105 B02 Methods for determination of colour fastness of textile materials to artificial

: 2014 light (xenon lamp)

IS/ISO 105-C10 Textiles — Tests for colour fastness: Part C10 Colour fastness to

: 2006 washing with soap or soap and soda

IS/ISO 105-E04 Textiles — Tests for colour fastness: Part E04 Colour fastness to

: 2008 perspiration

IS/ISO 105-X12 Textiles — Tests for colour fastness: Part X12 Colour fastness to

: 2001 rubbing

**ANNEX- B**

(*Table* 2)

**DETERMINATION OF DUST RESISTANCE PROPERTY**



FIG 2 AN APPARATUS TO DETERMINE DUST RESISTANCE CHARACTERISTICS OF THE FABRIC

**A-1 PRINCIPLE**

Test specimen, after conditioning in a controlled environment of 27 ± 2**°**C at 65 ± 2 percent relative humidity, is mounted on the sample holder. The sample holder is inserted between two chambers. The cement dust is allowed to throw on one side of the specimen using compressed air of varying pressure for 60 ± 5 seconds. The number of particles crossed through the specimen is measured using particles counter having the capacity to measure 1.0 microns particle size.

**A-2 DESCRIPTION OF THE APPARATUS**

The line diagram of the apparatus is shown in Fig 2. The apparatus constitutes a dual-chamber system to establish dust resistance characteristics of sheeting/textile material.

The first chamber includes a hooper to supply fine dust into dust air generating chamber 1; this hooper is attached to a removable dust collector to collect the extra amount of cement, as shown in the Fig 2. The dust air generating chamber is provided with a narrow bottom outlet for guiding the dust into the said dust collector. Chamber -1 is connected to air supply mean at one end, the other end of which is provided in flow communication with chamber - 2. The air supply means a compressor or a fan assembly to supply air at variable velocity. Chamber - 1, as illustrated, accommodates a sample holder to hold a sample of sheeting material under consideration. In conjunction with the above, there is a provision of a particle counter next to the sample holder and an exhaust fan mounted on the opening and closing door of the main chamber (2). The exhaust fan helps in exhausting fine dust in case of its presence.The particle counter counts the number of dust particles after passage through said sheeting material.

The quality of the sheeting material is inversely proportional to the number of dust particles. The whole set-up described hereinabove is mounted on a stand as shown forming support.

**A-3 SAMPLING**

The samples shall be selected from different places in the submitted sample to be representative of the whole. A minimum of 3 specimens from each sample shall be taken.

**A-4 CONDITIONING OF THE SAMPLE**

The samples need to be conditioned for a minimum of 2 h in relative humidity of 65 ± 2 percent and the temperature of 27 ± 2**°**C.

**A-5 TEST PROCEDURE**

**A-5.1** Condition the test fabric or sample at least for 2 hrs in the standard atmosphere for testing

**A-5.2** Take at least 3 specimens (30 cm × 30 cm) of fabric.

**A-5.3** Clean both the chamber using compressed air with exhaust fan remains on.

**A-5.4** Mount these specimens one by one on the sample holder

**A-5.5** Measure the number of particles present in Chamber-2 using a particle counter. At least three readings after 5 minutes intervals need to be taken. The reading with the maximum number of particles shall be considered.

**A-5.6** Fill the Hooper with dry cement dust.

**A-5.7** Throw the cement dust on the specimen at a pressure of 20 psi for 60 ± 2 seconds using a compressed air jet and measure the number of particles of size 1.0-micron passing through the specimen using particle counter installed in Chamber-2. During this test, the exhaust fan shall remain on. The measurement of particles passing through the specimen shall be done simultaneously with the cement dust throwing process.

**F-6 CALCULATION**

Number of particles passing through the specimen = Reading of particle counter after passing 60 seconds test (*see* **5.7**) - Number of particles already present in the chamber before starting the test (*see* **5.5**)

NOTE — If a negative value is coming, consider it zero or nil.

**Annex 6**

**(Item 5.1)**

**WIDE CIRCULATION DRAFTS**

**भारतीय मानक ब्यूरो**

**BUREAU OF INDIAN STANDARDS**

*Draft for comments only* Doc: TXD 32 (xxxx) WC

*भारतीय मानक*  मसौदा

**वस्त्रादि – उच्च घनत्व पॉलीइथलीन मोनोफिलामेंट का गोल जाली का मच्छरदानी का कपड़ा** – **विशिष्टी**

 (आई एस 10054 का *पहला पुनरीक्षण*)

Draft *Indian Standard*

**Textiles —cHigh Density Polyethylene (HDPE) Monofilament Mosquito Netting, Round Mesh —Specification**

( *First Revision* of IS 10054 )

**ICS 59.080.30**

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BIS or used as Standard ------------

Textiles Protective Clothing Sectional Committee, TXD 32

FOREWORD

(*Formal clauses will be added* *later*)

This standard was originally published in 1981 and was subsequently revised 1996. The present revision has been made in the light of experience gained since last revision and to incorporate the following major changes:

1. Method for identification of polyethylene has been incorporated in the standard.
2. Packaging clause has been modified.
3. Marking clause has been updated.
4. Method of test for count of yarn has been incorporated.
5. References to Indian Standard given in Annex A 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 prescribes constructional details and other requirements of HDPE monofilament mosquito netting, round mesh.

**1.2** This standard does not specify the general appearance, feel, shade, etc, of the netting.

**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 the standards indicated in Annex A.

**3 MANUFACTURE**

**3.1 Yarn**

The monofilament yarn used for the manufacture of the netting shall be made out of HDPE of designation HDPE LAN A50 T012, or HDPE LAN A57 T012, or HDPE LAN A50 T022 or HDPE LAN A57 T022 according to IS 7328. However, the density of the material used shall not be more than 955 kg/ m3 at 27°C and the melt flow rate (MFR) - 190/50 of the material shall be between 1.3 to 2.4 g/10 min. The filament shall be uniform and reasonably free from defects.

**3.2 Netting**

The shade of the netting shall be as agreed to between the buyer and the seller and the netting shall be free from knitting and other defects.

**4 REQUIREMENTS**

**4.1 Construction**

The netting shall comply with the requirements specified in Table 1. The linear density of filament is given for guidance only.

**Table 1 Particulars of HDPE Monofilament Mosquito Netting, Round Mesh**

(*Clause* 4.1)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl No.** | **Linear Density of Filament**  | **Number of Holes per cm2** | **Mass,** **g/m2** | **Bursting Strength,** ***Min*****N (or kgf/m2)** | **Width,** **cm** | **Length,** **m** |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| i) | 18 to 19 tex(or 160 to 170 denier) | 16 to 20 | 80 ± 5% | 83 (or 8.5) | 122 or as agreed ±1 | As agreed |
| Method of test | IS 3442 | Annex B | IS 1964 | IS 1966 | IS 1954 |

**4.2 Colour Fastness**

The colour fastness rating of netting shall comply with the requirements specified in Table 2.

**Table 2 Colour Fastness**

(*Clause* 4.2)

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl No.** | **Colour Fastness Rating** | **Requirement** | **Method of Test** |
| (1) | (2) | (3) | (4) |
| i) | Light (change in colour), *Min* | 5 | IS/ISO 105-B01 or IS/ISO105-B02 |
| ii) | Washing, Test 2 (change in colour and staining), *Min* | 4 | IS/ISO 105-C10 |

* 1. The Polyethylene in the monofilament Mosquito Netting shall be identified by the method prescribed in IS 667.

**5 MARKING**

**5.1** The netting shall be marked with the following:

a) Name of the material;

b) Width and length of the piece;

c) Source of manufacture; and

d) Year of manufacture

**5.2 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 products may be marked with the Standard Mark.

**6 PACKING**

Each roll or bundle of mosquito netting shall be packed in low density polyethylene film of 60 gm thickness (150 gauge) or any other suitable material as agreed to between the buyer and the seller. The rolls or bundles shall again be packed in bales or cases. The packaging shall be roadworthy, airworthy and seaworthy.

**7 SAMPLING**

**7.1 Lot**

The number of pieces of mosquito netting delivered to a buyer against one despatch note shall constitute a lot.

**7.2** For assessing the conformity of the lot to the requirements of the standard, the samples as given in Table 3 shall be drawn at random from the lot for inspection. To ensure the randomness of selection, methods given in IS 4905 shall be followed.

**Table 3 Sample Size**

(*Clause* 7.2)

|  |  |  |
| --- | --- | --- |
| **Sl No.** | **Number of Pieces in the Lot** | **Number of Pieces to be Inspected for** |
| **Length, Width and Number of Holes** | **Mass and Bursting Strength** | **Colour Fastness** |
| (1) | (2) | (3) | (4) | (5) |
| i) | Up to 100 | 8 | 3 | 2 |
| ii) | 101 to 150 | 13 | 5 | 2 |
| iii) | 151 to 300 | 20 | 5 | 2 |
| iv) | 301 and above | 32 | 8 | 3 |

**7.3** The lot shall be considered as conforming to the requirements of this standard if all the samples meet the requirements specified in the standard.

**ANNEX A**

(*Clause* 2)

**LIST OF REFERRED STANDARDS**

|  |  |
| --- | --- |
| *IS No.* | *Title* |
| IS 667 : 1981 | Methods for identification of textile fibres (*first revision*) |
| IS 1954 : 1990 | Determination of length and width of woven fabrics — Methods (*second revision*) |
| IS 1964 : 2001 | Textiles — Methods for determination of mass per unit length and mass per unit area of fabrics (*second revision*) |
| IS 1966 (Part 1) : 2022 | Textiles — Bursting properties of fabrics Part 1: Hydraulic method for determination of bursting strength and bursting distension (*third revision*) |
| IS 3442 : 2023 | Textiles — Method for determination of crimp and linear density of yarn removed from fabric (*second revision*) |
| IS 4905 : 2015 | Random sampling and randomization procedures (*first revision*) |
| IS 7328 : 2020 | Specification for Polyethylene Material for Moulding and Extrusion (*third revision*) |
|  IS/ISO 105-B01 : 2014 | Textiles — Tests for colour fastness — Part B01 Colour fastness to light: Daylight |
| IS/ISO 105-B02 : 2014 | Textiles — Tests for colour fastness — Part B02 Colour fastness to artificial light: Xenon arc fading lamp test |
| IS/ISO 105-C10 : 2006 | Textiles — Tests for colour fastness — Part C10 Colour fastness to washing with soap or soap and soda |

**ANNEX B**

(*Table* 1)

**MEASUREMENT OF NUMBER OF HOLES**

**B-1 APPARATUS**

**B-1.1 Template**

a) A metal plate of about 0.5 mm thickness with a square hole of 2 cm × 2 cm cut accurately in the centre.

OR

b) A rigid transparent plastic sheet with a square of 2 cm × 2 cm marked in the centre.

**B-2 METHOD**

Lay the netting flat without stretching on a flat surface of contrast colour. Count the number of holes in the square marked on/cut in the template in such a way that holes of more than half in size are counted as full hole and holes which are less than half in size are ignored. Divide the number of holes thus counted by 4. Count the number of holes at 5 different places and calculate the average.

**BUREAU OF INDIAN STANDARDS**

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*भारतीय मानक*  मसौदा

**वस्त्रों की ज्वलनशीलता और ज्वाला प्रतिरोध का निर्धारण**

( आई एस 11871 का*पहला पुनरीक्षण*  (

Draft *Indian Standard*

**DETERMINATION OF FLAMMABILITY AND FLAME RESISTANCE OF TEXTILE FABRICS**

 **(*First Revision* of IS 11871)**

**ICS 13.220.40**

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BIS or used as Standard ------------

Textiles Protective Clothing Sectional Committee, TXD 32

**FOREWORD**

*(Formal clause will be added later)*

The flammability is one of the important properties of textile materials, besides characteristics like combustion, thermal degradation, smouldering, after glow, smoke and toxicity. With the increasing awareness of fire hazards and promulgation of rules and regulations by several advanced countries, the development of flammability standard needs no emphasis.

While preparing this standard, considerable assistance has been derived from the following:

1. ASTM D 1230- 2019 ‘Standard Test Method for Flammability of Apparel Textiles' issued by the American Society for Testing and Materials.
2. BS 3119 : 1959 ‘Method of test for flameproof materials’ issued by the British Standards Institution.

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 : 2022 '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.

**1 SCOPE**

This standard prescribes two methods for determining the flammability and flame resistance of textile fabrics. It applies to all types of textile fabrics, clothing and garments whether they are, knitted, woven, laminated, bonded, or surface coated.

**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 subjected to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

**3 APPLICATION**

**3.1** Method A is based on vertical flame test and is recommended for evaluating flame resistance of all types of textile fabrics. Method B is based on 45° inclination flame test and it covers the evaluation of flammability of textile clothing and also textiles that are intended to be used in clothing.

**3.1.1** The methods described in this standard are not applicable to rugs and carpets and far interior fabrics used for passenger vehicles.

**4 DEFINITlONS**

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

**4.1** **Flammability** — The characteristics of a material which pertain to its relative ease of ignition and relative ability to sustain combustion.

**4.2 Flame** — As related to textile flammability, a hot, luminous zone of gas or matter in gaseous suspension, or both, that is, undergoing combustion, which is relatively constant in size and shape and which produces a relatively low heat flux.

**4.3 Ignition** — Flaming of the specimen for a period of 1 s or more after the removal of the igniting source.

**4.4 Flashing** — The sudden transition of a state of total surface involvement in a fire of combustible material within a compartment.

**4.5 Flame-Retardant** — A chemical used to impart flame resistance.

**4.6 Flame-Retardant Finish** — A process for incorporating or adding flame retardant(s) to a material or product.

**4.7 Flame Resistance** — The property of a material whereby flaming combustion is prevented, terminated, or inhibited following application of a flaming or non-flaming source of ignition, with or without subsequent removal of the ignition source. The degree of flame resistance exhibited by a specific material during testing may vary with different test conditions.

**4.8 Flame-Resistant** — The material having flame resistance.

NOTE — ‘Flame resistant’ is a mandatory description for a product that meets established conformance standard when the product is tested by a specific method. Where no conformance standard exists, ‘flame resistant’ is a relative term and is used to compare one material with another.

**4.9** Flame-Proof Fabric — A fabric which does not propagate flame; that is, any flame goes out quickly when the igniting flame is withdrawn.

**4.10 Glow** — Visible, flameless combustion of the solid phase of a material.

**4.11 After-Glow** — Persistence of glow in a material under specified test conditions, after the removal of an external ignition source or after the cessation ( natural or induced ) of flaming of the material.

**4.12 Duration of After-Glow (After-Glow Time)** — The time for which a material continues to glow, under specified test conditions, after cessation of flaming, or-after removal of the ignition source.

**4.13 Extent of After-Glow** — The area of specimen in which the afterglow spreads beyond the area damaged by flaming.

**4.14 Duration of Flame (After-Flame Time)** — The length of time for which a material continues to flame, under specified test conditions, after the ignition source has been removed.

**4.15 Char Length** — The distance from the edge of the specimen exposed to the flame under specified test conditions, to the upper edge of the charred section of the specimen, expressed in metric units.

**4.16 Raised Fabric** — A fabric with raised, brushed or napped surface or with cut or uncut pile.

**4.17 Unraised Fabric or a Fabric of Plain Surface** — A fabric having a surface significantly free from raised fibres, nap or pile.

**5 PRETREATMENT OF FABRIC**

**5.1** In order to determine the durability of a flame-retardant in case of treated fabrics, the specimens shall be subjected to leaching, washing, and/or dry cleaning treatments as described in Annex B depending upon the end use.

**5.1.1** The selection of leaching, and/or dry cleaning treatments, the number of such treatments and their sequence shall be as agreed to between the buyer and the seller or as specified in the relevant material specification.

**5.13** In reporting the results of a test it shall be clearly stated whether the fabric was tested:

1. without preliminary dry cleaning, leaching and washing procedures, or
2. after specified dry cleaning procedures, or
3. after specified leaching and/or washing procedures.

**6 SAMPLING**

Sample for test shall be selected so as to be representative of the lot. Sample drawn in accordance with the material specification or as agreed to between the buyer and the seller shall be held to be representative of the lot.

**7 METHOD A : VERTICAL FLAME TEST**

**7.1 Principle** — A conditioned strip of fabric is suspended vertically and ignited at the base by flame impinging on both sides in a standard manner. After igniting the specimen for a specified period of time, the char length, after-flame and after-glow characteristics are noted.

**7.2 Apparatus**

**7.2.1** A means for providing the atmosphere for conditioning and testing (*see* **7.3.1** and **7.3.2**).

**7.2.2** The flammability tester consisting of:

1. *Clip* — A suitable clip for suspending the test specimen above the flame.
2. *Shield* — An incombustible box 305 × 305 × 760 mm open at the top, and provided with a vertical transparent front. An opening, 25 mm deep and 125 mm long is left at the bottom of the front, to allow manipulation of the gas burner (*see* Fig 1).
3. *Gas burner* — A Bunsen burner about 150 mm high with an internal diameter of 9 mm.
4. *Specimen holder* — Consisting of two U-shaped metal plates between which the fabric specimen can be held in such a way that the fabric specimen is free at the bottom and is held at the top and sides so that the total exposed area is 50 × 305 mm. The specimen holder will be positioned in the draught-free box vertically so that the igniting flame strikes the specimen centrally and 19 mm above the bottom edge of the specimen (*see* Fig 2).
5. *Clamps* — These may be plain or serrated spring clips or small clamps. When made of smooth material, it may be necessary to insert emery paper to increase friction.
6. *Weights* — Weights such as are used with laboratory pan balances are satisfactory. A suitable pan may be made from a laboratory balance tray and wire.
7. *Stenter pin plates* — Two stenter pin plates, each consisting of a flat plate carrying pointed pins attached to one side of its broad surface, to prevent movement of the lower end of the test specimen during the application of the test flame. Each plate is secured at one end to the side of the shield in the horizontal position.



 FIG 1: APPARATUS FOR TESTING FLAMEPROOF MATERIALS FIG 2 : SAMPLE HOLDER

**7.2.3** *A stop-watch* — with an accuracy up to 0.1 second.

**7.3 Conditioning and Testing Atmospheres**

**7.3.1** *Conditioning* — Before testing, condition the specimens for 24 h in a standard atmosphere of 65 ± 2 percent relative humidity and 27 ± 2 °C temperature (*see* IS 6359). If the test is not carried out immediately after conditioning, place the specimens in a tightly closed container until the commencement of the test. Each specimen shall be tested within two minutes of removing it from either the conditioning atmosphere or the container.

**7.3.2** *Testing Atmosphere* — Carry out the test in a substantially draught-free room or enclosure in an atmosphere of relative humidity between 20 to 80 percent and temperature between 20 to 35 °C.

**7.4 Test Specimens**

**7.4.1** The test specimen shall be 315 mm long × 50 mm wide. It shall be prepared in accordance with **7.4.2**.

**7.4.2** Six specimens, where appropriate, three in warp direction and three in weft direction shall be cut from the sample (**6.1**) so as not to include selvedge. (*see* Note). They shall be cut from three widely separated sections of the sample. The specimens shall be conditioned as specified in **7.3.1**.

