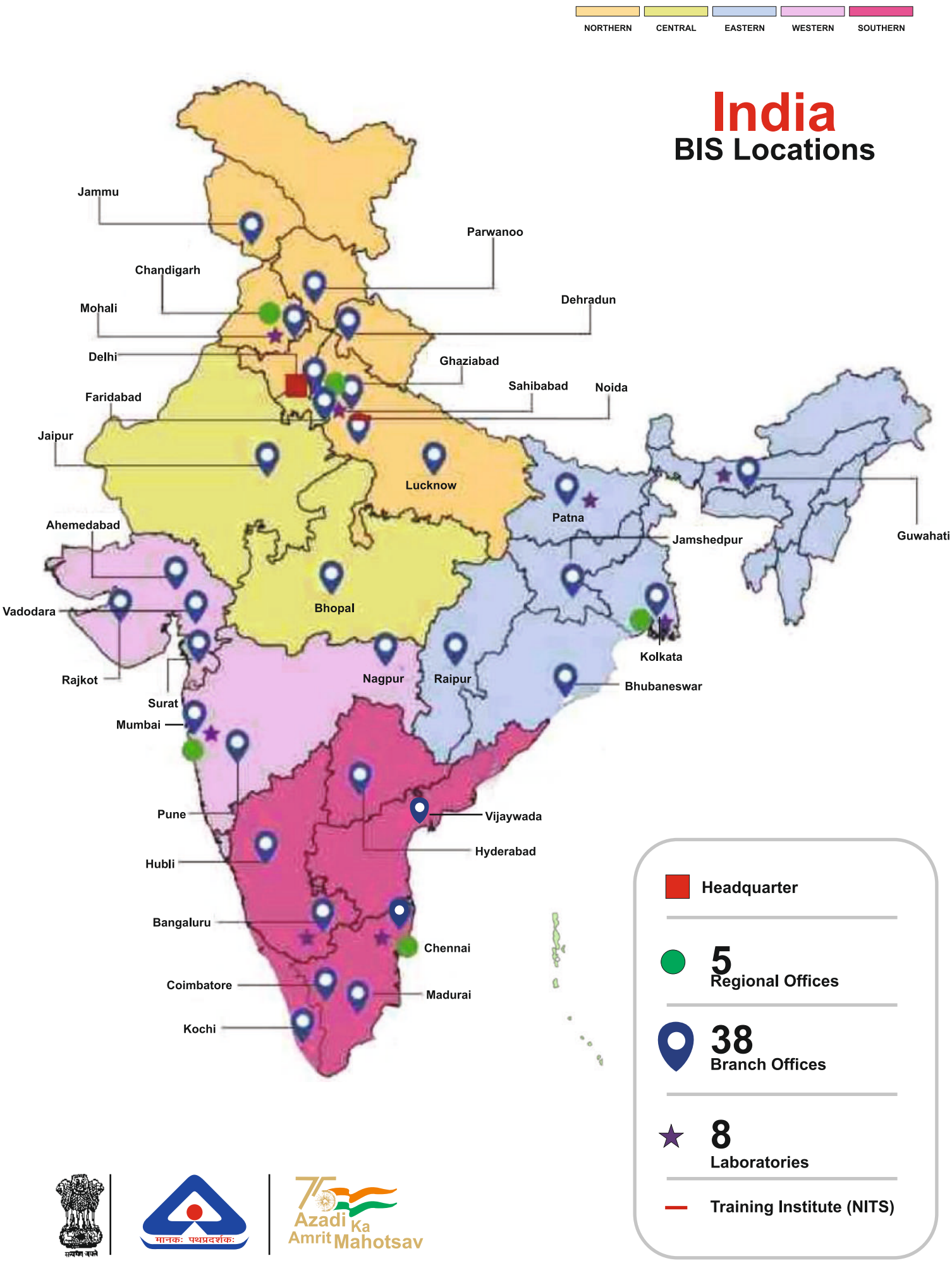
INDIAN STANDARDS ON AGROTEXTILES

BUREAU OF INDIAN STANDARDS
Ministry of Consumer Affairs,
Food and Public Distribution
Government of India

भारतीय मानक ब्यूरो
उपभोक्ता मामले, खाद्य और
सार्वजनिक वितरण मंत्रालय
भारत सरकार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मानकः पथप्रदर्शकः
Azadi Ka Amrit Mahotsav

ABOUT BIS

Bureau of Indian Standards (BIS), the National Standards Body (NSB) of India was established under the *BIS Act*, 1986 and came into existence on 1 April 1987 assuming the functions of the erstwhile Indian Standards Institution (ISI). The ISI was established on 6 January 1947. *The BIS Act*, 2016 came into force on 12 October 2017 superseding BIS Act 1986. *The BIS Act*, 2016 provides for the establishment of a national standards body for the harmonious development of the activities of standardization, conformity assessment and quality assurance of goods, articles, processes, systems and services and for matters connected therewith or incidental thereto.

BIS through its core activities of standardization and conformity assessment, has been benefiting the national economy by providing safe, reliable and quality goods; minimizing health hazards to consumers; protecting the environment; controlling over proliferation of varieties; promoting exports and imports substitutes, etc. The standardization and conformity assessment schemes of BIS apart from benefitting the consumers and industry also support various public policies especially in areas of product safety, consumer protection, food safety, environment protection, building and infrastructure development, etc.

BIS also represents India in international standards bodies like International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) and participates actively in the international standardization work undertaken by these bodies. BIS presents the national viewpoints on new areas taken up for international standardization and on various draft international standards during the process of development of these standards so that the country's interest is protected and reflected in these standards. This also enables the BIS technical committees to consider adoption of the international standards as Indian Standards, with or without modifications, in order to enable our products and services to integrate with global trade and commerce.

What are Standards?