NOTE — The test specimen should not have loose threads or any form of fringe along its edges, that might affect the ease of ignition, cause initial flaring or flashing and thus prejudice the test.

**7.5 Procedure**

**7.5.1** Keep the apparatus in a substantially draught-free room or enclosure (*see* Note 2) having atmosphere as described in **7.3.2**. Suspend the test specimen from the clip so that it hangs vertically, with its lower end held by the horizontal stenter pin plates in such a way that the bottom 6 mm of the specimen is attached to the horizontal stenter pins thereon. The plates shall be so fixed that not more than 9 mm of the specimen on either side is covered by them.

**NOTES**

 **1** In case of fabrics that shrink on burning, specimens may be mounted on suitable specimen holders so that the two long edges are held securely. In this case, the size of each specimen shall be 70 mm × 315 mm so that the total exposed area is 50 × 305 mm.

**2** Because the test is carried out in a draught-free room, the air in the room is likely to become contaminated with the products of combustion. Where these products include potentially toxic substances, for example, hydrochloric acid, phosphorous compounds, etc, a mask or respirator capable of removing these substances should be worn, or the test may conveniently be carried out in a fume hood with the draught shut off. If obnoxious fumes are produced, these may be removed by turning on the draught between the test(s).

**7.5.2** Shut off the air supply to the gas burner completely and adjust to give a luminous flame 38 mm in length. Place the gas burner such that the base of the flame is 19 mm below the middle of the lower edge of the specimen. Apply the flame for a period of 12 seconds to the mid-point of the lower edge of the specimen and then withdraw the flame.

**7.5.3** Record the duration of flaming, extent of after-glow, the duration of afterglow and occurrence of flashing over the specimen.

**7.5.4** When the after-glow has ceased, remove the test specimen from the clip and stenter pin plates and attach two clamps, one on each side of the charred area, 6 mm from lower edge of the test specimen. Attach a weight to one clamp gently so that combined weight is equal to about 10 percent of that required to tear the unburnt material. Measure the length of char or melt to the nearest 5 mm as the difference between the original length of test specimen and the distance of the unexposed edge to the end of the tear made on the test specimen.

**NOTES**

**1** If the material under test is made up of a thermoplastic fibre, it may be necessary to make a small cut vertically (with a pair of scissors or razor blades) through the area of resolidified polymer which extends round the charred areas. The clamps are then attached and the material is tested by the method as described above.

**2** In order to determine the weight required to’ tear the unburnt material, an unburnt specimen is laid on table and a cut, about 6 mm long, made in the middle of one end. A clamp is attached to the material on each side of the cut, and a weight is attached to the clamp on one side. The material is then gently lifted by the other clamp and the cut is observed. The process is repeated, if necessary, until the minimum weight necessary to tear the material is found. The combined weight of the clamp and attached weights is taken as the weight required to tear the unburnt material.

**7.5.4.1** Alternatively, the char length may be measured by the method prescribed in ANNEX C.

**7.6 Report**

**7.6.1** Report the following separately for each specimen before and after the leaching, washing and/or dry cleaning treatments.

a) Whether or not flashing occurs over the surface or the specimen;

b) Duration of flame (after-flame time) in seconds;

c) Duration of after-glow in seconds;

d) Char length to the nearest 5 mm;

e) Extent of after-glow; and

f) Any abnormal behaviour occurring under the influence of the flame, for example- melting, dripping, shrinking from the flame and abnormal charring.

**8 METHOD B : THE 45° FLAME TEST**

**8.1 Principle** — Specimens cut from the textile ate prepared by brushing if they have a raised fibre surface, by dry cleaning and laundering if they have a flame-retardant finish and by drying. The dried specimen of the fabric is held at an angle of 45° to the horizontal and a standardized flame is applied to the surface near the lower end for 1 s. The time required for flaming to proceed up the fabric a distance of 127 mm is measured. Ignition or fusing of’ the base of specimens having a raised fibre surface is noted.

**8.2 Apparatus**

**8.2.1** *Flammability Tester*

**8.2.1.1** *Draught-proof box* — Consisting of a ventilated draught-proof box (370 × 220 × 140 mm approx) containing standard ignition mechanism and a specimen rack inclined at 45° and adjustable laterally so that the surface of the tested fabric will be at a standard distance from the micro-burner. For ventilation it shall be provided with 12 holes each 13 mm in diameter equidistantly spaced, near the top of the rear wall and by a slit 300 mm long and 13 mm wide (or any equivalent ventilating strip) below the sliding glazed door. The glazed door slides in grooves at the front of the cabinet. A knob moves the catch mechanism used to hold the sliding door in an open position for insertion of the specimen holders.

**8.2.1.2** *Specimen rack* — It provides support for the frames in which the specimens are mounted. The angle of inclination is 45 degrees. Two guide pins projecting downward from the centre of the base of the rack, travel in slots provided in the floor of the chamber so that adjustment can be made for the thickness of the specimen in relation to the flame front. An indicating finger is provided, the fore part of which touches the specimen when the rack is correctly adjusted. Two control knobs hold the rack in test position. The knobs can be reached under the stage of the cabinet and permit forward and backward movements of the rack when loosened.

**8.2.1.3** *Specimen holders* — Each specimen holder shall consist of two matched metal U-plates between which the fabric can be held in such a way that the fabric specimen is free at the bottom and is held at the top and sides with 40 mm of width and 150 mm of length exposed. The specimen holder shall be so made that it will drop on the specimen rack into a precisely determined position of 45° inclination and will be positioned in the specimen rack SO that the igniting flame strikes the specimen centrally and 6 mm above the bottom edge. Five specimen holders are provided.

**8.2.1.4** *Ignition mechanism* — The ignition mechanism shall comprise a micro-burner mounted on a rotatable spindle so that, at the commencement of each test, it moves to a position perpendicular to the surface of the fabric: the respective parts of the apparatus shall be so disposed that the end of the micro-burner is 8 mm above the upper surface of fabric. A flame 16 mm long shall be produced at the micro-burner by butane gas or petroleum gas (*see* Note under 7.3.1) taken from a small cylinder, a sensitive reducing valve and a manometer device. The ignition mechanism provided shall be such that the flame is maintained in the igniting position for the duration of the test. It shall be provided with means for the timing of the interval (in seconds to the nearest 0.1 second) from the moment of first impingement of the flame on the fabric specimen to the time when the weighed cotton thread is burnt through. The cotton thread is stretched from a guide ring through suitable thread guides provided on the specimen frame and chamber walls, permitting the lacing of the thread in the proper position exactly 127 mm from the point where the centre of the ignition flame impinges on the test specimen. A weight attached by means of a clip to the cotton thread, in dropping, actuates the stop motion.

**8.2.1.5** *End Point* — The end point of the test is indicated by the burning through of a weighted cotton thread horizontally mounted across the specimen holder 127 mm from the point of ignition and not more than 6 mm above the surface of the specimen.

**8.2.2** *Brushing Device*

**8.2.2.1** *Movable carriage* — The brushing device consists of a base board over which a small carriage is drawn. This carriage runs on parallel tracks attached to the edges of the upper surface of the base board. A brush is hinged with pin hinges at the rear edge of the base board and rests on the carriage vertically with a pressure of 150 g. The carriage is so constructed as to receive the specimen in its holder and to permit its longitudinal brushing as the carriage is slowly moved beneath the weighted brush.

**8.2.2.2** *Brush* — 40 mm long, with two rows of nylon monofil tufts which are 0.4 mm in diameter and 20 mm in length and mounted in a staggered position. There are a total of four tufts per 25 mm and each tuft contains 20 filament ends. The brush is mounted so as to allow free movement in a vertical direction and is weighted so that it may rest on a horizontal surface with a load of 150 g.

**NOTE** — For further details, ASTM D 1230 (issued by the American Society for Testing and Materials) may be referred.

**8.2.3** *Laboratory Drying Oven* — maintained at 105 ± 3°C.

**8.2.4** *Desiccator* — 250 mm in diameter.

**8.2.5** *Mercerized Cotton Sewing Thread* — corresponding to variety No. 20 of IS 1720.

**8.2.6** *Worsted Test Fabric* — well scoured, undyed worsted cloth, plain weave, 170 to 180 g/m2.

**8.3 Reagents**

**8.3.1** *Butane gas*.

**NOTE** — In place of butane gas, commercially available liquefied petroleum gas (LPG) may also be used.

**8.3.2** *Calcium Chloride (Anhydrous)*

**8.4 Test Specimens**

**8.4.1** Five test specimens each measuring 150 × 50 mm shall be selected as given in **8.4.2** for each test and prepared as described in **8.4.3**.

**8.4.2** *Determination of the Type of Specimen* — Before specimens for the standard test are cut, establish by preliminary tests which type of specimen gives the highest observed burning rate. Conduct the preliminary tests as follows:

a) *Unraised fabrics* — Test one specimen cut in the warp or length direction of the fabric and one cut in the weft or width direction. If there is a face side to the fabric these specimens shall be tested with the face side uppermost and two additional specimens shall be tested with the face side downwards.

b) *Raised fabrics* — Fabrics which are raised on one surface only, are always tested with the raised surface in the uppermost position. Prepare two specimens cut in the warp direction, and test one with the lie of the nap or pile upwards and one with the lie downwards. Prepare two specimens cut in the weft direction and test these also in both directions with respect to the lie of the nap or pile.

**8.4.3** Preparation of Specimens — Cut five specimens each of the type shown by preliminary tests (*see* **8.4.2**) and of size given in **8.4.1** and mark out on the surface opposite that to be tested, with the long dimensions in the direction in which burning is most rapid as established in the preliminary trials (*see* **8.4.2**).

NOTE — The end of each specimen towards which, and on the surface of which, flame spread is most rapid shall be identified by attaching a staple to it. The specimens shall then be cut from the fabric.

**8.4.3.1** Each specimen having a raised fibre surface shall be brushed once against the lay of the surface fibres with the brushing device. Other fibres do not require brushing.

**8.4.3.2** Condition the specimen in accordance with **8.5.1.**

**8.5 Conditioning and Testing Atmospheres**

**8.5.1** *Conditioning* — Dry the specimens for test, already cut and mounted in their holders, for 30 minutes in the ventilated drying oven maintained at 105 ± 3 °C. Cool each specimen, still in its specimen holder, in a desiccator or’ air-tight container over anhydrous calcium chloride for at least 15 minutes. Keep each specimen enclosed until immediately before the test.

**8.5.2** *Testing Atmosphere* — Carry out the test in an atmosphere of relative humidity between 20 percent and 80 percent and temperature between 20 °C to 35 °C.

**8.6 Procedure**

**8.6.1** Set up the flammability tester with its base horizontal. Adjust the specimen rack so that the surface of the fabric to be tested will be 6 mm from the end of the burner in its igniting position. Open the control valve of the fuel supply and allow approximately 5 minutes for the air to be driven from the fuel line. Ignite the gas and adjust the flame so that it burns steadily and has a length of 15 mm measured from the tip of the flame to the nozzle of the burner.

**8.6.2** Remove one fabric specimen from the desiccator and place it in position on the specimen rack. The test specimen should be ignited within 45 seconds of the time it was removed from the desiccator. Thread the detecting cotton thread (*see* **8.2.5**) through the guides and attach the weight to the cotton thread close to and just below the guide ring. Close the door of the apparatus. Set the stop watch at zero. Conduct the test in a draught-free room with the apparatus under conditions as described in **8.5.2.**

**8.6.3** Move the ignition flame to the igniting position and immediately start timing mechanism. Apply the flame to the specimen for a period of one second until the cotton thread is severed by the advancing flame. Timing is automatic, starting upon application of the flame and ending when the weight is released by the burning of the detecting cotton thread.

**8.6.4** Record the time of flame spread for each specimen and note whether the base of each specimen having raised fibre surface is ignited or fused to a point where the damage is apparent from the bottom of the specimen. Repeat the procedure until all the five specimens have been tested.

**NOTE** — The time of flame spread is the average time required for flaming to proceed up the fabric specimen to a distance of 127 mm.

**8.6.5** Calculate the average of the time of flame spread obtained for the five specimens.

**8.6.6** If average time of flame spread (**8.6.5**) is less than 34 seconds or if some of the specimens do not burn, test five additional specimens. The time of flame spread of the fabric shall then be the average time for the ten specimens, or for the number of specimens that burn.

**8.7 Report** — The report shall include the following:

a) Average time of flame spread for the five or ten specimens or for the number of specimens that burn before and after dry cleaning or washing separately; and

b) The ignition or fusing of the base fabric of textiles having a raised fibre surface when the base fabric of more than one of the five (or two of the ten) specimens tested ignites or fuses, before and after dry cleaning or washing separately.

**ANNEX A**

(*Clause* 2)

**LIST OF REFFERED STANDARD**

|  |  |
| --- | --- |
| *IS No..* | *Title* |
| IS 1299 : 1984 | Method for determination of dimensional changes on washing of fabrics woven from rayon and synthetic fibres (*second revision*) |
| IS 1720 : 1978 | Specification for cotton sewing threads (*first revision*) |
| IS 6359 : 2023 | Method for conditioning of textiles (*first revision*) |
| IS 9424 : 1979 | Specification for sodium metastlicate |
| IS 9458 : 2020 | Synthetic Detergents for Washing Woollen and Silk Fabrics — Specification (*second revision*) |

**ANNEX B**

(*Clause* 5.1)

**LEACHING, WASHING AND DRY CLEANING**

**TREATMENTS OF FABRICS**

**B-1 LEACHING TREATMENT**

**B-1.1 General —** This treatment is applicable to non-apparel fabricssuch as awnings, hatch covers and theatre curtains which would notnormally be subjected to water or to dry cleaning in use but which mightbe subjected to spot cleaning or casual rinsing, for example, under a tap.It is also used as a preliminary treatment to the dry cleaning procedurein order to remove water soluble finishes which, in use, may be affectedby wetting. There is no objection to steeping together similar fabricswith the same finish.

**B-1.2** **Specimens** — Use sufficient fabric to permit subsequent preparation of test specimens of the size and number required in Method A or B.

**B-1.3 Reagents**

**B-1.3.1** *Water* — of 160 ± 20 mg/1 hardness (expressed as calcium carbonate) from one of the following sources:

a) Supply water of 160 ± 20 mg/1 hardness.

b) Supply water of higher than 180 g/l hardness and diluted to 160 ± 20 mg/l hardness with water of lower hardness.

c) Supply water of known initial hardness of ‘n’ mg/l where n is less than 140 mg/ 1 and artificially hardened to 160 ± 20 mg/l. To 5 litres of the water add 500 ml of the calcium chloride solution (*see* **B-1.3.2** ) and follow this with 500 ml of the sodium hydrogen carbonate solution (*see* **B-1.3.3**) and then sufficient of the water to give a total of 10 ± 0.1 litres.

**B-1.3.2** *Calcium Chloride Hexahydrate* — 43.8 (160 — n) mg/l solution in water of hardness n mg/l.

**B-1.3.3** *Sodium Hydrogen Carbonate* — 33.6 (160 — n) mg/l solution in water of hardness n mg/l.

**B-1.3.4** *Non-ionic Wetting Agent*— Conforming to IS 9458.

**NOTE** — The exact nature of the wetting agent is not critical.

**B-l.4 Apparatus**

**B-1.4.1** *Fiat-Bottomed Dish*

**B-1.4.2** *Iron or Press* — to be used at a temperature setting not exceeding 120°C.

**B-1.5 Procedure**

**B-1.5.1** Immerse each specimen in water (*see* **B-1.3.1**) containing 0-5 g/l of non-ionic wetting agent in the flat-bottomed dish at liquor ratio of 1 : 20 at a temperature of 40 ± 1°C. After 30 minutes, remove the specimen, rinse in the water (*see* **B-1.3.1**) using a liquor ratio of 1 : 20 for 2 minutes, partially dry the specimens by any method suitable for. the fabric type and then iron or press at a temperature setting not exceeding 120°C.

**B-2 HARD WATER WASHING TREATMENT USING NEUTRAL SOAP OR SYNTHETIC DETERGENT SOLUTION**

**B-2.1 General** — This treatment is applicable to those fabrics which would normally be subjected to a water wash treatment in use.

**B-2.2 Specimens** — Use sufficient fabric to permit subsequent preparation of test specimens of the size and number required in Method A or B.

**B-2.3 Apparatus**

**B-2.3.1** A mechanical washing device, for example, wash-wheel sponsored by the Society of Dyers and Colourists or the launder-ometer sponsored by the American Association of Textile Chemists and Colourists (*see* also IS 1299). Whichever type of machine is used; the volume of the container should be at least twice that of the washing solution. All the material subjected to washing should be of the type under test; the use of other materials as loading material may give erroneous results.

**B-2.4 Reagents**

**B-2.4.1** *Soap* — meeting the composition as specified in 7.1 of IS 1299.

**B-2.4.2** *Non-ionic Wetting Agent* — based on ethylene oxide fatty alcohol condensate conforming to IS 9458.

**B-2.4.3** *Sodium Dihydrogen Phosphate* — anhydrous (NaH2PO4).

**B-2.4.4** *Disodium Hydrogen Phosphate* — anhydrous (Na2HPO4).

**B-2.4.5** *Hard Water* — with a hardness of 160 ± 20 mg/l (expressed as calcium carbonate) (*see* **B-1.3.1**).

**B-2.5 Procedure**

**B-2.5.1** Treat the specimens in a suitable mechanical washing device (*see* **B-2.3.1**) as given in IS 1299 for a period given in **B-2.5.3** with sufficient washing liquor containing 5 g/l soap (*see* **B-2.4.1**) and hard water (*see* **B-2.4.5**) to give a liquor ratio of 1 : 10 (m/m).

**B-2.5.2** Alternatively, instead of soap, a neutral synthetic detergent solution of following composition may be used: Sodium dihydrogen phosphate, anhydrous (NaH2PO4) — 0.1 g/l. Disodium hydrogen phosphate, anhydrous (Na2HPO4) — 0.2 g/l. Non-ionic wetting agent of the ethylene oxide fatty alcohol condensate type — 0’05 g/l. Hard water — to make the required volume.

**NOTE** — The pH of the solution in **A-2.5.2** shall be adjusted to 7.0 ± 0.2.

**B-2.5.3** Keep the washing conditions as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl No.** | **Composition of Fabric** | **Solution****Temperature** | **Washing Time, min** |
| i) | Cotton and linen fibres | 80 to 85 °C or 60 to 70 °C | 30 |
| ii) | Polyamide, polyester, regenerated cellulosic fibres | 55 to 60°C | 30 |
| iii) | Wool, silk and acetate fibres | 38 to 40 °C | 10 |
| iv) | Acrylics, chlorofibres and modacrylic fibres | 38 to 40 °C | 30 |

**B-3** **SOFT WATER WASHING TREATMENT**

**B-3.1 General** — This treatment is applicable to those fabrics employed in end uses to which laundering will be applied.

**B-3.2 Specimens** — Use sufficient fabric to permit subsequent preparation of test specimens of the size and number required in Method A or B.

**B-3.3 Apparatus**

**B-3.3.1** *A Mechanical Washing Device* — (*see* **B-2.3.1**).

**B-3.4 Reagents**

**B-3.4.1** *Water* — with a maximum hardness of 20 mg/l (expressed as calcium carbonate).

**B-3.4.2** *Soap* — meeting the composition specified in **8.1** of IS 1299 and containing 3% sodium carboxymethyl cellulose.

**B-3.4.3** *Non-ionic Wetting Agent* — based on ethylene oxide condensate conforming to IS 9458.

**B-3.4.4** *Sodium Meta silicate* — conforming to IS 9424.

**B-3.5 Procedure**

**B-3.5.1** Treat the fabric in a suitable mechanical washing device by the procedure specified in IS 1299 for a period and at a temperature given in **B-2.5.3** with sufficient washing liquor containing

5 g/l soap, 0.05 g/l non-ionic wetting agent, 3.5 g/l sodium metasilicate and soft water (*see* **B-3.4.1**) to give a liquor ratio of 1 : 10 ( m/m ).

**B-4 DRY CLEANING TREATMENT**

**B-4.1 General** — This treatment is applicable to those fabrics which would normally be subjected to a dry cleaning treatment.

**B-4.2 Specimens** — Use sufficient fabric to permit subsequent preparation of test specimens of the size and number required in Method A or B.

**B-4.3 Reagents**

**B-4.3.1** *Perchloroethylene or Petroleum Ether* — dry cleaning grade.

**NOTE** — Perchloroethylene should be stored over anhydrous sodium carbonate to neutralize any hydrochloric acid formed.

**B-4.4 Apparatus**

**B-4.4.1** Suitable mechanical device consisting of a water bath containing a rotatable shaft which supports, radially, glass or stainless-steel containers (75 ± 5 mm diameter × 125 ± 10 mm high) of approximately 550 ± 50 ml capacity, the bottom of the containers being 45 ± 10 mm from the centre of the shaft. The shaft/container assembly is rotated at a frequency of 40 ± 2 min-1. The temperature of the water bath is thermostatically controlled to maintain the test solvent at 30 ± 2°C.

**NOTE** — Other mechanical devices may also be used for the test provided that the results are identical with those obtained by the apparatus described under **B-4.4.1.**

**B-4.4.2** Glass or stainless-steel containers of approximately 550 ml capacity which shall be closed using solvent resistant gaskets.

**B-4.4.3** non-corrodible (stainless) steel discs, (30 ± 2) × (3 ± 0.5) mm, smooth and free from rough edges of mass 20 ± 2 g.

**B-4.5 Procedure**

**B-4.5.1** Prepare a bag with inside dimensions of 10 × 10 cm using the undyed cotton twill cloth by sewing together two squares of this cloth around three sides. Place the specimen and 12 steel discs inside the bag. Close the bag by any convenient means.

**B-4.5.2** Place the bag containing the specimen and the steel discs in the container and add 200 ml of dry-cleaning solvent at 30 ± 2°C. Treat the specimens for 30 minutes at 30 ± 2°C in the specified mechanical device as specified in **B-4.4.1**.

**B-4.5.3** Remove the bag from the container, withdraw the specimens, place it between the absorbent paper or cloth and squeeze or centrifuge to remove surplus solvent. Dry the specimen by hanging it in air at a temperature not exceeding 60°C.

**ANNEX C**

(*Clause* 7.5.4.1)

**MEASUREMENT OF CHAR LENGTH**

**C-l APPARATUS**

**C-l.1** A hook and weight assembly. The combined mass of the assembly should be as given in Table 1.

**Table 1 Mass to Tear Charred Fabric**

(*clause* C-1.1)

|  |  |  |
| --- | --- | --- |
| **Sl No.** | **Mass of Fabric Being** **Tested ( g/m2 )** | **Total Mass Used to****Tear The Fabric** |
| **(1)** | **(2)** | **(3)** |
| i) | Less than 200 | 100 |
| ii) | 200 to 600 | 200 |
| iii) | Greater than 600 | 400 |

**C-2 PROCEDURE**

**C-2.1** Inspect the edge of the highest char penetration of the specimen to determine if as a result of thermoplastic behavior, a thickening of the edge has developed. If this has occurred, make a cut after cooling, only sufficiently deep to cut through the highest portion of this thickened edge of the charred specimen.

**C-2.2** Fold the specimen parallel to its length and crease it lightly through the maximum visible portion of the charred length.

**C-2.3** Insert the hook with total mass as given in Table 1, in the specimen one side of the charred area, 8 mm in from the adjacent outside edge of the charred length.

**C-2.4** Grasp the specimen with fingers on the opposite side of the charred area and raise gently until it supports the weight. The fabric will tear through the area until fabric strong enough to carry the load is reached.

**C-2.5** Measure the distance from the end of the specimen which was exposed to the flame to the end of a tear made lengthwise in the specimen through the centre of the charred area, as the char length.

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**BUREAU OF INDIAN STANDARDS**

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*भारतीय मानक*  मसौदा

**फर्श पर बिछाए जाने बाले वस्त्रादि** — **गोली परीक्षण द्वारा ज्वाला प्रतिरोध निर्धारण बिधी**

 (आई एस 12722 का*पहला पुनरीक्षण*)

Draft *Indian Standard*

**TEXTILE FLOOR COYERINGS — DETERMINATION OF FLAME RESISTANCE**

**BY TABLET TEST**

 **(*First revision* of IS 12722)**

**ICS 13.220.40**

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Textiles Protective Clothing Sectional Committee, TXD 32

**FOREWORD**

Besides the conventional textile floor coverings manufactured from wool, silk jute, etc., these are now increasingly being manufactured utilizing blends containing man-made fibres. Their flammability depends upon the constituent fibres, exposure conditions during actual use and the nature of flame retardant treatment imparted. The floor coverings are normally subjected to various treatments, such as shampooing, dry-cleaning, washing and hot water extraction cleaning during actual use. ‘The flame retardant finish is required to withstand these treatments. Since the type of such treatments vary considerably depending upon the end use, it is recommended that the type and number of such treatments may be as agreed to between the buyer and the seller.

This standard was first published in the year 1989 and it is being revised again to update the reference in the standard.

While preparing this standard, considerable assistance has been derived from ISO 6925 ‘Textile floor coverings-Burning behaviour - Tablet test at ambient temperature’, issued by the International Organization for Standardization (ISO).

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 ‘Rules for rounding off numerical values (*second revision*)’.

**1 SCOPE**

**1.1** This standard prescribes a method for the determination of f-lame resistance of textile floor coverings in a horizontal position when exposed to a small source of ignition under controlled laboratory conditions.

**1.2** The method is applicable to all types of textile floor coverings irrespective of their construction or their fibre composition. The method may also be applicable to unfinished material.

**1.3** The results obtained on specimens in a horizontal position, as specified in this standard, do not apply to the behaviour of the textile floor covering when used in another position, particularly in a vertical position.

NOTE — The method should be used solely to assess the properties of materials or systems in response to heat and flame under controlled laboratory conditions and should not be used for the evaluation or regulation of the hazard of textile floor coverings under actual fire conditions. The method has been used extensively in the trade for acceptance testing and is considered satisfactory as a test for acceptance of merchandise, provided that an appropriate sampling plan such as given IS 7877 (Part I). Methods of sampling and tests for handmade carpets: Part 1 Sampling and selection of areas of physical tests, is used.

**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 subjected to revision, and parties to agreements based on this standard are encourage to investigate the possibility of applying the most recent editions of the standards indicated in Annex **A**.

**3 PRINCIPLE**

**3.1** A specimen of textile floor covering is exposed in a horizontal position to the action of a small ignition source (methenamine tablet) under specified conditions and the resulting damaged length is measured.

**4 APPARATUS**

**4.1 Test Box**

A test box with inside dimensions of 300 × 300 × 300 mm and made from hard, fire resistant insulation board with similar thermal properties to asbestos cement board, not less than 6 mm thick. The chamber is open at the top and has a flat removable base made of the same material as above. The joints shall be air tight.

NOTE — Any other test chamber giving identical results may be used.

**4.2 Square Metal Plate**

The square metal plate shall be of size 230 × 230 mm, 6.5 ± 0.5 mm thick, with a 206 mm diameter hole cut in the centre of the plate.

**4.3 Desiccator(s)**

The desiccator shall be required for storing the methenamine tablets (set 5.1) and the bone dry specimens (*see* **6.4.2**). It is recommended that self-indicating silica gel is used as desiccant.

**4.4 Circulating Air Oven**

The oven shall be ventilated, forced draught and thermostatically controlled at 105 ± 2 ºC throughout the enclosure.

**4.5** **Glove**, disposable, of polyethylene, polypropylene or rubber.

**4.6** **Rule**, graduated in mm.

**4.7 Vacuum cleaner**

A vacuum cleaner of which all surfaces in contact with the specimen are flat and smooth, shall be required.

**4.8 Laboratory Fume Hood**

Laboratory fume hood of about 2m3 capacity, capable of being closed and having its draught turned off during the test shall be required. The front or one of the sides of the hood shall be of glass in order to permit observation of the specimen during the test.

**4.9 Timing Device**

Requirement of timing device will be optional.

**5 REAGENTS**

**5.1** **Methenamine Tablet**

**5.1.1** Tablets of hexamethylenetetramine, flat, having a mass of 150 ± 5 mg and a diameter of

6 mm.

NOTE — Storage of the tablets in a desiccator reduces the tendency to crack upon ignition.

**6 PREPARATION OF TEST SPECIMENS**

**6.1 Sampling**

**6.1.1** Sampling of specimens shall be carried out in accordance with IS 7877 (Part 1).

**6.2 Dimensions and Number**

**6.2.1** Cut at least eight specimens, each 230 ± 3 mm square, from each sample.

**6.3 Underlays**

**6.3.1** The use of an underlay is not specified. However, subject to agreement between the interested parties, this method can be used to assess the effect of an underlay in combination with a textile floor covering.

**6.4 Conditioning of Test Specimens**

**6.4.1** Clean each specimen with the vacuum cleaner (**4.7**) until the pile is free from fluff or loose ends of yarn, fibres, etc.

**6.4.2** Condition the test specimens in a manner that will permit free air circulation so that they are not resting upon one another, in one of the following ways, or as agreed between the interested parties:

1. In the standard atmosphere of 27 ± 2 °C and 65 ± 2 percent relative humidity in accordance with IS 6359, or
2. By drying the specimens in the oven (**4.4**) at 105 ± 2 °C for 2 hours, removing the specimens from the oven with a gloved hand (*see* **4.5**) and placing the specimens immediately in the desiccator (**4.3**) for at least 1 hour, until they reach ambient temperature.

NOTE — The use of bone dry specimens may be more stringent than the use of specimens conditioned at 65 percent relative humidity. However, it may be that use of specimens conditioned at 65 percent relative humidity is more realistic. Performance requirements should be set accordingly.

**7 DURABILITY OF FLAME RETARDANT TREATMENT**

**7.1** For checking the durability of flame retardant treatment applied to the textile floor-coverings, the type and number of treatments for shampooing, dry-cleaning, washing and/or hot water extraction cleaning, etc shall be as per the agreement between the buyer and the seller (*see* also IS 11471and IS 11969).

**8 PROCEDURE**

**8.1** Carry out the test in an atmosphere having a temperature between 15 and 35°C and a relative: humidity between 20 and 70 percent.

**8.2** Place the test chamber (**4.1**) in the laboratory fume hood (4.8) with the ventilation turned off.

**8.3** Remove a specimen from the conditioning atmosphere or desiccator according to the method of conditioning chosen in (**6.4**) with a gloved hand and, if there is a pile, brush it in a direction opposite to the lay to bring the pile to an upright position.

**8.4** Place the specimen flat on the floor of the test box with the use surface uppermost, ensuring the specimen is horizontal. Place the metal plate (**4.2**) on top of the specimen, and line up the outside edges of the plate with those of the specimen.

**8.5** Place a methenamine tablet (**5.1**) flat and in the centre of the specimen and ignite the tablet with a lighted match which shall only lightly touch the upper face of the tablet. If ‘used, start the timing device (**4.9**). Do not touch the specimen with the lighted match.

**8.5.1** If more than 2 minutes elapses between removal of the specimen from the conditioning atmosphere or the desiccator and ignition of the tablet, repeat the procedure specified in **8.1** to **8.5** with a new conditioned specimen. Close the fume cupboard.

**8.5.2** If the tablet cracks upon ignition, consider the test result void.

**8.6** Allow the ignition flame or any propagated flame to burn until extinction or until the flame or glowing reaches the edges of the hole in the metal plate. Terminate the test when either of the above conditions is reached. Stop the timing device, if used. Start the ventilation in the fume hood to eliminate any volatile products of combustion.

**8.7** After each specimen has been tested, lift the removable base from the test chamber and fret it of any residue which would prevent the next specimen from lying in a horizontal plane. Allow sufficient time between each test for the test chamber to cool to ambient temperature ±5˚C.

**8.8** Repeat the procedure specified in **8.3** to **8.7** on each specimen.

**8.9** On each specimen measure, to the nearest mm, the maximum distance between the centre of the specimen and the edge of the damaged zone using the rule (**4.6**).

**8.10** If required, measure the time in seconds from the ignition of the tablet to the moment when the flame or glowing reaches the edge of the hole in the metal plate, using the timing device (**4.9**).

**9 EXPRESSION OF RESULTS**

**9.1** The results of the test shall be the value obtained for each specimen (*see* **8.9**).

**10 TEST REPORT**

**10.1** The test report shall include the following information:

1. A statement of the sampling plan used.
2. Whether a separate underlay was incorporated in the test (*see* **6.3**).
3. The conditioning atmosphere used for the test specimens (*see* **6.4**).
4. For each specimen, the damaged length as determined in **8.9**.
5. If required, the flame spread time measured according to (**8.10**).
6. Any operating detail not stated in this standard or any incident likely to have an effect on the test results.

**ANNEX A**

(*Clause* 2)

**LIST OF REFERRED STANDARDS**

|  |  |
| --- | --- |
| *Is No.* | *Title* |
| IS 6359 : 2023 | Method for conditioning of textiles (*first revision*) |
| IS 11471 : 2020ISO 2551 : 2020 | Textile Floor Coverings and Textile Floor Coverings in Tile Form — Determination of Dimensional Changes Due to the Effects of Varied Water and Heat Conditions and Distortion out of Plane (*First Revision*) |
| IS 11969 : 2020ISO 18168 : 2020 | Textile floor coverings — Colour fastness to shampooing (*first revision*) |
| IS 7877 (Part 15) : 1976 | Methods of sampling and tests for hand-made carpets |

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**वस्त्रादि — ऑक्सीजन सूचकांक द्वारा ज्वलनशीलता ज्ञात करना**

 ( आई एस 13501 का *पहला पुनरीक्षण* )

Draft *Indian Standard*

**TEXTILES- DETERMINATION OF FLAMMABILITY BY OXYGEN INDEX**

 ( *First Revision* of IS 13501 )

**ICS 13.220.40**

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Textiles Protective Clothing Sectional Committee, TXD 32

FOREWORD

(*Formal clauses will be added* *later*)

Oxygen index results obtained using the method prescribed in this standard can provide a sensitive measure of the burning characteristics of a textile material intended for clothings under certain con- trolled laboratory conditions, and hence may be useful for quality control purposes. The results obtained are dependent upon the shape, orientation and isolation of the test specimen and conditions of ignition. For particular materials or applications, it may be necessary or appropriate to specify different test conditions. Such requirements should be referred to in other standards.

This standard was originally published in 1992. It has been revised to update the references in the standard.

Results obtained from test specimens of differing thickness or by using different ignition procedures may not be comparable and no correlation with flammability behaviour under other fire conditions is implied. Results obtained in accordance with this standard must not be used to describe or appraise the fire hazard presented by a particular textile material or shape under actual fire conditions, unless used as one element of a fire risk assessment that takes into account all the factors pertinent to the assessment of the fire hazard of a particular application for the textile material.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’.

**1 SCOPE**

**1.1** This standard specifies method for deter­mining the minimum concentration of oxygen, is admixture with nitrogen that will support combustion of small vertical test specimens under specified test conditions. The results are defined as oxygen index values.

**1.2** The method prescribed in this standard provides a sensitive measure of the burning characteristics of textile materials intended for clothings.

**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 subjected to revision, and parties to agreements based on this standard are encourage to investigate the possibility of applying the most recent editions of the standards indicated in Annex **A**.

**3 PRINCIPLE**

**3.1** A small test specimen is supported vertically in a mixture of oxygen and nitrogen flowing up­wards through a transparent chimney. The upper end of the specimen is ignited. The mini­mum concentration of oxygen in a mixture of oxygen and nitrogen flowing upward in a test chimney that will just support combustion is measured under equilibrium conditions of candle-like burning. The equilibrium is established by the relation between the heat generated from the combustion of the specimen and the heat lost to the surroundings as measured by one or the other of two arbitrary criteria, namely, the period for which burning continues, or the length of specimen burnt. This point is approa­ched from both sides of the critical oxygen con­centration in order to establish the oxygen index.

**4 DEFINITION**

**4.0** For the purpose of this standard, the definitions given in IS 11871 and the follow­ing definition shall apply.

**4.1 Oxygen Index**

The minimum concentration of oxygen by percentage volume in a mixture of oxygen and nitrogen that will just support combustion of a material under specified test conditions.

**5 APPARATUS**

The following apparatus shall be arranged as indicated in Fig. 1 and 2.

**5.1 Test** **Chimney**

A heat resistant glass tube supported vertically on a base through which oxygen-containing gas mixture can be introduced. The preferred dimensions of the chimney are 450 mm mini­mum height and 75 mm minimum diameter cylindrical bore. The upper outlet shall be rest­ricted as necessary by an overhead cap having an outlet small enough to produce an exhaust velocity of at least 90 mm/s from a flow rate within the chimney of 30 mm/s (*see* Note). Chimneys of other dimensions, with or without restricted outlets, may be used, if shown to give equivalent results. The bottom of the chimney, or the base upon which the chimney is supported, shall incorporate a means for distributing evenly the gas mixture entering the chimney. The pre­ferred means comprises solid glass beads of bet­ween 3 and 5 mm diameter, in a layer between 80 and 100 mm deep. Other means, such as radial manifolds, may be used, if shown to give equi­valent results. A porous screen may be mounted below the level of the specimen holder, to prevent falling combustion debris from fouling the gas entry and distribution paths. The chimney support may incorporate a levelling device and indicator, to facilitate vertical align­ment of the chimney and a test specimen supported therein. A dark background may be provided to facilitate observation of flames within the chimney.

NOTE— For tubes of 75 to 100 mm diameter, a cap converging to an outlet of 40 mm diameter at a level at least 10 mm above the top of the cylindrical chimney has been found satisfactory.

**5.2 Test Specimen Holder**

Suitable for supporting a specimen vertically in the centre of the chimney. The specimen shall be supported by both vertical edges in a frame equivalent to that illustrated in Fig. 2, with reference marks at 20 mm and 100 mm below the top of the frame. The profile of the holder and its support should be smooth to minimize induction of turbulence in the rising flow of gas.

**5.3 Gas Supply**

Comprising commercial grade oxygen and nitrogen. If an air supply is used with oxygen or nitrogen, it shall be clean and dry. The gas supply system shall incorporate a drying device. The constituent gas supply lines shall be linked in a manner which thoroughly mixes the gases, before they enter the gas distribution device at the base of the chimney, so that the variation in oxygen concentration in the gas mixture rising in the chimney, below the level of the test specimen, is less than 0.2 percent (v/v).