Standard is a document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

Importance of Standardization

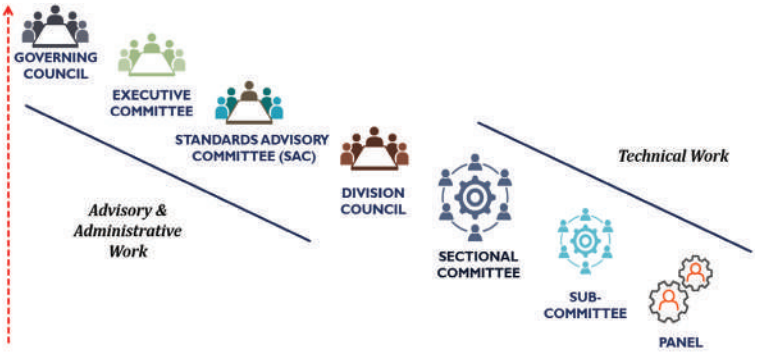
Standardization is the process of developing technical standards through consensus of different parties.This standardization aims to address one or all of compatibility, interchangeability, variety control, safety, environment protection, product protection and fitness for purpose. Standards provide numerable benefits to the technologists, producers, consumers and traders besides defining purpose for each of these entities.

Standards can be formulated at various levels ranging from an individual through National (IS) to International level (ISO). Also, depending on the subject in hand, standards can be made on various aspects such as terminology, specification, sampling, testing, code of good practice, systemes and services.

STANDARDIZATION ACTIVITY OF BIS

Standardization Structure

There are 16 Technical Departments formulating standards in various subject areas. Corresponding to these departments, 16 division councils exist. Each division council has several sectional committees working under it. The standards cover important segments of economy and help the industry in upgrading the quality of their goods and services.

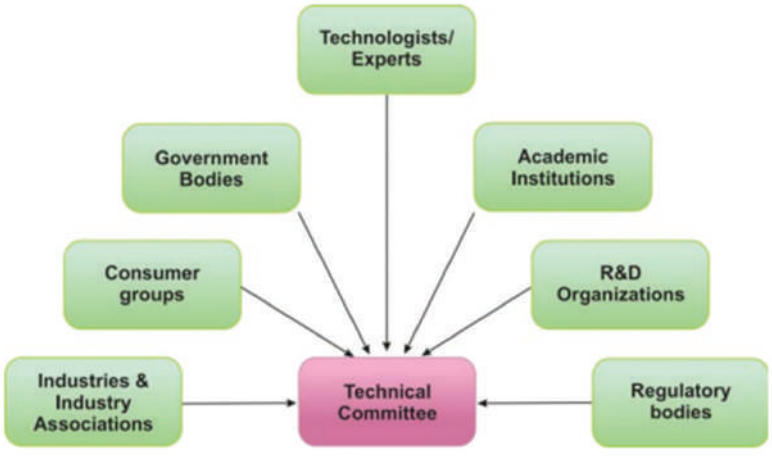


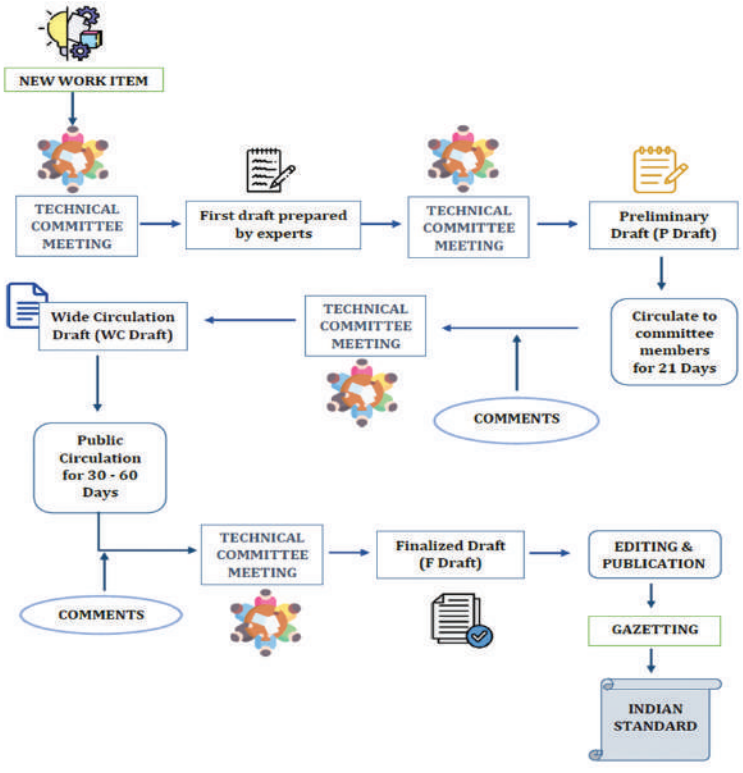
Ayush Division Council (AYDC)	Chemical Division Council (CHDC)	Civil Engineering Division Council (CEDC)	Electro-Technical Division Council (ETDC)
Electronics & Telecommunication Division Council (LITDC)	Food and Agriculture Division Council (FADC)	Mechanical Engineering Division Council (MEDC)	Management and Systems Division Council (MSDC)
Metallurgical Engineering Division Council (MTDC)	Medical Equipment & Hospital Planning Division Council (MHDC)	Petroleum, Coal & Related Products Division Council (PCDC)	Production and General Engineering Division Council (PGDC)
Transport Engineering Division Council (TEDC)	Textile Division Council (TXDC)	Water Resources Division Council (WRDC)	Service Sector Division Council (SSDC)

Standards Formulation Process

The Indian Standards are developed by technical committees that are representative of various stakeholders having interest in the relevant subject of standardization under the scope of such committees through a process of consultation so that views of all are given due consideration and a consensus is evolved in formulating a standard. The stakeholders involved in national standardization can broadly be categorized as industry, consumers/ users, technologists (R&D and scientific institutions, academia, individual subject experts, etc) and government departments/regulators.