**5.4 Gas Measurement and Control Devices**

Suitable for establishing the concentration of oxygen and nitrogen in the gas mixture entering the chimneywith an accuracy of ± 1.0 percent (*v/v)*.

NOTE — System of measurement and control that have proved satisfactory include the following:

1. Needle valves on individual and mixed gas supply lines, a paramagnetic oxygen analyzer that conti­nuously samples the mixed gas, and a flowmeter to indicate when the gas flow through the chimney is within the required limits;
2. Calibrated orifices, gas pressure regulators and pressure gauges on the individual gas supply lines; Or
3. Needle valves and calibrated flowmeters on the individual gas supply lines.

Systems (b) and (c) may require calibration after assembly to ensure that the compounded errors of the component parts do not exceed the requirements of **5.4**.

**5.5 Flame Igniter**

Comprising a tube that can be inserted into the chimney **to** apply to the test specimen a flame issuing from an outlet of 2 ± 1 mm diameter at the end of the tube. The flame fuel shall be commercially available liquefied petroleum gas (LPG). The fuel supply shall be adjusted so that the flame will project 6 to 25 mm vertically downwards from the outlet when the tube is vertical within the chimney and the flame is burning within the chimney atmosphere.

**5.6 Timing Device**

Capable of measuring periods up to 10 min with an accuracy of 5 seconds.



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1 Burning test specimen | 7 | Base plate | 12 | Precision pressure regulator |
| 2 Specimen holder | 8 | Gas premixing point | 13 | Filter |
| 3 Igniter | 9 | Cut-off valve | 14 | Needle valve |
| 4 Debris screen of wire mesh | 10 | Orifice in holder | 15 | Gas flow meter |
| 5 Chimney support | 11 | Pressure gauge | 16 | Temperature sensor |
| 6 Bead bed |  |  |  |  |

FIG 1 DIAGRAM OF TYPICAL APPARATUS FOR DETERMINATION OF OXYGEN INDEX



All dimensions in millimetres with tolerances It 0’25 mm.

FIG 2 FRAME DESIGN FOR SUPPORTING NON-SELF-SUPPORTING TEST SPECIMENS

**5.7 Soot, Fumes Heat-Extraction System**

Providing sufficient ventilation or exhaust to remove fumes or soot expelled from the chimney without disrupting the gas-flow rate or tempera­tures in chimney.

NOTES

**1** If soot-generating materials are being tested, the glass chimney may require cleaning to maintain good visibility, and the gas inlets, or inlet screen, and temperature sensor (if fitted) may also require cleaning to function properly. Suitable precautions should be taken to protect personnel from noxious materials or burns during testing or cleaning operations.

**2** Any other suitable oxygen analyzer equipment based on the principle specified in this standard and capable of giving reliable and reproducible results directly, may also be used.

**6 CALIBRATION OF EQUIPMENT**

**6.1** For compliance with this method, calibrate the equipment periodically in accordance with the instructions given in Annex B so that the maximum interval between recalibration and use complies with the periods stated in Table I.

**Table 1 Equipment Calibration Frequencies**

(*Clause* 6.1)

|  |  |  |
| --- | --- | --- |
| **Sl No.** | **Item**  | **Maximum Period** |
| (1) | (2) | (3) |
| i) | Gas-flow rate controls | 6 months |
| ii) | Oxygen concentration controls | 6 months |
| iii) | Gas system joints ( as required by **B-2** in Annex **B** ): |
| a) for joints disturbed use or cleaning of the apparatus | 24 hours |
| b) for undisturbed joints  | 6 months |

**7 PREPARATION OF TEST SPECIMENS**

**7.1 Sampling**

Obtain a sample sufficient for preparation of 5 to 10 test specimens. The sample shall be taken, if relevant, in accordance with the materials specification or otherwise specified.

NOTE — For a material for which the oxygen index is known to within f 2, 5 test specimens may be sufficient. For materials of unknown oxygen index, or which exhibit erratic burning characteristics, between 8 and 10 test specimens may be required.

**7.2 Test Specimen Dimensions and Their Preparation**

Cut test specimens of size 140 ± 5 mm × 52 ± 0.5 mm. Ensure that the surfaces of the speci­mens are clean and free from flaws that could affect burning behaviour. The edges of the specimens shall be relatively smooth and free from furr or burrs of material left from machin­ing.

**7.3 Marking of Test Specimens**

For monitoring the distance over which a speci­men burns, it may be marked with transverse lines at one or more levels which are dependent upon the specimen form and the ignition proce­dure to be used. If wet inks are used, the marks shall be dry before the specimen is ignited.

**7.3.1** The reference marks for testing specimens are carried by the supporting frame (*see* Fig. 2).

**7.4 Conditioning and Testing Atmospheres**

**7.4.1** *Conditioning*

Before testing, condition the specimens for 24 hours in a standard atmosphere of 65 ± 2percent relative humidity and 27 ± 2 °C tempe­rature (*see* IS 6359). If the test is not carried out immediately after conditioning, place the specimens in a tightly closed container until the commencement of the test. Each speci­men shall be tested within two minutes of removing it from either the conditioning atmos­phere or the container.

**7.4.2** *Testing Atmosphere*

Carry out the test in a substantially draught-free room or enclosure in an atmosphere of relative humidity between 20 to 80 percent and temperature between 20 to 35 °C.

**8 PROCEDURE**

**8.1 Setting up the Apparatus and Test Specimen**

**8.1.1** Re calibrate equipment components, if necessary (*see* **6.1** and Annex B).

**8.1.2** The test shall be conducted in the testing atmosphere specified in **7.4.2**

**8.1.3** Select an initial concentration of oxygen to be used. When possible, this may be based on experience of results for similar materials. Alternatively, try to ignite a test specimen in air, and note the burning behaviour. If the specimen burns rapidly, select an initial concen­tration of about 18 percent (*v/v*) of oxygen; if the test specimen burns gently or unsteadily select an initial oxygen concentration of about 21 percent WO; if the specimen does not continue to burn in air, select an initial concen­tration of at least 25 percent (v/v), depending upon the difficulty of ignition or the period of burning before extinguishment in air.

**8.1.4** Ensure that the test chimney is vertical (*see* Fig. 1). Mount a specimen vertically in the centre of the chimney so that the top of the specimen is at least 100 mm below the open top of the chimney and the lowest exposed part of the specimen is at least 100 mm above the top the gas distribution device at the base of the chimney (*see* Fig. 1 or Fig. 2 as appropriate).

**8.1.5** Set the gas mixing and flow controls so that an oxygen/nitrogen mixture containing the desired concentration of oxygen is flowing through the chimney at a rate of 40 ± 10 mm/s. Allow the gas to flow for at least 30 seconds to purge the system prior to ignition, of each specimen, and maintain the flow without change dur­ing ignition and combustion of each specimen. Ignite the test specimen as described in **8.2**.

**8.1.6** Record the oxygen concentration used as the volume percent calculated according to the equations given in Annex C.

**8.2 Igniting the Test Specimen**

**8.2.1** Apply the lowest visible part of the flame to the top of the specimen using a sweeping motion, if necessary, to cover the whole surface, but taking care not to maintain the flame against the vertical faces or edges of the specimen. Apply the flame for up to 30 seconds, removing it every 5 seconds for just sufficient time to observe whether or not the entire top surface of the specimen is burning.

**8.2.2** Consider the specimen to be ignited, and commence measurement of the period and dis­tance of burning, as soon as removal of the igniter, after a contact period increment of 5-seconds, reveals, burning supported by the whole of the top end surface of the specimen.

**8.3 Assessing Burning Behaviour**

**8.3.1** For the purpose of **8.3.2** to **8.3.5** inclusive, observe and terminate the burning of individual test specimens as follows:

**8.3.2** Commence measurement of the period of burning as soon as the specimen has beenignited in accordance with **8.2,** as applicable, and ob­serve its burning behavior. If burning ceases but spontaneous re-ignition occurs in less than 1 second, continue the observation and measure­ments.

**8.3.3** Theconcentration of oxygen is too high and must be reduced if the specimen burns and either the period or the extent of burning exceeds the relevant limits specified in Table 2. The concentration of oxygen must be raised if the flaming of the specimen extinguishes before meeting the criteria specified in Table 2. Do not adjust the oxygen concentration after igniting the specimen.

**Table 2 Criteria for Oxygen Index Measurements**

*(Clauses* 8.3.3 and8.3.5)

|  |  |  |
| --- | --- | --- |
| **Sl No.** | **Period of Burning After Ignition ( seconds )** | **Extent of Burning** |
| (1) | (2) | (3) |
| i) | 180  | 58 mm below the topof the specimens |

NOTE —These criteria do not necessarily produce equivalent oxygen index results for specimens of differing shape or tested using different conditions or procedures.

**8.3.4** Adjust the oxygen concentration, insert a new specimen, or if the previous specimen is long enough, turn it end for end or cut off the burnt end, then purge and re-ignite.

**8.3.5** Continue repeating **8.1.5** to **8.3.4** until the critical concentration of oxygen is determined. This is the lowest oxygen concentration that will meet the criteria specified in Table 2. At the next lower concentration that will give a difference in oxygen index of 0.2 percent or less, the specimen should not meet the criteria speci­fied in Table 2.

NOTES

**1** The critical oxygen concentration has been found to be dependent on the temperature of the specimen at ignition and the temperature of the gas mixture.

**2** For a material having consistent burning characte­ristics, the difference in oxygen concentration bet­ween and extinguishing as specified in **8.3.2** will be reproducible within **0.1** percent to 0'3 percent depend­ing on the sensitivity of the flow measuring equipment and upon the particular oxygen concentration invol­ved. Some materials, however, exhibit erratic burning characteristics because of inhomogeneity, char formation, dripping, bending, etc, which cause less reproducible results. In such cases, the critical con­centration may be determined by a statistical testing method as given in *American Statistical Association Journal,* pp-967-970 (1965).

**8.3.6** Perform the test at least three times by starting at a slightly different flow rate still within 30 to 50 mm/second limits and again per­forming the procedure from **8.1.5** to **8.3.5**.

**9 CALCULATIONS**

**9.1** Calculate the oxygen index, n, of the mate­rial for each replicate in **8.3.6** by the formula:

n = $\frac{100O\_{2}}{O\_{2}+N\_{2}}$

where

*O*2 = the volumetric flow of oxygen in cm3/s, at the concentration deter­mined in **8.3.5**; and

*N*2 = the corresponding volumetric flow rate of nitrogen in cm3/s.

NOTE — If an oxygen analyzer is used, the oxygen index should be determined using the readout from the particular instrument used.

**9.1.1** If air is used and either oxygen or nitrogen is added as required, calculate *n* assuming that air contains 20.9 percent oxygen as follows:

n= $ \left( 100× O\_{2 }\right)+\left(20.9 ×A\right):(O\_{2}+N\_{2 }+A)$

where

*A =* the volumetric flow rate of air in cm3/s.

**10 TEST REPORT**

**10.1** The test report shall include the following:

1. Identification of the material tested, including, where relevant, the type of material, density, previous history, and the specimen orientation with respect to any anisotropy in the material or sample;
2. The test specimen dimensions;
3. The igniter used;
4. The individual oxygen index values found for each of the tests, and average index value;
5. A description of any relevant ancillary characteristics or behaviour, such as charring, dripping, severe shrinkage, erratic burning, after-glow;
6. Any variations from the requirements of this standard;
7. Any other information required by the law in force

**ANNEX A**

(*Clause* 2)

**LIST OF REFERRED STANDARDS**

*IS No. Title*

IS 6359: 2023 Method for conditioning of textiles

IS 11871: 1986 Methods for determination of flammability and flame resistance of textile fabrics

**ANNEX B**

(*Clauses* 6.1 and 8.1.1 and *Table* 1)

**CALIBRATION OF EQUIPMENT**

**B-1 CALIBRATION OF GAS FLOW RATE CONTROLS**

**B-1.1** Check the system for indicating the gas-flow rate through the chimney using a water-sealed rotating drum meter (wet test meter), or an equivalent device, with an accuracy equi­valent to ± 2 mm/s flow rate through the chimney.

**B-1.2** Estimate the flow rate by dividing the total gas-flow rate through the chimney by the cross-sectional area of the bore of the chimney, for example by using the equation.

*F* = 1.27 ×$10^{6 }\frac{q\_{v}}{D\_{2}}$

Where

*F =* the flow rate through the chimney, in mm per second:

qv = the total gas-flow through the chimney, in litres per second

*D =* the diameter of the bore of the chimney, in millimeters.

**B-2 CALIBRATION OF OXYGEN CONCENTRATION CONTROLS**

**B-2.1** Check the the concentration of oxygen in the mixture of gases flowing into the chimney to an accuracy of 0.1 percent (*v/v*) of mixture, either by sampling the chimney atmosphere for analysis or by using an independently calibrated oxygen analyzer *in situ.* Integral oxygen analy­zers may be calibrated using standard oxygen/ nitrogen mixtures. The checks should be carried out for at least three different nominal concen­trations, representing respectively maximum, minimum and intermediate levels for the oxygen concentration range for which the equipment is to be used.

**B-2.2** Carry out leak-tests on all joints where leaks could change the oxygen concentration levels in the chimney from the concentration levels set or indicated.

**B-3 CALIBRATION OF COMPLETE EQUIPMENT**

**B-3.1** Check the performance of the equipment for a specific test procedure, by testing a cali­brated material and comparing the measured results with the expected result for the calibrated material. For information on the availability and use of calibrated materials, *see* Annex C.

**ANNEX C**

(*Clause* 8.1)

**CALCULATION OF OXYGEN CONCENTRATION**

**B-1** Calculate the oxygen concentrations accord­ing to the following equation:

C0 = $\frac{100 V\_{0}}{V\_{0 }+ V\_{N}}$

Where

*Co* = the oxygen concentration, in per­cent by volume;

Vo = the volume of oxygen per volume of mixture; and

VN = the volume of nitrogen per volume of mixture.

NOTES

**1** If an oxygen analyzer is used, the oxygen con­centration should be determined using the readout from the particular instrument used.

**2** If the result is calculated from flow or pressure data for individual gas streams contributing to the mixture, it is necessary to allow for the proportion of oxygen present in streams other than a pure oxygen supply. For example, for mixtures made using air mixed with oxygen of 98.5 percent (*v/v*  purity or with nitrogen containing 0.5 percent ( *v/v* ) of oxygen, the oxygen concentration, in percent by volume, should be calculated using the relationship:

C0 = $ \frac{98.5 V^{t}\_{0}+20.9 V^{t}\_{A}+0.5 V^{t}\_{N}}{V^{t}\_{0}+V^{t}\_{A}+V^{t}\_{N}}$

Where

*Vto* = the volume of oxygen stream used, per volume of mixture;

*VtA* = the volume of air stream used, per volume of mixture; and

*V tN* = the volume of nitrogen stream used, per volume of mixture.

assuming that the streams are at the same pressure and temperature.

For mixture based on two gas streams, $V^{t}\_{0},V^{t}\_{A},V^{t}\_{N}$ becomes zero, as appropriate

**Annex 7**

**(Item 6.1)**

**COMMENTS RECEIVED FROM CMD-II**

1. **Comments received on IS 16725 : 2018 on Tactical 3 points sling universal**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SNo.** | **Clause /****Subclause No.** | **Paragraph****No./Figure****No./Table No.** | **Type of Comment** | **Attachment** |
| 1 | 3.2.1 | 1 | Editorial | N/A |
| **Comments/Suggestions along with****Justification for the Proposed Change** | Methods of test for determination of approximate denier of yarn and tenacity of singleply yarn as well as number of ends and picks are not specified in Table 1 and 2(Weave particulars). |
| **Proposed Change/Modified Wordings** | Methods of test for approximate denier of yarn and tenacity of single ply yarn as wellas number of ends and picks may be specified in Table 1 and 2 (Weave particulars) |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SNo.** | **Clause /****Subclause No.** | **Paragraph****No./Figure****No./Table No.** | **Type of Comment** | **Attachment** |
| 2 | 3.2.2 | 1 | Editorial | N/A |
| **Comments/Suggestions along with****Justification for the Proposed Change** | Appendix A does not exist in IS 4727:2020.Currently the method for determination of weight per metre is given in Annex B of IS 4727:2020(Table 2, Sl No (iii) Mass per linear meter of tape, Col. (4)) |
| **Proposed Change/Modified Wordings** | In Col(4), Annex B may be substituted for Appendix A of IS 4727 alternatively, only IS4727 may be indicated under Col (4) as the method of test (Table 2, Sl No (iii) Massper linear meter of tape, Col. (4)) |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SNo.** | **Clause /****Subclause No.** | **Paragraph****No./Figure****No./Table No.** | **Type of Comment** | **Attachment** |
| 3 | 3.2.2 | 1 | Editorial | N/A |
| **Comments/Suggestions along with****Justification for the Proposed Change** | Table 2, Sl No (v) Colour fastness to light, Col. (4) - IS 2454 has been superseded by IS/ISO 105-B02:2014 |
| **Proposed Change/Modified Wordings** | In Col(4), IS/ISO 105-B02 may be substituted for IS 2454 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SNo.** | **Clause /****Subclause No.** | **Paragraph****No./Figure****No./Table No.** | **Type of Comment** | **Attachment** |
| 4 | 3.2.2 | 1 | Editorial | N/A |
| **Comments/Suggestions along with****Justification for the Proposed Change** | Table 2, Sl No (vi) Colour fastness to rubbing, Col. (4) - IS 766 has been superseded by IS/ISO 105- X12:2016 |
| **Proposed Change/Modified Wordings** | In Col(4), IS/ISO 105- X12 may be substituted for IS 766 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SNo.** | **Clause /****Subclause No.** | **Paragraph****No./Figure****No./Table No.** | **Type of Comment** | **Attachment** |
| 5 | 6 | 1 | Editorial | N/A |
| **Comments/Suggestions along with****Justification for the Proposed Change** | Sealed Sample - Establishing conformity to the requirements of having a standard sample would be difficult from a conformity assessment perspective since different customers may have different requirements |
| **Proposed Change/Modified Wordings** | Sealed Sample - It may be added that this clause is only for information and guidance |

1. **Comments received from CMD-II through portal on IS 16874 : 2018**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SNo.** | **Clause / Subclause No.** | **Paragraph No./Figure No./Table No.** | **Type of Comment** | **Attachment** |
| 1 | 4.5 | 1 | Editorial | N/A |
| **Comments/Suggestions along with Justification for the Proposed Change** | Method of test for pH of leather may be changed from IS 16258:2015 to IS 582 (Part 9) : 2022 because IS 16258:2015 specified as the method of test in the standard, has been withdrawn |
| **Proposed Change/Modified Wordings** | Method of test for pH of leather may be changed from IS 16258:2015 to IS 582 (Part 9) : 2022 |
| **Action Taken** |  |
| **SNo.** | **Clause / Subclause No.** | **Paragraph No./Figure No./Table No.** | **Type of Comment** | **Attachment** |
| 2 | 5.4.1 | 1 | Editorial | N/A |
| **Comments/Suggestions along with Justification for the Proposed Change** | In the 1st para, 2nd line |
|   |
| **procedure F** (tumble drying) may be substituted for procedure E (tumble drying)  because As per IS 15370 : 2020, drying procedure E is Flat press whereas procedure F is tumble drying |
| **Proposed Change/Modified Wordings** | In the 1st para, 2nd line |
|   |
| **procedure F** (tumble drying) may be substituted for procedure E (tumble drying)  |