The process of standards development of BIS is aligned with accepted international best practices that are based on the core principles of openness, transparency, impartiality and consensus. The process begins with the identification of the standardization needs of the given sector or subject following which the development of the standard is taken up and planned bythe relevant technical committee. Apart from consultation within the technical committees, draft standards are also open for public views/comments.





Standards Development Process Flow

TEXTILES DIVISION COUNCIL

The standardization in the area of textiles including technical textiles is undertaken by Textiles divisional council through a network of 26 sectional committees. The Textiles Division of BIS has published around 1510 standards for textiles, out of which about 600 standards are on the technical textiles and its test methods. The scope of the textiles division council is provided as follows:-

SCOPE: Standardization in the field of textiles and apparel covering natural and man-made fibres and their products, dyestuffs, textile specialty chemicals, textile machinery and technical textiles.

OVERVIEW OF TEXTILES DEPARTMENT (As on 19 September, 2023)

•	Indian Standards published	: 1510			
•	Product standards	: 749	Method of Test	:	534
•	Terminology	: 70	Code of practice	:	66
•	Dimensions, safety & Others	: 91			
•	Standards on Technical Textiles	: 600			
•	Products under certification	: 78			
•	Number of licences granted	: 1054			

The list of the 26 sectional committees are provided as follows :-

i) Physical Methods of Test Sectional Committee, TXD 01

ii) Jute and Jute Products Sectional Committee, TXD 03

iii) Wool, Wool Products and Textile Floor Coverings Sectional Committee, TXD 04

iv) Chemical Methods of Test Sectional Committee, TXD 05

v) Textiles Speciality Chemicals & Dyestuffs Sectional Committee, TXD 07

vi) Handloom and Khadi Sectional Committee, TXD 08

vii) Cordage Sectional Committee, TXD 09

viii) Hosiery Sectional Committee, TXD 10

ix) Textile Materials for Aeronautical and Related Products Sectional Committee, TXD 13

x) Textile Machinery and Accessories Sectional Committee, TXD 14

xi) Textile Materials for Marine/Fishing Purposes Sectional Committee, TXD 18

xii) Made-up Items (Including Ready-made Garments) Sectional Committee, TXD 20

xiii) Textile Materials Made from Polyolefins (Excluding Cordage)

Sectional Committee, TXD 23

xiv) Coir and Coir Products Sectional Committee, TXD 25

xv) Silk and Silk Products Sectional Committee, TXD 28

xvi) Geosynthetics Sectional Committee, TXD 30

xvii) Man-Made Fibres, Cotton and their Products Sectional Committee, TXD 31

xviii) Protective Clothing Sectional Committee, TXD 32

xix) Industrial Fabrics Sectional Committee, TXD 33

xx) Technical Textiles for Buildtech Applications Sectional Committee, TXD 34

xxi) Technical Textiles for Agrotech Applications Sectional Committee, TXD 35

xxii) Technical Textiles for Medtech Applications Sectional Committee, TXD 36

xxiii) Technical Textiles for Sportech Applications Sectional Committee, TXD 37

xxiv) Technical Textiles for Mobiltech Applications Sectional Committee, TXD 38

xxv) Technical Textiles for Clothtech Applications including Narrow Fabrics and Braids Sectional Committee, TXD 39

xxvi) High Performance Fibres, Fibrous Structure and Textile Components of Composites, TXD 40

TECHNICAL TEXTILES FOR AGROTECH APPLICATIONS SECTIONAL COMMITTEE

STANDARDIZATION IN THE FIELD OF AGROTECH

Standardization in the field of Agrotextiles has been undertaken by **TECHNICAL TEXTILES FOR AGROTECH APPLICATIONS SECTIONAL COMMITTEE, TXD 35** under Textiles Division Council at BIS.

Scope — To formulate Indian Standards for terminology, testing and specifications for technical textiles for agrotech application such as horticulture, agriculture, forestry and animal husbandry, etc.

- Number of standards formulated - 27
- Product Standards - 26
- Terminogy - 01

Number of standards under development - 02

S.N.	IS No.	Title
1	IS 15351 : 2015	Agro textiles — Laminated high density polyethylene (HDPE) woven geomembrane for water proof lining — Specification (second revision)
2	IS 15907 : 2010	Agro textiles — High density polyethylene (HDPE) woven beds for vermiculture — Specification
3	IS 16008 (Part 1) : 2016	Agro textiles — Shade nets for agriculture and horticulture purposes — Specification Part 1 Shade nets made from tape yarns (first revision)
4	IS 16008 (Part 2) : 2016	Agro textiles — Shade nets for agriculture and horticulture purposes — Specification Part 2 Shade nets made from mono filament yarns (first revision)
5	IS 16089 : 2013	Jute agro-textile — Sapling bags for growth of seedling/ sapling — Specification
6	IS 16190 : 2014	Agro textiles — High density polyethylene (HDPE) laminated woven lay flat tube for irrigation purpose —Specification
7	IS 16202 : 2014	Agro textiles —Woven ground covers for horticulture application —Specification
8	IS 16366 : 2015	Glossary of terms used in agrotextile
9	IS 16390 : 2015	Agro textiles —Nylon knitted seamless gloves for tobacco harvesters — Specification
10	IS 16513 : 2016	Agro textiles — Insect nets for agriculture and horticulture purposes — Specification
11	IS 16627 : 2017	Agro textiles — High density polyethylene (HDPE) laminated woven lay flat tube for use in mains and submains of drip irrigation system — Specification
12	IS 16718 : 2021	Textiles — Polypropylene Spun Bonded Non-Woven Crop Covers and Fruit Skirting Bags for Agricultural and Horticultural Applications —Specification (first revision)
13	IS 17070 : 2019	Jute agrotextiles for growth of plant and suppression of weeds — Specification