**Annex 8**

**(Item 6.2)**

**Comments received from M/s NITRA, Ghaziabad on IS 15768 : 2008**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SNo.** | **Clause /****Subclause No.** | **Paragraph****No./Figure****No./Table No.** | **Type of Comment** | **Attachment** |
| 1 | 4.1 | 1 | Editorial | N/A |
| **Comments/Suggestions along with****Justification for the Proposed Change** | High Hazard Category is missing in the Table 1 |
| **Proposed Change/Modified Wordings** | Below the Low and Moderate Hazard categories, include the **High Hazard category** |

**Annex 9**

**(Item 6.3)**

**COMMENTS RECEIVED ON IS 16890 : 2018 FROM M/S SYSTEM 5S**

Proposed changes in IS 16890:2018

**A . In the existing IS 16890: 2018**

1. Multi layer assembly shall consist of
	* + 1. *Outer layer' —* Mass shall not be more than 220 g/m'

 Change to not more than 270 g/m2

* + - 1. *Moisture barrier —* Mass shall not be more than 140 g/m'-

Change to not more than 150 g/m2

* + - 1. *Thermal layer —* Thermal layer may be a single layer or two layers quilted together and the mass shall not be more than 350 g/m

Change to not more than 380 g/m2

1. Kindly include contact Heat as per ISO 12127-1 at 250 degree C with a minimum threshold of 10 seconds for level 2 Garment
2. Heat transfer flame IS 15758 Part 1 change to an equivalent test to EN ISO 9151:2016 to obtain a X2 i.e level 2 result of HTI 24 ≥ 13 seconds and HTI 24-12 ≥ 4 seconds
3. Heat Transfer radiant exposure as per IS15758 Part 2 change to an equivalent test EN ISO 6942 at 40kw/m2 to obtain a Level 2 result RHTI ≥ 18 seconds and RHTI 24-12 ≥ 4 seconds
4. Spray rating test can be removed
5. Dimensional change to be changed to woven fabric ≤ 3% and for Knit fabric ≤ 5%
6. Water penetration to change current IS test standard to ≥ 20 kpa as per EN ISO 811
7. Kindly include that all test are to be performed in as received condition and after 5 washes
8. Practical Performance Test as per ANNEXURE B for checking Ergonomics to be included in the scope of the NABL accredited Lab and offer relevant test report regarding this to be issued by them

**B . IMPORTANT SUGGESTION for INCLUDING TYPE A and TYPE B Protective clothing** :

In order for the END USERS to choose a better performing Protective clothing for Fire Fighters Kindly Demarcate the Basic Protective clothing as TYPE A and Superior Protective clothing as Type B

The changes in the Type B Protective clothing to be

1. Multi layer assembly shall consist of
	* + 1. *Outer layer' —* Mass shall not be more than 250 g/m'
			2. *Moisture barrier —* Mass shall not be more than 140 g/m'-
			3. *Thermal layer —* Thermal layer may be a single layer or two layers quilted together and the mass shall not be more than 250 g/m
2. Tensile strength of Outer material when tested as per IS 1969 (Part 1) will give a breaking load in both machine and cross direction of ≥ 2000 Newtons
3. Tear strength of Outer material when tested as per IS 6489 (Part 2) will give a tear strength

in both machine and cross direction of ≥ 150 Newtons

1. Residual Strength of Outer material after exposure to radiant heat as per IS 1578 (part 2) Method A for 10kw/m2 and when tested as per IS 1969 (Part 1) will give a breaking load in both machine and cross direction of ≥ 1500 Newtons
2. Heat transfer flame IS 15758 Part 1 change to an equivalent test to EN ISO 9151:2016 to obtain a X2 i.e level 2 result of HTI 24 ≥ 15 seconds and HTI 24-12 ≥ 5 seconds
3. Heat Transfer radiant exposure as per IS15758 Part 2 change to an equivalent test EN ISO 6942 at 40kw/m2 to obtain a Level 2 result RHTI ≥ 20 seconds and RHTI 24-12 ≥ 6 seconds
4. Water Vapour resistance when tested in accordance with ISO 11092 shall have a maximum reading of 20 m2 Pa/w

**C. Changes proposed for inclusion of specific Fire Fighting suits in BIS licence as being safety item**

1. There are different types of Fabrics that are available in the Market that can be used in the manufacture of the Outershell and Moisture barrier and thermal liner.

The specific type of Fabric layer assembly i.e Outershell + Moisture barrier + Thermal Liner used in the manufacture of protective Clothing , which has been tested and for which license is sought must be captured in the License .

1. The Design of the Protective clothing for Fire Fighters can vary and can be different from one design to another.The Article number is associated with the Design of Protective clothing and hence in order to ensure that the Design which has been tested and for which license is sought it is essential to mention the Article number in the License.
2. The fabric layer assembly used in the manufacture as well the design of the protective clothing is represented by the Model name. Hence, it is essential to capture the Model name in the License.

Inclusion of the above vital information will enable the END USERS to get a clear picture of the Item being offered by that particular manufacturer .Most importantly , the License holder will have to use the same fabric layer assembly + Design + Model as declared in the License thereby preventing any kind of substitution and misuse.

 A similar approach is followed in the European standard EN 469:2020- Protective clothing for Fire Fighters. Please find attached a copy of our EU type examination certificate issued by the Notified Body capturing the above mentioned parameters of Fabric Layer assembly + Article Number (design related) + Model.

We look forward to your kind guidance on the above request

**Annex 10**

**(Item 7.1)**

**COMMENTS RECEIVED FROM M/S OCF ON DRAFT ECWC**

**TABLE FOR SCALE OF SAMPLING AND PERMISSIBLE NUMBER BASED ON 4% AQL IS : 2500-2000**

|  |  |
| --- | --- |
| **Lot Size in Sets.** | **Sampling Plan for** |
|  | Visual examination/ dimensional check at the time of sampling (L-1) | Sample size for detail check at Bulk QA stage (L-II) | Physical parameters (for laboratory tests) (S-4) | Chemical Parameters(for laboratory tests) (S-2) |
|  | Sample size | Acceptance No. | Sample size | Acceptance No. | Sample size | Acceptance No. |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Up to 280 | 13 | 1 | 32 | 13 | 1 | 5 | 0 |
| 280-500 | 20 | 2 | 50 | 13 | 1 | 5 | 0 |
| 501-1200 | 32 | 3 | 80 | 20 | 2 | 5 | 0 |
| 1201-3200 | 50 | 5 | 125 | 32 | 3 | 8 | 1 |
| 3201-10000 | 80 | 7 | 200 | 32 | 3 | 8 | 1 |

**Note:-** (i) The Sampling shall be done randomly as per IS: 4905,1968- Amd -1

(ii) Samples for lab testing will be drawn from the samples drawn and mentioned in Col No. 2 only.

(iii) Samples for chemical test (Col. No.7) shall be drawn out of Physical test samples (Col. No.5).

(iv) Total Acceptance No. mentioned in Col. No. 6 for physical Parameter is inclusive of Acceptance No. mentioned at Col. No.8 for Chemical Parameter

**13.0 CRITERIA FOR CONFORMITY**

**13.1** The lot shall be considered to be in conformity with the required standard of the samples drawn for lab test as above are found satisfactory and the lot is also found otherwise satisfactory in regard to visual parameters.

**14.0 TEST METHOD**

**14.1** The basic cloth and garniture used shall conform to the specification requirements when tested as per method laid down in the relevant specification as shown in Appendix 'A' and ‘B’.

**15.0 MARKING OF STORE**

**15.1** Each Wind Cheater, Insulating Layer 86 Waist Coat shall be stitched with marking label made of cloth taffeta synthetic white 7.0 cm × 2.5 cm in double layer on inside below the collar seam of back side in Insulating Layer, on white side of Wind Cheater at left portion from the inside of storm flap at top and on back of the neck

 **BS EN 342:2004**

 **EN 342:2004 (E)**

**Annex B**

**(informative)**

**Levels of performance**

The protective value of measured effective thermal insulation or resultant effective thermal insulation of a garment assembly is converted into combinations of ambient air temperature and activity level (metabolic heat production) (see Tables B.1 and B.2).

The levels in Table B.1 correspond to a standing wearer and in Table B.2 to a wearer moving and performing light or moderate activity. For each level a minimum temperature is calculated at which the body can be maintained at thermoneutral conditions indefinitely (8 h), and a lowest temperature at which a one hour exposure can be sustained with an acceptable rate of body cooling. Values are based on the conditions that air temperature is equal to mean radiant temperature, relative humidity is about 50 % and air velocity is between 0,3 and 0,5 m/s and a walking speed of about 1,0 m/s.

NOTE It is possible that an adequate level of whole body insulation is not sufficient to prevent the cooling of susceptible parts of the body (e.g. hands, feet, face) and the concomitant risk of cold injury. The protection of hands against cold is dealt with in EN 511.

**Table B.1 — Effective thermal insulation of clothing *I*cle and ambient temperature conditions for heat balance at different durations of exposure**

|  |  |
| --- | --- |
| **Insulation Icle m2 , K/W** | **Wearer standing activity 75 W/m2** |
|  | 8h | 1h |
| 0,310 | 11 | -2 |
| 0,390 | 7 | -10 |
| 0,470 | 3 | -17 |
| 0,540 | -3 | -25 |
| 0,620 | -7 | -32 |

**Table B.2 — Resultant effective thermal insulation of clothing Icle and ambient temperature conditions for heat balance at different activity levels and durations of exposure**

|  |  |
| --- | --- |
| **Insulation Icle m2 , K/W** | **Wearer moving activity** |
| **Light 115 W/m2** | **Medium 170 W/m2** |
| 8h | 1h | 8h | 1h |
| 0,310 | -1 | - 15 | - 19 | - 32 |
| 0,390 | -8 | - 25 | - 28 | - 45 |
| 0,470 | -15 | - 35 | - 38 | - 58 |
| 0,540 | -22 | - 44 | - 49 | - 70 |
| 0,620 | -29 | - 54 | - 60 | - 83 |

These temperature values are only valid with even distribution of the insulation on the body and with adequate hand-food-and headwear and an air velocity between 0,3 m/s and 0,5m/s.

Higher wind speeds will increase the temperature in Tables B.1 and B.2 because of wind chill effects (see ENV ISO 11079).

**6.0 DIMENSIONS 85 TOLERANCES AND WEIGHT OF ECWCS SET-**

**6.1** The Dimensions of ECWCS which are given below are as under & the tolerances applicable are of ± 4.0%.

**6.1.1** **Outer Layer: Thermal Condensation Jacket (White on Outer Side and Olive Green on Inner Side-Reversible)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Parameters** | **Small (cm)** | **Medium (cm)** | **Large (cm)** | **Extra Large (cm)** |
|  | Chest circumference 6.5 cm below armhole (A × 2) | A | 122.0 | 130.0 | 137.0 | 144.0 |
|  | Hem circumference at bottom (B × 2) | B | 117.0 | 124.5 | 132.0 | 140.0 |
|  | Front length from neck side top to bottom of hem | C | 78.0 | 78.0 | 80.0 | 82.0 |
|  | Front placket length | D | 84.5 | 84.5 | 86.0 | 88.0 |
|  | Sleeve length from shoulder | E | 66.0 | 67.5 | 69.0 | 71.0 |
|  | Sleeve circumference at armhole (F x 2) | F | 55.0 | 58.0 | 61.0 | 64.0 |
|  | Hood height diagonal | G | 36.0 | 37.0 | 38.5 | 39.5 |
|  | Back length at centre | H | 81.0 | 81.0 | 82.5 | 84.5 |
|  | Shoulder width | J | 51.0 | 54.0 | 57.0 | 60.0 |
|  | Back neck width | K | 24.0 | 25.5 | 26.5 | 27.5 |
|  | Inner detachable part bottom relaxed (L × 2) | L | 74.5 | 82.0 | 89.5 | 97.5 |
|  | Cuff relaxed (M × 2) | M | × 37.5 | 27.5 | 28.0 | 28.0 |

**6.1.2 Outer Layer : Thermal Condensation Trousers (White on Outer Side and Olive Green on Inner Side-Reversible)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Parameters** | **Small (cm)** | **Medium (cm)** | **Large (cm)** | **Extra Large (cm)** |
|  | Waist relaxed - circumference at waist line (A × 2) | A | 89.0 | 96.5 | 104.5 | 112.5 |
|  | Waist stretched- circumference at waist line (B × 2) | B | 101.5 | 109.0 | 117.0 | 125.0 |
|  | Thigh circumference 5 cm below crotch seam ( C × 2) | C | 71.2 | 75.0 | 78.7 | 82.5 |
|  | Seat-8 cm up from crotch-3 point measurement (D × 2) | D | 119.5 | 127.0 | 134.5 | 142.0 |
|  | Side leg seam from top of waist band | E | 113.0 | 118.0 | 122.0 | 123.0 |
|  | In side leg seam | F | 75.0 | 80.0 | 84.0 | 85.0 |
|  | Bottom hem circumference, Zip closed (G × 2) | G | 46.0 | 47.0 | 47.0 | 52.0 |
|  | Frontrise from top of waistband to crotch seam | H | 40.5 | 41.5 | 42.5 | 42.5 |
|  | Backrise from top of waistband to crotch seam | J | 52.0 | 53.0 | 54.0 | 54.0 |

**6.1.3 Middle Laver : Insulated Jacket (Olive Green on Outer Side and Green on Inner Side)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Parameters** | **Small (cm)** | **Medium (cm)** | **Large (cm)** | **Extra Large (cm)** |
|  | Chest circumference 6.5 cm below armhole (A × 2) | A | 122.0 | 127.0 | 132.0 | 137.0 |
|  | Hem circumference at bottom (B × 2) | B | 93.0 | 98.0 | 103.0 | 108.0 |
|  | Front placket length | C | 80.0 | 80.0 | 85.0 | 85.0 |
|  | Sleeve length from shoulder | D | 63.0 | 65.5 | 68.0 | 70.5 |
|  | Sleeve circumference at armhole (E × 2) | E | 53.5 | 56.0 | 58.5 | 61.0 |
|  | Cuff relaxed (F × 2) | F | 26.5 | 26.5 | 27.0 | 27.0 |
|  | Hood height diagonal | G | 35.5 | 36.0 | 37.5 | 38.0 |
|  | Back length at centre | H | 71.0 | 71.0 | 76.0 | 76.0 |
|  | Shoulder width | J | 50.5 | 52.5 | 54.5 | 56.5 |
|  | Back neck width | K | 23.0 | 24.0 | 25.0 | 26.0 |

**6.1.4 Middle Laver : Insulated Trousers (Olive qreen on Outer Side and Green on Inner Side)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Parameters** | **Small (cm)** | **Medium (cm)** | **Large (cm)** | **Extra Large (cm)** |
|  | Waist relaxed - circumference at waist line (A × 2) | A | 52.5 | 60.0 | 68.0 | 76.0 |
|  | Waist stretched- circumference at waist line (B × 2) | B | 104.5 | 112.0 | 120.0 | 128.0 |
|  | Thigh circumference 5 cm below crotch seam  | C | 33.5 | 36.0 | 37.0 | 39.0 |
|  | Seat-8 cm up from crotch-3 point measurement (D × 2) | D | 117.5 | 125.0 | 132.5 | 139.5 |
|  | Side leg seam from top of waist band | E | 110.0 | 115.0 | 119.0 | 120.0 |
|  | In side leg seam | F | 72.0 | 77.0 | 81.0 | 82.0.0 |
|  | Bottom hem circumference, Zip closed (G × 2) | G | 45.25 | 46.0 | 46.0 | 49.0 |
|  | Frontrise from top of waistband to crotch seam | H | 39.5 | 40.0 | 40.5 | 41.0 |
|  | Backrise from top of waistband to crotch seam | J | 49.0 | 50.0 | 51.0 | 52.0 |

**6.1.5 Inner Layer: Next to Skin Layer under Shirt Long John (Black)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl No** | **Parameters** | **Small****cm** | **Medium****cm** | **Large****cm** | **Extra large cm** |
| a) | Chest width 2.5 cm down from arm hole (A × 2) | A | 112.0 | 117.0 | 122.0 | 127.0 |
| b) | Bottom width (B × 2) | B | 102.0 | 107.0 | 112.0 | 117.0 |
| c) | Shoulder to neck point | C | 19.0 | 19.5 | 20.0 | 20.5 |
| d) | Shoulder (One edge to other) | D | 54.5 | 56.5 | 58.5 | 60.5 |
| e) | Back length at centre | E | 71.0 | 71.0 | 76.0 | 76.0 |
| f) | Sleeve from shoulder edge to cuff | F | 56.0 | 58.5 | 61.0 | 63.5 |
| g) | Width of cuff opening | G | 9.0 | 10.0 | 10.0 | 10.0 |
| h) | Collar circumference edge to edge | H | 43.5 | 46.0 | 48.0 | 50.5 |

**6.1.6 Inner Layer: Next to Skin Layer Trusers Long John (Black)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl No** | **Parameters** | **Small****cm** | **Medium****cm** | **Large****cm** | **Extra large cm** |
| 1 | Frontrise from top to waist band to crotch seam | A | 32.5 | 33.0 | 33.3 | 34.5 |
| 2 | Backrise from top to waist band to crotch seam | B | 38.0 | 39.0 | 40.5 | 42.0 |
| 3 | Out seam from top of waist band | C | 103.5 | 103.5 | 106.0 | 106.0 |
| 4 | Waist stretched – circumference at waist line (D × 2) | D | 77.5 | 82.5 | 87.5 | 92.5 |
| 5 | Waist relaxed – circumference at waist line (E × 2) | E | 61.0 | 66.0 | 71.0 | 76.0 |
| 6 | Width of leg cuff relaxed | F | 8.5 | 9.0 | 9.5 | 10.0 |

**6.3 Weight of ECWCS set (Refer Amendment No 1 dated 15 May 19 attached)**

6.3.1 The total weight of ECWCS complete set shall be as under;

|  |  |  |  |
| --- | --- | --- | --- |
| **Small** | **Medium** | **Large** | **Extra Large** |
| 4.5 ± 0.5 Kg |

**7.0** **WORKMANSHIP AND FINISH**

7.1 The general workmanship and finish shall be of high standard and similar to approved sample. The ECWCS shall be free from stitching defects like uneven stitching, puckering, gathering of threads, cuts and holes, streaky or patchy dying.

**Comments on Draft IS specification framed for** **Textiles – Protective Clothing: Extreme Cold**

**Weather Clothing System for - 50°C**

1. **Material [For all layers]**
2. Fabrics to be used in various layers of ECWCS have not been defined although parameters values are given in draft spec. It is suggested the fabrics are to be defined first so that as per properties of particular fabric/material, parameters may be decided and on the other hand easy availability of raw material may be ensured.
3. Insulation material also needs to be defined with requisite parameters.
4. Besides above, 100% polypropylene defined for inner most layer fabric is not technically fit due to its moisture regain 0.3% only & other properties. 100% polyester fabric with Anti-bacterial, Anti-Fungal and thermo-regulation properties may be defined as best alternatives fabric for inner most layer.

**B) Breaking strength at point no.6.8 [For Outer & Middle layer]**

1. Breaking strength mentioned in BIS draft specification of all layer fabrics is inclusive of warp & weft which is fundamentally wrong and breaking strength should be defined separately for warp & weft to select technically feasible fabrics. It will help the weaver to select the weave, no. of ends & no. of picks per decimeter.

**C) Tearing strength at point no.6.9 [For Outer & Middle layer]**

1. Tearing strength mentioned in BIS draft specification of all layer fabrics is inclusive of warp & weft which is fundamentally wrong and tearing strength should be defined separately for warp & weft to select technically feasible fabrics.
2. Mentioned tearing strength of outer layer inner shell fabric i.e. 75 N (min) (warp + weft) is not appropriate (higher side) and same should be redefined. It should be 15 N (Min) warp and 15 N (Min) weft.

**D) Water-vapour Resistance at point no.6.13 [For Inner & Outer layer]**

1. Water Vapour Resistance ret value i.e. 20 m² Pa/W (Max) for most inner layer fabric is higher side which will affect breathability of the fabric being body touch layer and user will not feel comfortable. It is suggested to define 6.0 m² Pa/W (Max) value fabric for most inner layer of the ECWCS.

Besides this, Water Vapour Resistance ret value i.e. 15 m² Pa/W (Max) for outer layer outer shell fabric is on lower side which should be redefined as 20 m² Pa/W (Max) being a coated & laminated fabric.

**E) Breathability at point no.6.4 - [For Inner layer]**

1. Given standard i.e. AATCC-20/20A shall not be applicable to measure moisture released from body since this standard is related to fibre analysis/identification.

**F) Absorbency at point no.6.5 - [For Inner layer]**

1. Given value of 3 sec max for inner layer fabric should be reviewed and it should be defined as per the particular fabric to be used.

**G)** **Wicking power at point no.6.6 - [For Inner layer]**

10. Given value of 3 sec max for inner layer fabric should be reviewed and it should be defined as per the particular fabric to be used.

**H)** **Bursting Strength - [For Inner layer]**

11. Bursting Strength value has not been defined and it should be 550 kN/m² (minimum).

**I) Hydrostatic Penetration Resistance at point no.6.12 [For Outer & Middle layer]**

1. Given value of 1.0 bar (min) for outer layer- outer shell, inner shell and middle layer- outer shell are higher side and it may be defined as 0.5 bar (min) to make it technically achievable. [report enclosed – Annexure A]

**J) Seam Sealing property –**

1. Seam sealing material /tape to be used needs to be specified for uniformity.

**K)** **Shrinkage Resistance at point no.6.11** -

1. The outer layer- outer shell, inner shell and middle layer- outer shell shrinkage resistance should be defined as ± 2.5% (max) in place of ± 2.0% (max) to make it technically feasible and more viable to select the appropriate fabric.

**L)** **Wearability Requirements w.r.t Ergonomic aspect at point no.6.3** –

1. Wearability Requirements parameters (determination baseline values of metabolic rate, respiratory rate, breathing capacity, core temperature, dehydration and heart rate in order to evaluate wearability and ergonomic suitability of different layers of ECWCS) are required to be discussed since testing of these parameters in India is not commercially viable and it is also necessary to frame a comprehensive specification for manufacturing technically & commercially feasible ECWCS.

**M)** **Restriction of Movement at point no. 4.2.2** –

1. This parameter is also required to be discussed since it is very subjective and varies from person to person and this can be covered in subjective requirement of field trial.

**N)** **Thermal insulation at point no. 6.3** -

1. Thermal Insulation Value (TIV) of the complete system should be defined in line with BS EN 342:2004 to specify effective thermal insulation value for a time period with different levels of wearer activity. [BS EN 342:2004 copy enclosed – annexure B attached]

**O) Weight of complete system at point no. 4.2.8** -

1. In light of various materials to be used, the weight of complete system should be defined.

**P)** **Size Designations at point no. 4.3** -

1. The sizes are given only in small, medium & large sizes which define only Height and Half chest girth. The mentioned Half chest girth are lower side (tight) in comparison to other DGOS specifications and against the principle of loose fitting of multi-layer clothing. The principle of loose fitting of multi-layer clothing will also limit the requirement of parameter restriction of movement. [reference document annexure – C attached]

**Q)** **Sample And Conformity Criteria at ANNX.3** -

1. Mentioned sampling plan with AQL of 0% is not comprehensive. For this parameter sampling plan with 4% AQL may be followed for to make it broad as samples for lab test if required has been defined in 4% AQL sampling plan along with acceptance number for bigger lot size. [reference document annexure – D attached]

V. Mathivanan. IOFS.,

 General Manager

Ordnance Clothing Factory, Shahjahanpur

Member Technical Committee

**Date of sample receiving: 06.02.2018**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl No.** | **Test parameter** | **Test method** | **Unit** | **Test Results Sample Code: 4476** |
| 1 | Water Vapour Resistance, Ref | ISO 11092 : 1993 | m 2 pa/ W | 21.0067 |
| 2 | Resistance to surface wetting (spray test)- Initial-After 05 wash cycles⃰ | ISO 4920-2012 | Rating | ISO 5ISO 2 |
| 3 | Resistance to Water penetration: Hydrostatic | ISO 811 : 1981(dynamic test mode) Test Area: 100 cm2  Water pressure below the test specimen, Rate of rise : 60 cm H2O/ minutes | cm/ H2O | Penetration occure:542 |

**Annex 12**

**(Item 9.1)**

**TERMS OF REFERENCE FOR FIRE HOODS FOR FIREFIGHTER**

**1. Title of the Project:** Collection of technical and design-related data based on test results for framing requirements for ‘Fire Hoods for firefighter’.

**2.** **Background**

**Sectional Committee**: Textiles Protective Clothing  Sectional Committee, TXD 32

1. Firefighters play a crucial role in our society, not only rescuing lives during fire accidents but also preventing property damage from hazardous fires. This life-threatening occupation demands intensive physical work in hazardous environments. To enhance firefighting effectiveness and save lives, providing appropriate Personal Protective Equipment (PPE) is essential. Firefighter PPE includes jackets, trousers, fire helmets, fire hoods, face protection, goggles, gloves, and boots. The fire hood, a vital protective gear, is typically made from inherently heat- and flame-resistant materials, offering thermal protection for the head and neck region.
2. TXD 32 Textiles Protective Clothing Sectional Committee has taken up the new work item on firehoods for firefighters. Considering the importance of firehoods for firefighters in ensuring the safety of firefighters in life threatening situations, and with the aim to mitigate the risk of life due to fire induced accidents, TXD 32 sectional committee has decided to undertake a research and development project on firehoods for firefighters so that the requirements for the standard may be developed not only based on secondary information but also on primary test data.

**3.** **Objectives**

The objective of the project is This project aims to identify the technical and design requirements of firehoods for firefighters.

**4. Scope**

1. The scope of this project covers extensive study of the existing literature, research papers and/or any other published information on firehoods for firefighters.
2. It also covers identification of the existing testing and manufacturing infrastructure and assessing the number of small, medium, and large-scale industry of firehoods for firefighters. The scope also encompasses gathering data on the export and import of firehoods for firefighters, including information on foreign manufacturers, if applicable. It also covers the identification of users for firehoods for firefighters along with the national and international regulations on firehoods for firefighters, if any.
3. It also covers visiting of one manufacturing facility (each for small, medium and large whichever is available in the country), one user organization and one testing lab to gather information regarding the manufacturing processes, testing procedures and challenges faced by them.
4. It also covers collections of samples and generation of test data for important requirements of firehoods for firefighters like fire spread, heat transfer due to flame, heat transfer due to radiant heat, Heat Resistance, residual bursting strength, seam burst strength, dimensional change due to heat and washing, tensile strength, tear strength, shape retention, Liquid-chemical Penetration Resistance, Water-vapour Resistance, Cleaning-shrinkage Resistance, and Surface Wetting. The information regarding the packaging practices, test methods for the requirements mentioned above and sampling procedure shall also be collected during the visit.

**6.** **Research Methodology**:

1. Collect the secondary data by the survey of available literature, research papers, magazines international standards etc. on Fire Hoods for firefighters, along with the information available with any other source.
2. Identification of the existing testing and manufacturing infrastructure and assessing the number of small, medium, and large-scale industry of firehoods for firefighters. The scope also encompasses gathering data on the export and import of firehoods for firefighters, including information on foreign manufacturers, if applicable. It also covers the identification of users for firehoods for firefighters along with the national and international regulations on firehoods for firefighters, if any.
3. Visiting one manufacturing facility (each for small, medium and large whichever is available in the country), one user organization and one testing lab to gather information regarding the manufacturing processes, testing procedures and challenges faced by them.
4. To collect 6 samples from 3 manufacturers/suppliers (2 from each small, medium and large manufacturer/supplier, whichever is available) and get them tested from 2 NABL accredited Labs for the requirements of fire spread, heat transfer due to flame, heat transfer due to radiant heat, Heat Resistance, residual bursting strength, seam burst strength, dimensional change due to heat and washing, tensile strength, tear strength, shape retention, Liquid-chemical Penetration Resistance, Water-vapour Resistance, Cleaning-shrinkage Resistance, and Surface Wetting. The design of the Fire Hood will also be decided considering all safety aspects. These results are to be tabulated and examined to determine the final values.
5. Prepare the final R&D report to be submitted to the technical committee.

**5.** **Expected Deliverables**

1. Report on the complete data for the requirements of fire spread, heat transfer due to flame, heat transfer due to radiant heat, Heat Resistance, residual bursting strength, seam burst strength, dimensional change due to heat and washing, tensile strength, tear strength, shape retention, Liquid-chemical Penetration Resistance, Water-vapour Resistance, Cleaning-shrinkage Resistance, and Surface Wettingafter getting the samples tested from 2 NABL accredited labs.
2. A report on the detailed summary of all the discussions with the manufacturers, laboratory, and users taken place during the visit. To deliver the detailed summary of all the export and import data, data on the number of manufacturers, user and laboratories, challenges faced by them and the national and international regulations on firehoods for firefighter.
3. The detailed summary of packaging practices of firehoods for firefighter along with sampling plan for lot testing and detailed test methods for testing the above mentioned requirements of the firehoods for firefighter.

**7.** **Requirement for the CVs:**

The person shall be graduate in Textile Engineering/ Technology with a minimum work experience of 5 years in the field of testing or manufacturing/production of firehoods for firefighters in technical and/or managerial position.

**8.** **Timeline and Method of Progress Review:**

|  |  |
| --- | --- |
| **No. of Days (Timeline)** | **Status of work to be done** |
| 0 to 20 | * Literature review and collecting of books/magazines/ national and international standards to generate secondary data to fulfill the requirements of the project.
* Identifying suitable industries involved in manufacturing Fire Hoods and collecting samples of fire Hoods.
 |
| 21 to 50 | * Visiting the industry involved in the manufacturing of Fire Hoods to collect information on sampling and packaging of Fire Hoods.
 |
| 51 to 99 | * Testing of various samples in at two NABL-accredited laboratories and compiling the results.
 |
| 100 to 120 | * Submission of the final report of the project.
 |

**9.** **Support required from BIS:**

All the relevant Indian Standards and international standards required during the project will be provided by BIS.

**Annex 13**

**(Item 9.1)**

**R&D GUIDELINES**

**STANDARDS COORDINATION AND MONITORING DEPARTMENT**

**Our Ref** SCMD/G-4 09-09-2023

**Subject:** Guidelines for Research & Development Projects for Formulation and Review of Standards

The revised ‘**Guidelines for Research & Development Projects for Formulation and Review of Standards**’ duly approved by EC is circulated to all Technical Departments for compliance.

The ‘**Template for the Terms of Reference for the R&D Projects**’ to be used in this regard is also attached.

DDG (IR, SCM & MSC)

Circulated to All Technical Departments

(A K Bera) HSCMD

**Doc no. SCMD/R&D Guidelines/20230909**

**GUIDELINES FOR RESEARCH & DEVELOPMENT PROJECTS FOR FORMULATION AND REVIEW OF STANDARDS**

**1 INTRODUCTION**

Bureau of Indian Standards (BIS), as the National Standards Body of India is responsible for formulating Indian Standards for products, processes and services. In the pursuit of this endeavour, it has so far developed more than 22000 Indian Standards. Action Research and Research & Development Projects have always been part of the standardization process. However, there has been a growing realisation in the context of the increasing diversification, innovation and complexities in the manufacturing sector and evolution of services and also due to the fast pace of changes in the manufacturing and services landscapes, research & development projects have to be made an integral part of the standardization process. The idea is that in principle no standard should be developed without intensive and insightful research work, which is not confined only to the review of the existing literature and focus group discussions on the subject chosen for standardization, but also covers the detailed field level study of the existing processes and practices in product manufacturing and service delivery. This requires a large network of domain area experts to carry out the research & development work. The existing network encompasses only a small segment of experts, who are either associated with technical committees as members or belong to some R&D organizations. The Memorandum of Understanding with the premier educational institutions imparting technical and professional education opens the window to the opportunities to expand this network substantially by utilizing the intellectual capital that resides with the faculty and the research scholars in these institutions. This association is conceived not only as a way to promote research & development work necessary for standards formulation but also to enrich the research ecosystem in these educational institutions.

**2 OBJECTIVES**

Objectives of this Scheme are to:

**2.1** support and commission research & development projects to generate knowledge, empirical data and insights that would help in formulating new standards and updating & upgrading the existing Indian standards;

**2.2** expand the network of domain area experts to carryout research & development projects in the areas related to standardization and conformity assessment; and

**2.3** enrich the research ecosystem in the educational institutions imparting technical and professional education.

**3 RESEARCH & DEVELOPMENT PROJECTS**

**3.1** Research & development projects under these guidelines are described as follows:

A project aimed at comprehensive, in depth and incisive study of a product, process or service or all taken together in respect of a subject under standardization, encompassing literature review, analysis of the data from secondary sources, collection and analysis of data from primary sources and stakeholder consultations.

**3.2** The duration of a project shall not exceed six months counted from the date of the award of the project to acceptance of the final report by the Sectional Committee concerned, provided that the Sectional Committee must not take more than one month to give its decision on the final report. Further provided that the time taken by the Sectional Committee for giving its decision shall not be counted. The Sectional Committee may extend the duration but for not more than 2 months in special circumstances, the reasons for which shall be recorded in the minutes of meeting of the Sectional Committee.

**3.3** The upper limit for expenditure for a project shall be Rs 10 lakhs (including taxes) only.

**3.4** BIS will publish a list of research & development projects along with Terms of Reference (ToR) on Standardization portal or any other suitable digital platform.

**3.5** If any organization or an expert on behalf of an institute wants to propose a research & development project on any new and emerging area in which they have expertise, they can do so through the same platform for the consideration of the Sectional Committee.

**4 TERMS OF REFERENCE (ToR)**

**4.1** The ToR of Research& development project shall be prepared by the Sectional Committee concerned, and shall contain:

a) Title, background and objectives of the study;

b) Expected research methodology (brief information, for example, survey, testing, industry visits, etc.);

c) Scope of study;

d) Outline of the tasks and final deliverables expected from the Proposers;

e) Methods of review, schedule for submitting the 1st draft report and project completion report;

f) Any support or inputs to be provided to the Proposer; and

g) Maximum duration of project and timelines for submission of proposal.

**4.2** While preparing the Terms of Reference (ToR) the sectional committee may consider the following points as a research & development project may include one or mix of the following:

a) Secondary research based on internet or published information including authentic data sources;

b) Survey based research (including industry visits) to ascertain prevailing market conditions and practices, standards in use, industry and consumer preferences, availability of infrastructure, technical capabilities, comparative trends, economic trends;

c) Ascertaining compliance to existing and proposed standards through testing, review of past test reports, other validation and verification checks; and

d) Basic and innovative research to establish normative criteria. Criteria may include performance, health, safety, environmental impact.

**5 APPROVAL OF COMISSIONING OF THE RESEARCH AND DEVELOPMENT PROJECTS**

**5.1** There shall be a Review Committee for approving the projects recommended by the Sectional Committee. The composition of Review Committee shall be as follows:

DDG (SCMD) : Chairperson

DDG (Standardization) concerned : Member

DDG (Certification) : Member

DDG (Labs) : Member

Officer in-charge for research works in SCMD : Member Secretary

**5.2** The Head of Technical Department concerned and Member Secretary of the Sectional Committee shall apprise the review committee about the project and explain the rationale behind the proposed research & development project.

**6 ELIGIBILITY CRITERIA**

**6.1** The following shall be eligible for carrying out research & development projects under the Scheme:

a) Academic institutions & universities having MoU with BIS and faculties and research scholars thereof;

b) Member(s) of Technical Committees of BIS.

**6.2** Faculties and research scholars shall submit proposals through their institute. Members of technical committees belonging to any association/organization shall submit the proposals through their association/organization. Members of technical committees in personal capacity can submit their proposals directly to BIS, however if carrying out a research & development project requires collaboration with any institution/organization, concurrence of the same shall also be submitted.

**7 PROCEDURE FOR APPLICATION**

**7.1** Submission of Proposal

**7.1.1** Applications for undertaking research & development projects shall be submitted in the manner prescribed by the Bureau and within the prescribed timelines,

**7.1.2** Proposer(s) shall submit their proposal in a “single stage - two envelope bid system” consisting of separately sealed “Technical and Financial proposals”. The Technical Proposal shall be submitted as per format prescribed in Annex A and the Financial Proposal shall be submitted in the format prescribed as per Annex B, clearly specifying expected expenditure against each element such as manpower, equipment (shall not include computer hardware and software), travelling, testing, consumables, stationery, overheads, etc.

**7.1.3** There shall be maximum one proposal from one institute on a given subject.

**7.1.4** No contractual obligation whatsoever shall arise until a formal agreement is signed and executed between the Bureau and the Proposer.

**7.2** The proposals shall inter-alia consist of the following:

**7.2.1** In respect of the research & development projects put up by the Bureau:

a) Details of the Project team along with the organization/institution associated with;

b) The CV of the Project leader and expert/expert(s) to be associated with the project and a letter from organization authorizing Project Leader and expert/expert(s) to undertake the research as proposed.

c) A write up on the understanding of the scope and objectives of the project.

d) Methodology (sampling size, if applicable) to be adopted for the proposed study with a clear road map and time plan for completion of the project;

e) Stage wise timelines for completion of the project.

**7.2.2** In respect of research & development projects proposed by any expert/organization:

a) Details of the Project team along with the organization/institution associated with;

b) The CV of the Project leader and expert/expert(s) to be associated with the projects and a letter from organization authorizing Project Leader and expert/expert(s) to undertake the study as proposed.

c) Objective that will be achieved and scope of the project clearly highlighting the need of such study and what would be the final deliverable;

d) Methodology (sampling size if applicable) to be adopted for the proposed study with a clear road map and time plan for completion of the project;

e) Details of infrastructure facilities available for the project, in the institution and additional facilities required (if any) for carrying out research.

f) Stage wise timelines for the completion of the project

**7.3** The Head of the concerned institution while forwarding the application and nominating the project leader shall certify that:

a) the core facilities (land, buildings, laboratory, manpower and other infrastructure etc.) are available and will be provided to the Project Leader to work on the proposed project,

b) the organization will discharge all its obligations, particularly in respect of management of the financial assistance given, and

c) no other funding is being received/sought for the project proposed to be sanctioned by BIS.