14	IS 17355 : 2020	Agro textiles — Propylene spun bonded non-woven mulch mat for agricultural and horticultural applications — Specification
15	IS 17356 : 2020	Agro textiles — Windshield nets for agriculture and horticulture purposes — Specification
16	IS 17357 : 2020	Agro textiles — Harvest nets for agriculture and horticulture purposes — Specification
17	IS 17358 (Part 1) : 2020	Agro textiles — Fencing nets for agriculture and horticulture purposes — Specification Part 1 Fencing nets made from extruded polymer mesh
18	IS 17358 (Part 2) : 2020	Agro textiles — Fencing nets for agriculture and horticulture purposes — Specification Part 2 Fencing nets made from mono filament yarns and combination of tape and mono filament yarns
19	IS 17513 : 2020	Agro Textiles — Plant Support Nets for Agriculture and Horticulture Purposes – Specification
20	IS 17728 : 2021	Agro Textiles — High Density Polyethylene (HDPE) Laminated Woven Lay Flat Tube and Fittings for use in Rain Irrigation System —Specification
21	IS 17729 : 2021	Agro-Textiles — Flexible Water Storage Tank for Agriculture and Horticulture Purposes — Specification
22	IS 17730 (Part 1) : 2021	Agro-Textiles — Hail Protection Nets for Agriculture and Horticulture Purposes — Specification Part 1 Warp Knitted Hail Protection Nets
23	IS 17730 (Part 2) : 2021	Agro-Textiles — Hail Protection Nets for Agriculture and Horticulture Purposes — Specification Part 2 Woven Hail Protection Nets
24	IS 17731 : 2021	Agro-Textiles — Laminated Woven Orchard Protection Covers — Specification
25	IS 18310 (Part 1) : 2023	Agro Textiles — Bird Protection Nets For Agriculture And Horticulture Purposes — Specification Part 1 Knotted Bird Protection Nets
26	IS 18310 (Part 2) : 2023	Agro Textiles — Bird Protection Nets For Agriculture And Horticulture Purposes — Specification Part 2 Knitted Bird Protection Nets
27	IS 18310 (Part 3) : 2023	Agro Textiles — Bird Protection Nets For Agriculture And Horticulture Purposes — Specification Part 3 Extruded Bird Protection Nets

Some of the important standards formulated by this committee under the field of agrotextiles such as Shade nets, Insects nets, Hail nets, Crop covers, Flexible water storage tanks, Fencing nets, Mulch mats, Vermiculture beds etc are explained in brief in this handbook.

IS 16008 : 2016 (Part 1 & Part 2) Shade Nets for Agriculture and Horticulture Purposes - Specification

This standard has two parts:

1. Part 1 Shade Nets Made from Tape Yarns

Scope: This standard (Part 1) prescribes constructional and other performance requirements for synthetic agro shade nets manufactured from tape yarns for agriculture and horticulture purposes in protecting/increasing crop yield by providing partially controlled climatic conditions for the intended crops.

2. Part 2 Shade Nets Made from Mono Filament Yarns

Scope: This standard (Part 2) prescribes constructional and other performance requirements for synthetic agro shade nets manufactured from mono filament yarns for agriculture and horticulture purposes in protecting/ increasing crop yield by providing partially controlled climatic conditions for the intended crops

- **IMPORTANT DEFINITIONS**

  Shading Factor — It is the percentage of normally incident UV visible radiation in the range of 290 to 770 nanometer not transmitted by the shade nets.

  Cover Factor — It is the area of shade nets covered by the yarn and fibre of the structure.

  Photosynthetically Active Radiation (PAR) — It designates the spectral range (wave band) of solar radiation from 400 to 700 nanometer that photosynthetic organisms are able to use in the process of photosynthesis. PAR watts directly indicate how much light energy is available for plants to use in photosynthesis.

- **SHADE NETS**

  The shade nets are mostly used for agriculture and horticulture applications particularly in countries like India where the scorching heat of the sun plays a major role in damaging the crops by sun burning and thus causing severe financial losses. The varying climatic conditions throughout the year, together with the slow but constant rising temperature in the summer months prove the need for shade nets to maximize growth and crop yields. The shade nets helps in controlling the temperature by accumulating the day heat to withstand the low temperatures of night thus help in off season ripening of fruits and vegetables. It also acts as a wind shield and prevents damage to young plants from damage.

- **TYPES**

  IS 16008 (Part 1) : 2016 Agro Textiles — Shade Nets for Agriculture and Horticulture Purposes — Specification Part 1 Shade Nets Made from Tape Yarns

  Based on the shading percentage, the agro shade nets are classified as follows:

  a) Type I — having shading percentage of 50 percent;
  b) Type II — having shading percentage of 75 percent; and
  c) Type III — having shading percentage of 90 percent.

  Agro Textiles — Shade Nets for Agriculture and Horticulture Purposes — Specification Part 2 Shade Nets Made from Mono Filament Yarns

Based on the shading percentage, the monofilament agro shade nets are classified as follows:

a) Type I — having shading percentage of 35 percent;

b) Type II — having shading percentage of 50 percent;

c) Type III — having shading percentage of 75 percent; and

c) Type IV — having shading percentage of 90 percent.

Fig. SHADE NETS

REQUIREMENTS

The standard specifies the basic performance requirements like GSM, Average breaking strength, Retention of breaking strength after UV exposure, Colour fastness to artificial light, Shading percentage etc.

Along with the current requirements and additional variety of Type IIA is also added in the Shade Nets with the latest amendment.

Requirements of Shade Nets Made from Tape Yarns (Part 1)

Sl No.	Characteristic	Requirement(s)				Method of Test, Ref to
		Type I	Type II	Type III	Type IV	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Mass, g/m^2, *Min*	95	125	310	460	IS 1964
ii)	Average breaking strength of shade nets fabric (Strip method,325 mm × 50 mm test piece with gauge length of 200 mm).*N, Min;* a) Warpway b) Weftway	 300 350	 300 620	 450 1700	 650 4300	 IS 1969 (Part 1)
iii)	Retention of breaking strength after UV exposure, *N, Min*	85 percent of original actual value (fabric)				Annex B and IS 1969 (part 1)
iv)	Colour fastness to artificial light [1)]	4 or better	4 or better	4 or better	4 or better	IS 2454
v)	Bursting Pressure, Kgf/cm^2, *Min*	11	13	30	40	IS 1966 (part 1) or IS 1966 (Part 2)
vi)	Shading percentage	30 to 40	45 to 55	70 to 80	85 to 95	Annex C
[1)] Applicable for coloured shade nets only						

Requirements of Shade Nets Made from Monofilament Yarns (Part 2)

Sl No.	Characteristic	Requirement(s)				Method of Test, Ref to
		Type I	Type II	Type III	Type IV	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Mass, g/m^2, *Min*	95	125	310	460	IS 1964
ii)	Average breaking strength of shade nets fabric (Strip method,325 mm × 50 mm test piece with gauge length of 200 mm).N, *Min;* a) Warpway b) Weftway	 300 350	 300 620	 450 1700	 650 4300	 IS 1969 (Part 1)
iii)	Retention of breaking strength after UV exposure, N, *Min*	85 percent of original actual value (fabric)				Annex B and IS 1969 (part 1)
iv)	Colour fastness to artificial light [1)]	4 or better	4 or better	4 or better	4 or better	IS 2454
v)	Bursting Pressure, Kgf/cm^2, *Min*	11	13	30	40	IS 1966 (part 1) or IS 1966 (Part 2)
vi)	Shading percentage	30 to 40	45 to 55	70 to 80	85 to 95	Annex C
[1)] Applicable for coloured shade nets only						

IS 15351 : 2015 Agro textiles — Laminated high density polyethylene (HDPE) woven geomembrane for water proof lining — Specification (second revision)

1. HDPE Laminated Geomembrane for waterproof lining

Scope: This standard prescribes requirements for high density polyethylene (HDPE) woven geomembrane laminated with low density polyethylene (LDPE) or suitable combination of LDPE and LLDPE for use as lining for canal, pond and reservoir to control seepage. However, the material is not suitable for lining of roof/ terrace and for proper disposal of industrial effluents, etc

- **LAMINATED HIGH DENSITY POLYETHYLENE (HDPE) WOVEN GEOMEMBRANE FOR WATER PROOF LINING**

  Laminated high density polyethylene woven fabric, so called geomembranes, are very low permeability synthetic liners used to control fluid or gas migration within soil, rock, earth or any other geotechnical material, as integral part of a manmade product, structure or system. As a synthetic component used within the ground, they are technically geo-synthetic, the prefix 'geo' indicating usage on or in the earth. The other primary geo-synthetics are geo-textiles, geo-nets, geo-grids, geo-composites and geo-composite clay liners.

  The original use of geomembranes was for the distribution, storage and containment of potable agricultural water supplies. It still remains as an important element of this market, except now it has been broadened to contain a wide variety of liquids.

  Geomembranes have become the design choice as part of a cover system due to a variety of factors such as imperviousness, chemical resistance, inertness to surrounding soils, ease and variety of seaming, mechanical strength and elongation, ease of application and economics, product durability and ageing over the designed life of the containment system.

  The primary function of geomembrane applied in ponds/reservoirs is to prevent loss of water due to seepage. The successful performance of geomembrane is based on a good quality material, installation and appropriate design of ponds/reservoirs. To improve the service lifetime of geomembrane, it is essential that the geomembrane are placed on the pond/reservoir surface according to the dimensions and contours of the pond/reservoir ensuring full contact with the sub grade. To achieve this onsite laying, joining and fixing is imperative

- TYPES

  Based on the thickness and mass, in g/m², of waterproof woven fabric, the material is classified as follows:

  a) Type I — Having thickness of 0.25 mm and mass of 250 g/m², Min;

  b) Type II — Having thickness of 0.50 mm and mass of 420 g/m², Min;

  c) Type III — Having thickness of 0.75 mm and mass of 650 g/m², Min; and

  d) Type IV — Having thickness of 1.00 mm and mass of 950 g/m², Min.

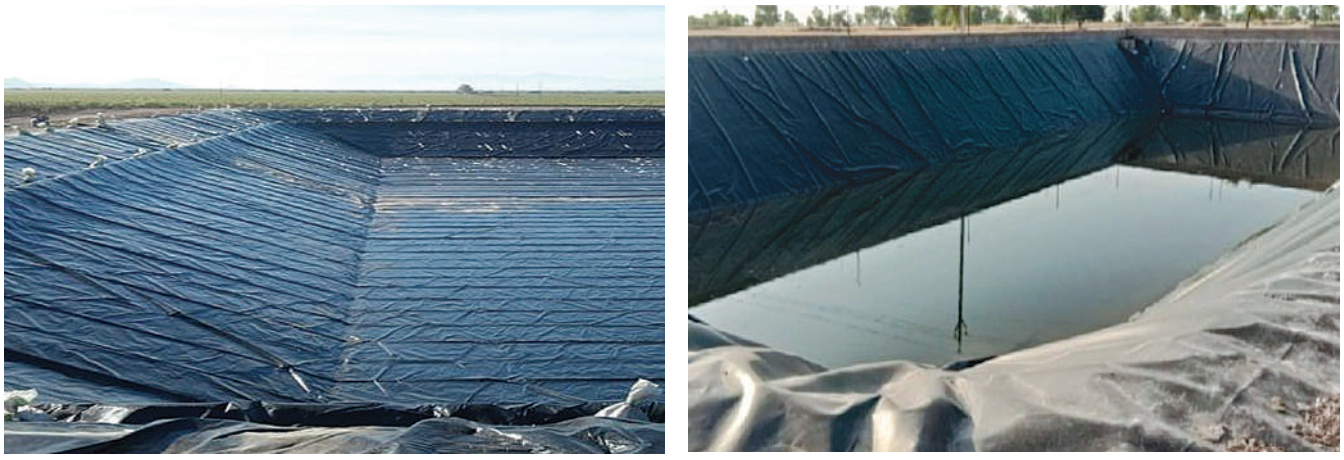


Fig. HDPE GEOMEMBERANE (Pond Liners)