**8 PROCEDURE FOR APPROVAL WITHIN BIS**

**8.1** There shall be a Research Evaluation Committee (REC) to evaluate the proposals received, the composition of which shall be as follows:

DDG (PRT) : Chairperson

Head (CMD) concerned : Member

Head (LPPD) : Member

Head of the Technical Department concerned : Member Director Finance : Member

Two Experts from the Sectional : Members Committee concerned

Head (SCMD) : Member Secretary

\*The experts shall be nominated by the Sectional Committee and the nominated members shall give a declaration to the effect that there is no conflict of interest with respect to the project.

**8.2** The evaluation and selection will be as per Quality and Cost Based Selection (QCBS) method (Rule 192, GFR 2017) which is explained in Annex C.

**8.3** The criteria for evaluation of technical proposal shall be as under:

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl****No.** | **Criteria** | **Max.****Marks** | **Score by****REC** |
| 1 | Profile of key individual/individuals to be associated with theresearch project | **10** |  |
| 2 | Experience of the individual/organisation in conductingresearch projects in the relevant discipline | **20** |  |
| 3 | Understanding of Scope, Objectives and deliverables | **15** |  |
| 4 | Methodology | **30** |  |
| 5 | Work plan/Execution strategy | **15** |  |
| 6 | Chapterisation, contents and lay out of the proposed report | **10** |  |
| **TOTAL** | **100** |  |

Note: REC may call for a presentation by the proposers if deemed necessary.

**8.4** The minimum qualifying marks shall be 70. All the proposals with marks below 70 shall be considered rejected.

**8.5** REC may refer back, advise changes for reconsideration or reject any proposal.

**8.6** REC shall open the financial proposals (bids) within 7 days from completion of technical evaluation.

**8.7** A final score sheet of all the proposers shall be made as detailed in Annex C and the proposer getting the highest combined score shall be selected for awarding the project.

**8.8** The member secretary (REC) shall send the selected proposals to DG/DDG Standardization concerned, as per their delegated powers, for consideration and approval for sanction of the project.

**8.9** After the approval of project, the member secretary (REC) shall inform the concerned technical department and the proposer regarding the decision.

**8.10** After the sanction of fund is approved, the draft agreement (prepared in line with model agreement given at Annex D, to be modified on case-to-case basis) shall also be prepared by the Member Secretary (Sectional Committee), clearly highlighting the payment term. The Head (Technical Department) shall sign the agreement on behalf of BIS in all cases.

**8.11** In case the proposer to whom the project is awarded declines to take up the project, the Research project shall be awarded to the proposer getting the next highest combined score among the qualified proposers.

**9 SIGNING OF AGREEMENT AND ISSUING OF SANCTION LETTER**

**9.1** After receipt of duly signed agreement from the proposer and after the receipt of the approval of competent authority, a sanction letter shall be issued by the concerned Head (Technical Department) to the organization/individual member. The project would be considered to have commenced from the date the sanction letter is issued.

**10 FUNDING**

**10.1** The mode of payment for Research & development projects shall be as follows:

a) First instalment up to a maximum of 30 percent of the total approved project cost would be released after approval of the project.

b) Second instalment to the extent of 50 percent of the approved estimated cost would be released on the submission of progress report along with the report on utilization of the 75 percent of the fund and acceptance of the same by the Sectional Committee.

c) The balance amount shall be released after submission of the final project report along with utilization certificate for the fund released and its acceptance by the Sectional Committee.

**10.2** Release of each instalment is subject to satisfactory progress, required stage - wise deliverables and submission of the Utilization Certificate (UC) as per Form GFR12-A of GFR 2017 along with the statement of expenditure (SoE) issued by the Competent Authority.

**11 PROGRESS REPORT AND MONITORING OF PROJECT**

**11.1** The relevant Sectional Committees of BIS will monitor the progress of project to ensure that the project is progressing as per the planned arrangement. However, member secretary of the concerned Sectional Committee under overall coordination of HoD would be the controlling/link officer for Research & Development projects and would constantly monitor the progress of the project every 30-45 days. Any delay in implementation of project should be duly justified by the Project leader and shall be put up to Research Evaluation Committee (REC) for approval.

**11.2** The Sectional Committee shall review and give its acceptance of the progress reports submitted, within 3 weeks.

**12 SUBMISSION OF FINAL PROJECT REPORT (FPR)**

**12.1** The FPR must be detailed and should include information about:

a) the original objective(s) of the project,

b) how far these objective(s) have been achieved, and

c) how the results will benefit the development of the national standard(s) and

d) a copy of final working draft of the concerned standard(s) (wherever applicable)

e) include clear inferences, recommendations regarding their use in the proposed standards,

f) all references used, raw data of surveys, sampling, testing and experiments,

g) undertaking that all the information presented is authentic.

**12.2** FPR received in BIS would be put up to the concerned Sectional Committee, which will take necessary action for preparation/revision of standard appropriately. The Project leader shall assist in the disposal of comments received on the research project, draft standard and for the preparation of the finalized draft, as may be desired by the Sectional Committee.

**12.3** The proposer shall submit the Project Completion Report (PCR), within one month of completion of project along with the Utilization Certificate of the fund released as per Form GFR 12-A of GFR 2017 and the statement of expenditure (issued by the Competent Authority -in case of Govt. organization / Charted Accountant in case of private organization).

**13 RESULTS OF RESEARCH & DEVELOPMENT**

**13.1** Project Leader(s) would be encouraged to publish the results of research & development. While doing so, acknowledgement to the effect that financial assistance was received from BIS should be made in the research paper(s) published. BIS should be acknowledged in similar type of other published work/press reports.

**13.2** One re-print of each research paper(s) published as a result of the work done under the BIS funds shall be sent to BIS as and when published.

**14 INTELLECTUAL PROPERTY RIGHTS**

**14.1** Ownership of any intellectual property, including but not limited to confidential information, know-how, patents, copyrights, design rights, rights relating to computer software, and any other industrial or intellectual property rights, developed solely by Proposer shall be vested with that Party.

**14.2** Ownership of any intellectual property, including but not limited to confidential information, know-how, patents, copyrights, design rights, rights relating to computer software, and any other industrial or intellectual property rights, developed solely by the Bureau shall be vested with that Party.

**14.3** The Intellectual Property arising out as an outcome of research project undertaken under these guidelines shall be vested with Bureau.

**15 OPERATION OF FUNDS**

**15.1** The utilization certificate of the funds received in previous instalment (if any) to BIS should be annexed with the Statement of all equipment, books, etc purchased out of the funds certified by the Head of the organization. The name, description of the equipment, cost in rupees, date of purchase, and the name of the supplier to be given in the list. The main purpose/function of the equipment may also be mentioned against each item.

**15.2** Any unspent balance lying with the organization should be refunded to BIS after the finalization of the draft immediately, by means of demand draft or online transfer.

**15.3** The Head of the concerned standardization department of BIS shall ensure that the project leader submits the utilization certificate in the manner prescribed in Form GFR 12-A of GFR 2017.

**15.4** Head of the Standardization department shall also ensure that the operation of funds is monitored strictly as specified in Annex E. Further the Project Leader is also fully aware and shall adhere to the obligations of his/her as given in this procedure.

**16 OTHER REQUIREMENTS**

**16.1** Organizations receiving financial assistance for research & development projects from BIS would have to maintain separate accounts for each research project.

**16.2** In the event of a Project Leader’s absence from his normal place of duty for two months at a stretch, the Head of the organization would need to immediately nominate an Alternate Project Leader(s) to supervise the implementation of the project and such a name has to be approved in advance by BIS. In any event, a Project Leader shall give prior notice to BIS of his intention to stay away from the project.

**16.3** Items of equipment, etc should be purchased on the basis of the established rules and procedures of the entity/organization.

**16.4** Stock register of all equipment, books, etc purchased out of the funds shall be maintained.

**16.5** Any capital-intensive equipment/devices purchased using financial assistance from BIS for research & development projects shall be allowed to be retained by the proposer for their research activity etc.

**16.6** The organization shall have to ensure that expenditure with respect to TA/DA are made only as per their own norms but under no circumstances the executive/business class air travel or stay in a five-star hotel is made. The overhead expenses should not be more than 20 percent of the cost of the project.

**16.7** The Project Leader must ensure that the concerned organization’s newsletter would carry information on the activities and accomplishments of the various projects funded by the BIS.

**17 TERMINATION OF PROJECT:**

The research & development project can be terminated in case of any of the following:

a) the approval of research & development project may be treated as withdrawn, if the sanctioned research & development project does not commence within one month from the date of receipt of the sanction letter, unless otherwise authorized by BIS;

b) A Proposer may request for the withdrawal of a research & development project even after commencement of the project. In such case the entire fund given till that date shall be refunded to the Bureau; and

c) if the Proposer fails to submit Progress report/Completed Project report within the prescribed timelines.

The REC shall take decision on all cases of termination.

**18 RESOLUTION OF DISPUTES**

Dispute Resolution: In case of any dispute that cannot be resolved amicably, it shall be referred to Sole Arbitrator appointed by the Director General of the Bureau of Indian standards, whose decision shall be final and binding upon both the parties. The provisions of the Arbitration and Conciliation Act, 1996, as amended from time to time, shall be applicable.

**ANNEX A**

**TECHNICAL PROPOSAL**

|  |  |
| --- | --- |
| 1. Name of the Proposer and Organization |  |
| 2. Project title |  |

3. Project leader

|  |  |
| --- | --- |
| 1. Title: Prof/Dr/Mr/Ms
2. Name:
 | Sex  M/F |
| c) Full official address |  |
| Mobile/TelephoneFax E-mail |  |
| d) Designation |  |
| e) Date of birth |  |
| f) Academic qualifications along with year of completion |  |
| g) Experience |  |

4. Other members of the research team (give name, address, experience and academic qualifications for each member)

|  |  |
| --- | --- |
| 1. Name | Designation: Address: Experience:Academic Qualifications: |
| 1. Name | Designation: Address: Experience:Academic Qualifications: |

5. Research support availed/being availed/applied for by the Project leader from different sources, including BIS, during the last 5 years:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Funding agency | Title of the project andreference number | Duration (from mm/yyyy tomm/yyyy) | Percentage of time devoted/being devoted/to be devoted, in man months | Amount in lakh Rs. |
|  |  |  |  |  |

6. Details of facilities available with the institute/organization w.r.t. the research & development project

|  |  |
| --- | --- |
| Facilities | Relevance to project |
| 1. |  |

7. Aims and significance of the project

(Include the current status of work in area, both in India and abroad, with appropriate reference list at the end; identify lacunae, define question to be investigated; list briefly specific objectives of investigation. ethical clearance be enclosed where necessary).

8. The CV of the Project leader and expert/expert(s) to be associated with the projects and a letter from organization authorizing Project leader and expert/expert(s) to undertake the study as proposed.

9. Objective that will be achieved and scope of the project clearly highlighting the need of such study and what would be the final deliverable.

10. Methodology (sampling size if applicable) to be adopted for the proposed study.

11. Road map (Stage wise timelines for the completion of the project) and time table for completion of the project

12. Plan of work, methods and techniques to be used.

13. List of awards and honours conferred on the Project leader with dates.

14. Deliverables

15. Declaration and attestation:

|  |  |
| --- | --- |
| I certify that all the details declared here are correct and complete.Signature of Project leader | Date: |

16. Certificate of the institution:

|  |
| --- |
| This is to certify that1. we have read the terms and conditions of the BIS Research & Development Guidelines necessary for the compliance of the same.
2. the necessary institutional facilities are available and will be provided for the implementation of this research proposal being submitted to the BIS for funding.
3. Full account of expenditure will be rendered by the institution.
 |
| Name of the head: of the institutionSignature with date: Seal: |

**ANNEX B**

**FINANCIAL PROPOSAL FORMAT**

[To be submitted on letterhead wherever applicable]

To:

Bureau of Indian Standards

Manak Bhavan, 9 Bahadur Shah Zafar Marg

New Delhi – 110002, India

Sub: Financial Proposal for Research & development Project on (Title: ) for Bureau of Indian Standards (Research guidelines document no. dated 2023).

Dear Sir,

We are pleased to submit our Financial Proposal for Research & Development Project on (Title:

 ) for Bureau of Indian Standards as per the terms and conditions of the Research & Development guidelines document (Ref No.: dated: - -2023).

1. We hereby declare that our financial proposal is unconditional in all respects.
2. Our financial proposal is as follows:

Cost of the Project:

|  |  |  |
| --- | --- | --- |
| Sl no. | Budget items | Amount |
| 1 | Manpower cost |  |
| 2 | Consumables[Chemicals, samples, testing glassware, stationery, books etc, information search (from databases)] |  |
| 3 | Equipment |  |
| 4 | Travel |  |
| 5 | Any other/Overhead expenses |  |
|  | Total project cost |  |

\*Please write NA in case any item is not applicable

a) The prices should be quoted in Indian Rupees above by the proposer.

b) The quoted price should be inclusive of all applicable taxes and charges.

c) Fund shall be released after deducting TDS as per applicable provisions of GST and income tax.

d) Justification of cost (for each item of equipment, consumables and travel. Quotation(s) for equipment should also be enclosed).

Yours faithfully,

Date: (Signature of the Project leader)

Place: (Name and Designation of the proposer)

Name and Signature of the head of the institution

(Rubber seal of the proposer/institution/organization, as applicable)

**ANNEX C**

Stage 1: Evaluation of Technical Proposal:

**a)** The proposal will be evaluated against the criteria defined at clause 8 in these Guidelines. The proposer may be required to provide additional details as deemed necessary by the REC.

**b)** Upon technical evaluation of each proposal, “Technical marks” out of 100 marks will be assigned to every proposal.

**c)** The proposals with score 70 or more marks in technical evaluation, will qualify for the evaluation of the financial proposal.

**d)** The proposer with the highest marks in technical proposal will be awarded 100 “Technical Score” and subsequently other proposers will also be awarded “Technical Score” relative to the highest technical marks for the final composite score calculation purpose e.g., if the highest technical marks is 90 then “Technical Score” is (90/90) × 100 = 100, hence the proposer with highest technical marks will score 100 “Technical Score”. Similarly, another proposer who scored 80 marks, will get (80/90) × 100 = 88.88 “Technical Score”. Following formula will be used for the “Technical Score” (TS) calculation:

Technical Score (TS) = $\frac{Proposer’s Technical Marks }{Highest Technical Marks}$ × 100

e) The details of technical evaluation parameters are provided at clause 9.

Stage-2 Evaluation of Financial Proposal

a) The evaluation will be carried out if financial proposals are complete and computationally correct.

b) Upon financial evaluation of each proposal, the lowest financial proposal will be awarded 100 “Financial score”. The “Financial Score” of other proposer(s) will be computed by measuring the financial proposal against the lowest financial proposal. Following formula will be used for calculating “Financial Score”:

Financial Score (FS) = $\frac{Lowest Financial proposal }{Proposer’s Financial Proposal} ×100$

Stage-3 Computation of Combined Score

The “Combines Score” is a weighted average of the Technical and Financial Scores. The ratio of Technical and Financial Scores is 70:30 respectively. The Combined Score will be derived using the following formula:

Combined Score = [(TS × 0.70) + (FS × 0.30)]

The responsive proposers(s) will be ranked in descending order according to the Combined Score, which is calculated based on the above formula. The highest-ranking proposer asper the Combined Score will be selected for award of Research Project.

**ANNEX D**

**MODEL AGREEMENT**

(To be modified on case-to-case basis)

This Deed of Agreement made this day of (Month & Year) between Bureau of Indian Standards having Head Office at Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi – 110 002 (hereinafter called ‘BIS’, which expression shall, wherever the context so admits, includes its successors and assigns) on one part and (name of the organization/expert) (hereinafter called which expression shall, wherever the context so admits, include their heirs, executors, administrators, legal representative and assigns) of the other part, witness as follows:

1. Whereas (name of the organization/expert) through (name of the Project Leader) has submitted a proposal to BIS pertaining to Research & development project titled for consideration and BIS has accepted the proposal.

2. That duration of the Research & development project shall be months with periodic and final reviews. The total cost of the project shall be Rs /- (Rupees in words) for the complete project. No further expenditure shall be borne by BIS on any account of this project including escalation of time.

3. The fund would be utilised for the specific project/assignment as approved by BIS and shall be spent within the specified time. Any portion of the fund which is ultimately not required for expenditure for the approved purpose shall be duly surrendered to BIS.

4. (Name of the organization/expert) shall not entrust the implementation of the project/assignment approved by BIS for which fund has been received to any other institution/expert or to divert the fund received from BIS as assistance to any other institution/expert/proposer.

5. (Name of the organization/expert) indemnifies BIS from any legal and/or financial encumbrance arising out of any infringement of IPR/licensing of IPR/technology transfer/commercialization.

6. (Name of the organization/expert) shall maintain an audited record in the form of a register for permanent, semi-permanent assets acquired solely or mainly out of BIS fund. Once the Research & development project is completed satisfactorily, the organization taking up the Research project may retain the equipment/devices for their Research & development activities, etc. The equipment procured through BIS fund should bear a label "BIS Funded".

7. BIS shall release the funds for the project as follows:

a) First instalment up to a maximum of 30 percent of the total approved project cost would be released after approval of the project.

b) Second instalment to the extent of 50 percent of the approved estimated cost would be released on the submission of progress report along with the report on utilization of the 75 percent of the fund and acceptance of the same by the Sectional Committee.

c) The balance amount shall be released after submission of the final project report along with utilization certificate for the fund released and its acceptance by the Sectional Committee.

8. The completion of the Research & development project shall remain the responsibility of (name of the organization/expert) even if the project leader is not available due to any reason whatsoever. After completion of the project, a Project Completion Report giving details (objective(s) achieved, raw data of surveys, sampling, testing and experiments) of shall be submitted by the Project leader the original objective(s) of the project,

9. (Name of the organization/expert) shall ensure the completion of the project under the guidance and supervision of any other faculty/researcher, if the nominated project leader would not be available due to any reason. Such a faculty member/researcher can only be nominated with the approval of BIS.

10. In case (name of the organization/expert) is unable to complete the project to the satisfaction of BIS in stipulated time or extended time and leads to termination of the research project, BIS shall be entitled to claim the refund of fund so sanctioned with interest @ 10 percent thereon from (name of the organization/expert).

11. The authority to extend the duration of the project shall rest with BIS.

12. BIS shall have the right to formulate monitoring methodology of the Research & development project.

13. Dispute Resolution: In case of any dispute that cannot be resolved amicably, it shall be referred to Sole Arbitrator appointed by the Director General of the Bureau of Indian standards, whose decision shall be final and binding upon both the parties. The provisions of the Arbitration and Conciliation Act, 1996, as amended from time to time, shall be applicable.