REQUIREMENTS

The standard specifies the basic performance requirements like Thickness(mm) , Mass (g/m^2),Breaking load, Retention of breaking load after UV exposure, Puncture resistance, Tear resistance etc.

Requirement for Laminated HDPE Woven Geomembrane for Water Proof Lining

Sl No.	Characteristic	Requirement(s)				Method of Test, Ref to
		Type I	Type II	Type III	Type IV	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Thickness (mm), *Min*	0.25	0.50	0.75	1.00	IS 7016 (Part 1)
ii)	Mass (g/m2), *Min*	250	420	650	950	IS 7016 (Part 1)
iii)	Dimensions (length and width)	As declared + 1 percent with no negative tolerance				Annex A of IS 11652
iv)	Carbon black content, percent	2.5 ± 0.5				IS 2530
v)	Breaking load on 20 × 10 cm strip,N, *Min* before U.V exposure: a) Warpway b) Weftway	 3 300 3 000	 6 600 6 000	 8 200 7 400	 10 700 9 700	 IS 13162 (Part 5)
vi)	Strain at maximum load, percent	20 ± 5	20 ± 5	20 ± 5	20 ± 5	IS 13162 (Part 5)
vii)	Breaking load on 20 × 10 cm strip, N, *Min* after U.V exposure of 1000 h for warp and weft	80 percent of the actual original value				Annex B and IS 13162 (Part 5)
viii)	Impact failure load, at 1524 mmdrop, *Min,* gram force at 50percent failure	1 150	1 840	2 875	4 025	Annex C
ix)	Tear resistance, N, *Min*	100	250	300	350	Method A1 of IS 7016 (Part 3)

x)	Puncture resistance, N, *Min*	300	500	725	900	Annex D
xi)	Bursting strength (Ball burst), N/cm², *Min*	60	110	135	200	IS 7016 (Part 6)
xii)	Seam strength before UV exposure (N/mm), *Min*	15	30	40	42	IS 15060
xiii)	Seam strength after UV exposureN/mm, *Min*	80 percent of the actual original value				Annex B and IS 15060
xiv)	Hydrostatic resistance	No leakage at10 Kg/ cm²	No leakage at 15kg/ cm²	No leakage at 20kg/ cm²	No leakage at 25kg/ cm²	Annex E
xv)	Hydrostatic resistance after U Vexposure of 1000 h	80 percent of the actual original value				Annex B and Annex E
xvi)	Ash content, percent, Max	1	1	1	1	Annex F

NOTE — For hydrostatic resistance test, the test specimen shall be selected such that at least one joint is covered, if provided.

IS 16513 : 2016 Agrotextiles – Insect Nets for Agriculture and Horticulture Purposes –Specification

1. Insect Nets for Agriculture and Horticulture Purposes

Scope: This standard prescribes constructional and other requirements for insect nets for agriculture and horticulture purposes in protecting crop from insects such as aphids, white fly, carrot fly, cabbage root fly and caterpillar etc.

- **IMPORTANT DEFINITIONS**

  Mesh — The number of openings per inch in longitudinal direction.

  Cover Factor — It is the area of insect nets covered by the yarn of the structure.

- **INSECT NETS FOR AGRICULTURE AND HORTICULTURE PURPOSES**

  Insect nets are used in various agriculture and horticulture applications mainly to protect vegetables and fruits from those crop insects that are small in stature but cause severe damage to vegetables and fruit on a large scale. These nets provide protection from insect such as aphids, whitefly, carrot fly, cabbage root fly and caterpillars etc, and also allow adequate vital sunlight, air and water for plants to grow.

- **TYPES**

  Based on the mesh, the insect nets are classified as follows:

  a) Type I — having mesh of 30;

  b) Type II — having mesh of 40; and

  c) Type III — having mesh of 50.

Fig. INSECTS NETS

REQUIREMENTS

The standard specifies the basic performance requirements such as Cover factor, Percentage change in Breaking strength after UV exposure, Bursting Strength, Air permeability etc.

Requirements of Insect Nets of Different Mesh Sizes.

Sl No.	Characteristic(s)	Requirements			Tolerance		Method of Test, Ref to
		Type I 30 Mesh	Type II 40 Mesh	Type III 50 Mesh			
(1)	(2)	(3)	(4)	(5)	(6)		(7)
i)	Mass, g/m²	90	105	125	± 5 percent		IS 1964
ii)	a) Ends per inchb) Picks per inch	3024	4024	5024	± 2	± 2	IS 1963
iii)	Covers factor, percent, *Min*	30	40	50	—		Annex B
iv)	Breaking strength of insects nets fabric before UV exposure (ravelled strip method 325 mm × 70 mm)[1], kg, *Min* a) Wrapway b) Weftway	 80 50	 120 65	 140 70	 — —		 IS 1969 (Part 1)
v)	Retention in breaking strength after UV exposure, kg, *Min*	85 Percent of original actual value of fabric					Annex C and IS 1969 (Part 1)
vi)	Bursting strength, kg/cm², *Min*	10	18	20	—		IS1966 (Part 1) or IS 1966 (Part 2)
vii)	Air permeability in mm/s at 50 pascal water head pressure, *Min*	6 500	5 000	3 000	—		IS 11056

[1] Width after raveling = 50 mm, Gauge length = 200 mm.

IS 17730 : 2021 (Part 1 & Part 2) Agro-Textiles — Hail Protection Nets for Agriculture and Horticulture Purposes — Specification

This standard is published in two parts:

1. Part 1 Warp Knitted Hail Protection Nets

Scope: This standard (Part 1) prescribes constructional and other performance requirements for knitted hail protection nets manufactured from mono filament yarns for agriculture and horticulture purposes to avoid fruit or flower drop/damage.

2. Part 2 Woven hail protection nets

Scope: This standard (Part 2) prescribes constructional and other performance requirements for woven hail protection nets manufactured from mono filament yarns for agriculture and horticulture purposes to avoid fruit or flower drop/damage.

- HAIL PROTECTION NETS

  Hail protection nets are used to avoid the damage caused to flowers or fruits from hails (seasonal or unseasonal) especially in hilly areas. These also helps in minimizing the flower drop/fruit drop due to hails. Hail protection nets can be manufactured from weaving technique as well as warp knitting technique, maintaining the optimum shading percentage and porosity to dampen the impact of heavily falling hails.

- TYPES

  IS 17730 (Part 1) : 2021 Agro-Textiles — Hail Protection Nets for Agriculture and Horticulture Purposes — Specification Part 1 Warp Knitted Hail Protection Nets

  Based on the mass in g/m2, the knitted hail protection nets are classified as follows:

  a) Type I — Having mass of 60 g/m²; and

  b) Type II — Having mass of 70 g/m².

  IS 17730 (Part 2) : 2021 Agro-Textiles — Hail Protection Nets for Agriculture and Horticulture Purposes — Specification Part 2 Woven Hail Protection Nets

  Based on the mass in g/m2, the knitted hail protection nets are classified as follows:

  a) Type I — Having mass of 60 g/m²; and

  b) Type II — Having mass of 70 g/m²


Fig. HAIL PROTECTION NETS

REQUIREMENTS

This standard also specifies important performance requirements for agro textile hail protection nets such as breaking strength, Retention of breaking strength after UV exposure, color fastness to artificial light, bursting pressure, Shading percentage, Cold cracking resistance test etc.

Requirements of Knitted Hail protection Nets

Sl No.	Characteristic(s)	Requirement(s)		Method of Test, Ref to
		Type 1	*Type 2*	
(1)	(2)	(3)	(4)	(5)
i)	Mass in g/m^2, (with a tolerance of ± 5 percent)	60	70	IS 1964
ii)	Average breaking strength of knitted hail protection fabric (Strip method, 325 × 50 mm test piece with gauge length of 200 mm), N, *Min*			IS 1969 (Part 1)
	a) Wales direction	180	180	
	b) Course direction	250	300	
iii)	Retention of breaking strength after UV exposure of 144 hours, percent, *Min*	85 percent of original actual value (fabric)		Annex B and IS 1969 (Part 1)
iv)	Colour fastness to artificial light[1)]	← 5 or better →		IS/ISO 105-B02
v)	Bursting pressure, kgf/cm^2, *Min*	6	8	IS 1966 (Part 1) or IS 1966 (Part 2)
vi)	Shading percentage, percent, *Max*	17	20	Annex C
vii)	Cold cracking resistance test at –10 °C	No specimen shall damage or broken		Annex D
viii)	Seam (joint) strength, percent, *Min*	85 percent of the original average breaking strength of the fabric		IS/ISO 13935-1

[1)] Applicable for coloured hail protection nets only

Requirements of Woven Hail protection Nets

Sl No.	Characteristic(s)	Requirement(s)		Method of Test, Ref to
		Type 1	*Type 2*	
(1)	(2)	(3)	(4)	(5)
(i)	Mass in g/m^2, (with a tolerance of ± 5 percent)	60	70	IS 1964
(ii)	Average breaking strength of woven hail protection fabric (Strip method, 325 × 50 mm test piece with gauge length of 200 mm), N, *Min*;			IS 1969 (Part 1)
	a) Warpway	450	450	
	b) Weftway	280	300	
iii)	Retention of breaking strength after UV exposure of 144 hours, percent, *Min*	85 percent of original actual value (fabric)		Annex B and IS 1969 (Part 1)
iv)	Colour fastness to artificial light[1)]	← 5 or better →		IS 105-B02
v)	Bursting pressure, kgf/cm^2, *Min*	10	12	IS 1966 (Part 1) or IS 1966 (Part 2)
vi)	Shading percentage, percent, *Max*	17	17	Annex C
vii)	Porosity, percent	80 ± 5	80 ± 5	Annex D
viii)	Cold cracking resistance test at –10 °C	No specimen shall damage or broken		Annex E
ix)	Seam (joint) strength, percent, *Min*	85 percent of the original average breaking strength of the fabric		IS/ISO 13935-1

[1)] Applicable for coloured hail protection nets onl

IS 16190:2014 High Density Polyethylene (HDPE) Laminated Woven Lay Flat Tube For Irrigation Purpose — Specification

1. High Density Polyethylene (HDPE) Laminated Woven Lay Flat Tube for Irrigation Purpose

Scope: This standard prescribes constructional and other requirements for insect nets for agriculture and horticulture purposes in protecting crop from insects such as aphids, white fly, carrot fly, cabbage root fly and caterpillar etc.

- **IMPORTANT DEFINITIONS**
- **LLDPE —** It is a co or terpolymer of ethylene produced by catalytic polymerization of ethylene with other l-alkenes having density in the range of 908.4 to 938.4 kg/m3 at 27°C (910 to 940 kg/m3 at 23°C).