14. Undertaking given by project leader, if any, shall be part of the agreement.

15. (Name of the organization/expert) shall be responsible for discharge of all its obligations of the project through the nominated project leader or any other expert/expert(s) in case of necessity particularly in respect of management of financial assistance given to them. (Name of the organization/expert) shall refund any excess/unutilized amount of the fund to BIS.

16. Release of subsequent instalments is subject to satisfactory progress, required stage - wise deliverables and submission of the Utilization Certificate (UC) as per Form GFR12-A of GFR 2017 along with the statement of expenditure (SoE) issued by the Competent Authority.

17. (Name of the organization/expert) shall ensure that Project leader shall give presentation on the progress of project to BIS as and when directed by BIS for continuation of the project, and shall assist in the disposal of comments received related to the Research & development Project.

18. The project shall be deemed to have been commenced from the date of release of sanction letter.

19. (Name of the organization/expert) shall ensure that while publishing the results of research & development, acknowledgement to the effect that financial assistance so received from BIS be made in the research papers published/ other published work/ press reports.

20. Procedure for screening/evaluation, selecting, monitoring Research & development projects prescribed in “Guidelines for Research & Development Projects for Formulation and Review of Standards’ shall be part of the agreement.

**ANNEX E**

**OPERATION OF FUNDS AND PROGRESS REPORT**

|  |  |
| --- | --- |
| 1. Title of the Project: | Project number: |
| 2. Name & Address of Project leader: | Date of Commencement: dd/mm/yyyy |

3. Details of Equipment Purchased (if any):

|  |  |  |  |
| --- | --- | --- | --- |
| Name of equipment | Cost | Supplier | Date of purchase/ placing order foreach item of equipment |
|  |  |  |  |
| NOTE - The equipment fund once fixed cannot be enhanced. Project leaders are advised to give authenticated estimates of the cost of equipment. Equipment should invariably be purchased within 1 month from the date of receipt of the fund and/or sanction letter. |

4. Fund received

 .

5. Expenditure made in Rupees: (Please provide the details)

|  |  |  |  |
| --- | --- | --- | --- |
| Expenditure | Amount | Taxes (as applicable) | Total |
| Manpower cost |  |  |  |
| Consumables |  |  |  |
| Equipment |  |  |  |
| Travel |  |  |  |
| Others |  |  |  |
| Grand Total |  |  |  |

6. Amount saved (if any) from the last instalment: Rs .

7. Date on which scheme will complete its normal tenure of months .

8. Whether extension beyond normal tenure has been requested. Yes /No.

If yes, justification for extension and programme of work to be completed. Also mention as to why the work could not be completed as per the original plan.

{Extension beyond normal tenure should be requested at the Project Monitoring Session before end of tenure (as given in ToR)}.

9. Constraints (if any) faced in the progress of work and suggestions to overcome them.

10. Any deviation from original plan with its nature and cause.

11. List of publication giving full bibliographic details accrued from this project (copies of the paper (s) should be enclosed).

12. Summary of work done (200 words).

13. Proposed programme of work for the next month (1000 words).

14. Detailed Progress Report enlisting the objectives in beginning briefly (up to five pages maximum).

Signature of Project leader

Date:

Note: No column should be left blank; write not applicable (NA), wherever applicable.

**TEMPLATE FOR THE TERMS OF REFERENCE FOR THE R&D PROJECTS**

(*Refer to the Guidelines on R&D Projects issued vide note SCMD/R&D dated xx-09-23*)

1. **Title of the Project:** Mention the title of the project.

2. **Background:**

a) Mention the Technical Committee and Division Council the project is related to;

b) Mention the standard / document no. for the standard under development or review to which the project is related to;

c) Briefly explain the rationale for the commissioning of the project.

3. **Scope**: Mention the scope of the project.

4. **Expected Deliverables**: Mention the outcome of the project.

5. **Research Methodology**:

Mention the essential components of the methodology like mid-term review, focus group discussions, visits to the manufacturing units and/or laboratories, collection and testing of samples etc. with the details of the sample size for them as applicable.

6. **Requirement for the CVs:**

Mention the requirement for the CVs of the persons to be engaged for the project.

7. **Timeline and Method of Progress Review:**

Suggest the stagewise timelines including that for the submission of the first draft, final draft and the report and the mechanism for the review of the progress.

8. **Support BIS will Provide:**

Indicate the support BIS may provide in terms of the standards, other publications, information regarding manufacturers and labs etc.

**Annex 14**

**(Item 10.1)**

**SCOPE OF ISO TC 94/SC14 AND TXD 32**

1. **SCOPE OF ISO TC 94/SC14**

ISO/TC 94/SC14 was established specifically to deal with the unique requirements for firefighters' Personal Protective Equipment (PPE). Under the scope of SC 14, each Standard for firefighters' PPE is developed for a particular aspect of fire and rescue activities. Within its scope, firefighters PPE includes head protection, eye and face protection, hearing protection, hand protection, body protection (includes upper and lower torso), foot protection and respiratory protection that is used by firefighters.

These Standards are developed by SC14 Working Groups that consist of the following:

* WG1 General Requirements
* WG2 Structural Firefighting
* WG3 Wildland Firefighting
* WG4 HAZMAT
* WG5 Rescue
* JWG SC14/SC13 CBRN
* JWG SC15/SC14 RPD

The approach this subcommittee has used has differed to other subcommittees, developing PPE Standards using a hazard-based approach. The committee determine the types of hazards that a firefighter will face; structural firefighting, wildland firefighting, hazardous chemical and CBRN incidents, and rescue operations. It is also recognised that firefighters need to be physically comfortable as well as protected by all PPE being used while they perform their duties.

Firefighters are a unique group of workers, who use PPE as a primary means of protection against all hazards that they may encounter in the performance of their duties as firefighters and first responders. Other industries can re-engineer the tasks or processes to be undertaken to either eliminate or control the hazard or risk to the worker. Unlike firefighters, industry generally can withdraw the workers from the hazardous zone/s and therefore only needs to consider the use of PPE as a means of last resort, when the risk to the worker cannot be controlled or eliminated.

Of late, types and intensity of hazards encountered by firefighters have increased dramatically, these include wildland firefighting and major rescue operations that include rescuing members of the community from extreme floods. These increased hazards also include chemical and highly toxic fires, high intensity fires stemming from electric vehicles and fires in extremely difficult situations such as high-rise buildings and tower structures.

The primary focus for ISO/TC 94/SC 14 is on performance requirements for PPE, however, other important considerations include Selection Use Care and Maintenance (SUCAM) and Cleaning and Maintenance. The goal of SC14 is to, wherever possible, direct its Working Groups to utilise existing ISO test method standards. Where a requirement for new or revised testing requirement is considered necessary, then a request setting out a clearly defined performance requirement/s should be prepared by the relevant Working Group and be assigned to the most appropriate Sub-Committee of ISO/TC 94 for action.

1. **SCOPE OF TXD 32**

To formulate Indian Standards for testing and specification for textile protective clothing for protection from fire and other health/life hazards.

 **Liaison :**

ISO TC 94 / SC 13 - Personnel Safety- Protective Clothing and Equipment - Principle (P)

**Annex 15**

**(Item 10.1)**

**PROGRAM OF WORK OF ISO TC 94/SC14**

1. **STANDARDS PUBLISHED UNDER ISO TC 94/SC14**

|  |
| --- |
| [ISO 23616:2022](https://www.iso.org/standard/76407.html?browse=tc) Cleaning, inspection and repair of firefighters' personal protective equipment (PPE) |
| [ISO 21942:2019](https://www.iso.org/standard/72255.html?browse=tc) Station uniform for firefighters |
| [ISO/TR 21808:2021](https://www.iso.org/standard/73744.html?browse=tc) Guidance on the selection, use, care and maintenance of personal protective equipment (PPE) designed to provide protection for firefighters |
| [ISO/TR 19591:2018](https://www.iso.org/standard/65420.html?browse=tc) Personal protective equipment for firefighters — Standard terms and definitions |
| [ISO 18640-2:2018/Amd 1:2019](https://www.iso.org/standard/77125.html?browse=tc) Protective clothing for firefighters — Physiological impact — Part 2: Determination of physiological heat load caused by protective clothing worn by firefighters — Amendment 1 |
| [ISO 18640-2:2018](https://www.iso.org/standard/65017.html?browse=tc) Protective clothing for firefighters — Physiological impact — Part 2: Determination of physiological heat load caused by protective clothing worn by firefighters |
| [ISO 18640-1:2018/Amd 1:2019](https://www.iso.org/standard/77124.html?browse=tc) Protective clothing for firefighters — Physiological impact — Part 1: Measurement of coupled heat and moisture transfer with the sweating torso — Amendment 1 |
| [ISO 18640-1:2018](https://www.iso.org/standard/65016.html?browse=tc) Protective clothing for firefighters — Physiological impact — Part 1: Measurement of coupled heat and moisture transfer with the sweating torso |
| [ISO 18639-6:2018](https://www.iso.org/standard/67129.html?browse=tc) PPE ensembles for firefighters undertaking specific rescue activities — Part 6: Footwear |
| [ISO 18639-5:2018](https://www.iso.org/standard/67128.html?browse=tc) PPE ensembles for firefighters undertaking specific rescue activities — Part 5: Helmet |
| [ISO 18639-4:2018/Amd 1:2023](https://www.iso.org/standard/83809.html?browse=tc) PPE ensembles for firefighters undertaking specific rescue activities — Part 4: Gloves — Amendment 1 |
| [ISO 18639-4:2018](https://www.iso.org/standard/67127.html?browse=tc) PPE ensembles for firefighters undertaking specific rescue activities — Part 4: Gloves |
| [ISO 18639-3:2018](https://www.iso.org/standard/67126.html?browse=tc) PPE ensembles for firefighters undertaking specific rescue activities — Part 3: Clothing |
| [ISO 18639-1:2018](https://www.iso.org/standard/67124.html?browse=tc) PPE ensembles for firefighters undertaking specific rescue activities — Part 1: General |
| [ISO 17723-1:2019](https://www.iso.org/standard/68421.html?browse=tc) PPE ensembles for firefighters undertaking hazardous materials response activities — Part 1: Gas-tight, vapour-protective ensembles for emergency response teams ("type 1") |
| [ISO 16073-9:2020](https://www.iso.org/standard/74217.html?browse=tc) Wildland firefighting personal protective equipment — Requirements and test methods — Part 9: Firehoods |
| [ISO 16073-8:2019](https://www.iso.org/standard/74216.html?browse=tc) Wildland firefighting personal protective equipment — Requirements and test methods — Part 8: Hearing |
| [ISO 16073-7:2019](https://www.iso.org/standard/74215.html?browse=tc) Wildland firefighting personal protective equipment — Requirements and test methods — Part 7: Face and eye protection |
| [ISO 16073-6:2021](https://www.iso.org/standard/74214.html?browse=tc) Wildland firefighting personal protective equipment — Requirements and test methods — Part 6: Footwear |
| [ISO 16073-5:2019](https://www.iso.org/standard/74213.html?browse=tc) Wildland firefighting personal protective equipment — Requirements and test methods — Part 5: Helmets |
| [ISO 16073-4:2019](https://www.iso.org/standard/74212.html?browse=tc) Wildland firefighting personal protective equipment — Requirements and test methods — Part 4: Gloves |
| [ISO 16073-3:2019](https://www.iso.org/standard/74211.html?browse=tc) Wildland firefighting personal protective equipment — Requirements and test methods — Part 3: Clothing |
| [ISO 16073-2:2019](https://www.iso.org/standard/74210.html?browse=tc) Wildland firefighting personal protective equipment — Requirements and test methods — Part 2: Compatibility |
| [ISO 16073-1:2019](https://www.iso.org/standard/74209.html?browse=tc) Wildland firefighting personal protective equipment — Requirements and test methods — Part 1: General |
| [ISO 15538:2001](https://www.iso.org/standard/28153.html?browse=tc) Protective clothing for firefighters — Laboratory test methods and performance requirements for protective clothing with a reflective outer surface |
| [ISO 15384:2018/Amd 1:2021](https://www.iso.org/standard/81696.html?browse=tc) Protective clothing for firefighters — Laboratory test methods and performance requirements for wildland firefighting clothing — Amendment 1 |
| [ISO 15384:2018](https://www.iso.org/standard/67219.html?browse=tc) Protective clothing for firefighters — Laboratory test methods and performance requirements for wildland firefighting clothing |
| [ISO 11999-9:2016](https://www.iso.org/standard/60196.html?browse=tc) PPE for firefighters — Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures — Part 9: Fire hoods |
| [ISO 11999-6:2016](https://www.iso.org/standard/60193.html?browse=tc) PPE for firefighters — Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures — Part 6: Footwear |
| [ISO 11999-5:2015](https://www.iso.org/standard/60192.html?browse=tc) PPE for firefighters — Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures — Part 5: Helmets |
| [ISO 11999-4:2015](https://www.iso.org/standard/64020.html?browse=tc) PPE for firefighters — Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures — Part 4: Gloves |
| [ISO 11999-3:2015](https://www.iso.org/standard/64019.html?browse=tc) PPE for firefighters — Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures — Part 3: Clothing |
| [ISO/TS 11999-2:2015](https://www.iso.org/standard/65537.html?browse=tc) PPE for firefighters — Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures — Part 2: Compatibility |
| [ISO 11999-1:2015](https://www.iso.org/standard/64017.html?browse=tc) PPE for firefighters — Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures — Part 1: General |
| [ISO 11613:2017](https://www.iso.org/standard/64815.html?browse=tc) Protective clothing for firefighter's who are engaged in support activities associated with structural fire fighting — Laboratory test methods and performance |

1. **STANDARDS UNDER DEVELOPMENT UNDER ISO TC 94/SC14**

|  |
| --- |
| [ISO/CD 6529](https://www.iso.org/standard/83924.html?browse=ics) Protective clothing — Protection against chemicals — Determination of resistance of protective clothing materials to permeation by liquids and gases |
| [ISO/CD 9185](https://www.iso.org/standard/85806.html?browse=ics) Protective clothing — Assessment of resistance of materials to molten metal splash |
| [ISO/FDIS 11611](https://www.iso.org/standard/74040.html?browse=ics) Protective clothing for use in welding and allied processes |
| [ISO/DIS 11612](https://www.iso.org/standard/85658.html?browse=ics) Protective clothing - Clothing to protect against heat and flame - Minimum performance requirements |
| [ISO/DIS 11999-1](https://www.iso.org/standard/82549.html?browse=ics) PPE for firefighters — Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures — Part 1: General |
| [ISO/CD 11999-2](https://www.iso.org/standard/82826.html?browse=ics) PPE for firefighters — Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures — Part 2: Compatibility |
| [ISO/DIS 11999-3](https://www.iso.org/standard/82550.html?browse=ics) PPE for firefighters — Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures — Part 3: Clothing |
| [ISO/DIS 11999-4](https://www.iso.org/standard/82551.html?browse=ics) PPE for firefighters — Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures — Part 4: Gloves |
| [ISO/CD 11999-10](https://www.iso.org/standard/85586.html?browse=ics) PPE for firefighters — Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures — Part 10: Part 10 Respiratory Protective Device (RPD) |
| [ISO/DIS 13506-1](https://www.iso.org/standard/75863.html?browse=ics) Protective clothing against heat and flame — Part 1: Test method for complete garments — Measurement of transferred energy using an instrumented manikin |
| [ISO/DIS 13506-2](https://www.iso.org/standard/75864.html?browse=ics) Protective clothing against heat and flame — Part 2: Skin burn injury prediction — Calculation requirements and test cases |
| [ISO/DIS 14116](https://www.iso.org/standard/85657.html?browse=ics) Protective clothing — Protection against flame — Limited flame spread materials, material assemblies and clothing |
| [ISO/DIS 14460](https://www.iso.org/standard/85870.html?browse=ics) Protective clothing for automobile racing drivers — Protection against heat and flame — Performance requirements and test methods |
| [ISO/DIS 15027-1](https://www.iso.org/standard/78057.html?browse=ics) Immersion suits — Part 1: Constant wear suits, requirements including safety |
| [ISO/DIS 15027-2](https://www.iso.org/standard/78058.html?browse=ics) Immersion suits — Part 2: Abandonment suits, requirements including safety |
| [ISO/DIS 15027-3](https://www.iso.org/standard/78059.html?browse=ics) Immersion suits — Part 3: Test methods |
| [ISO/CD 16602-1.2](https://www.iso.org/standard/83269.html?browse=ics) Protective clothing for protection against chemicals — Classification, labelling and performance requirements — Part 1: General |
| [ISO/CD 16602-2.2](https://www.iso.org/standard/83270.html?browse=ics) Protective clothing for protection against chemicals — Classification, labelling and performance requirements — Part 2: Physical test methods, classification and requirements |
| [ISO/CD 16602-3.2](https://www.iso.org/standard/83271.html?browse=ics) Protective clothing for protection against chemicals — Classification, labelling and performance requirements — Part 3: Chemical test methods, classification and requirements |
| [ISO/CD 16602-4.2](https://www.iso.org/standard/83272.html?browse=ics) Protective clothing for protection against chemicals — Classification, labelling and performance requirements — Part 4: Design test methods, classification and requirements |
| [ISO/CD 16602-5.2](https://www.iso.org/standard/83273.html?browse=ics) Protective clothing for protection against chemicals — Classification, labelling and performance requirements — Part 5: Garment test methods, classification and requirements |
| [ISO/CD 16602-6.2](https://www.iso.org/standard/83274.html?browse=ics) Protective clothing for protection against chemicals — Classification, labelling and performance requirements — Part 6: Guidance for selection, use, care and maintenance |
| [ISO/DIS 17491-4](https://www.iso.org/standard/69029.html?browse=ics) Protective clothing — Test methods for clothing providing protection against chemicals — Part 4: Determination of resistance to penetration by a spray of liquid (spray test) |
| [ISO/DIS 17491-5](https://www.iso.org/standard/83202.html?browse=ics) Protective clothing — Test methods for clothing providing protection against chemicals — Part 5: Determination of resistance to penetration by a spray of liquid (manikin spray test) |
| [ISO/DTR 21808](https://www.iso.org/standard/85651.html?browse=ics) Best practices on the selection and use of personal protective equipment (PPE) designed to provide protection for firefighters |
| [ISO 21942:2019/DAmd 1](https://www.iso.org/standard/85653.html?browse=ics) Station uniform for firefighters — Amendment 1 |
| [ISO/CD 22615](https://www.iso.org/standard/83254.html?browse=ics) Protective clothing — Performance requirements and test methods for protective clothing against infective agents |
| [ISO/DIS 23616](https://www.iso.org/standard/85650.html?browse=ics) Cleaning, inspection and repair of firefighters' personal protective equipment (PPE) |
| [ISO/DIS 24231](https://www.iso.org/standard/78152.html?browse=ics) Protective clothing — Protection against rain — Test method for ready-made garments against high-energy droplets from above |
| [ISO/DIS 24232](https://www.iso.org/standard/78153.html?browse=ics) Protective clothing — Protection against rain |
| [ISO/FDIS 24588](https://www.iso.org/standard/79012.html?browse=ics) Protective clothing — Personal protective ensembles for use against chemical, biological, radiological and nuclear (CBRN) agents — Classification, performance requirements and test methods |