HIGH DENSITY POLYETHYLENE (HDPE) LAMINATED WOVEN LAY FLAT TUBE FOR IRRIGATION PURPOSE

Transportation of the water from ponds, canal or borewell to the various part of the field for agriculture is of paramount importance. High density polyethylene laminated woven lay flat tube has been developed to easily transport water in the agriculture field and have an advantage of lighter in weight. These lay flat tubes do not require fixed installation and can transport water at the place of choice easily. Farmers are expected to incur less fixed expenditure to irrigate their field at considerably lower running cost as compare to the existing piping systems. These lay flat tubes can sustain the actual field conditions like uneven field surface, extreme climatic conditions, resistance to puncture etc.

TYPES

Based on diameter, the HDPE Lay Flat Tube covers HDPE laminated woven lay flat tube of internal diameter 50, 63, 75, 90, 110, 125, 150, 175 and 200 mm for irrigation purpose.

Fig. HDPE LAY FLAT TUBE FOR IRRIGATION

REQUIREMENTS

The standard specifies the basic performance requirements such as Mass (g/m^2), Breaking strength before UV exposure, Percentage change in Breaking strength after UV exposure, Abrasion resistance, Trapezoid tear strength, Puncture strength, Environmental stress cracking test, Cold cracking resistance test at –5°C etc.

Requirements of HDPE Woven Laminated Fabric for Woven Lay Flat Tube

Sl No.	Characteristics	Requirement(s)	Method of Test, Ref to	
			Annex	IS No.
(1)	(2)	(3)	(4)	(5)
i)	Mass, g/m^2, *Min*	260	—	IS 1964
ii)	Breaking strength before UV exposure, N, *Min*	1 200 (Warp)900 (Weft)	—	IS 1969 (Part 1)
iii)	Elongation at break, percent	20 ± 5	—	IS 1969 (Part 1)
iv)	Retention of breaking strength after UV exposure of 500 h, N, *Min*	85 percent of original actual value (fabric)	B	—
v)	Abrasion resistance	Loss in breaking strength shall not be more than 15 percent	—	IS 14714
vi)	Trapezoid tear strength, N, *Min*	100 (Warp)100 (Weft)	—	IS 14293
vii)	Puncture strength, N, *Min*	300	C	—
viii)	Environmental stress cracking test	There shall be no evidence of stress cracking	D	—
ix)	Accelerated ageing test for 72 h at 70 ± 1°C	Loss in breaking strength shall not be more than 1 percent	—	IS 7016 (Part 8) (Oven method)
x)	Cold cracking resistance test at –5°C	No specimen shall damage or broken	E	—

IS 17729 : 2021 Agro Textiles — Flexible Water Storage Tank for Agriculture and Horticulture Purposes — Specification

1. Flexible Water Storage Tank Scope:

This standard prescribes constructional particulars and performance requirements for flexible water storage tanks for storage of rain water, especially in hilly areas for agriculture and horticulture purposes.

These tanks may also be used for storage of water for other domestic and commercial applications except drinking water applications.

FLEXIBLE WATER STORAGE TANK FOR AGRICULTURE AND HORTICULTURE PURPOSES

The flexible water storage tank is used to store water in remote areas where the land is undulated and usage of rigid tanks or concrete tanks is not feasible. These tanks can be easily transportable from one place to another after the water being used at one place. The flexible water storage tanks are generally used for storage of rain water, especially in hilly areas for agriculture and horticulture application.

TYPES

Based on the capacity, the flexible tanks are categorized into the following 6 types:

Type I — Having minimum capacity of 2 kL;

Type II — Having minimum capacity of 6 kL;

Type III — Having minimum capacity of 12 kL;

Type IV — Having minimum capacity of 25 kL;

Type V — Having minimum capacity of 50 kL; and

Type VI — Having minimum capacity of 100 kL

The Flexible storage tank is made with a combination of an outer layer woven from HDPE tapes and an inner layer made up of 3 film layer of which each film is a further combination of seven sub layers made up of (PE/Tie/Nylon/ Tie/EVOH/Tie/PE) being extruded simultaneously as one film.

Fig. FLEXIBLE WATER STORAGE TANKS

REQUIREMENTS

The standard specifies the basic performance requirements such as Tensile strength at break for Machine direction & Transverse direction, Ageing test at (70 ± 1) °C for 7 days, Dart impact strength, Oxygen transmission rate etc.

Requirements for Inner Layer

Sl No.	Characteristics	Requirements	Method of Test, Ref to
(1)	(2)	(3)	(4)
i)	Tensile strength at break, kg/cm^2, *Min* a) Machine direction b) Transverse direction	 350 350	IS 13360 (Part 5/Sec 1) and IS 13360 (Part 5/Sec 3)
ii)	Elongation at break, percent, *Min* a) Machine direction b) Transverse direction	 650 650	IS 13360 (Part 5/Sec 1) and IS 13360 (Part 5/Sec 3)
iii)	Ageing test at (70 ± 1) °C for 7 days	Maximum 30 percent reduction of original values of tensile strength	4 of IS 7016 (Part 8)
iv)	Dart impact strength, g, *Min*	Shall not fail at 1650 g	Method B of IS 13360 (Part 5/Sec 6)
v)	Moisture vapour transmission rate for single inner layer, g/m^2/day, *Max*	2	Annex C
vi)	Oxygen transmission rate, cc/m^2/day, *Max*	1	ISO 15105-2

Requirements for Flexible Water Storage Tank

SINO.	Characteristics	Requirements	Method oftest, Refto
(1)	**(2)**	**(3)**	**(4)**
i)	Puncture strength, N. *Min*	300	Annex G
ii)	Ultrasonic leak test	The sample shall not show any leakage	Amex H

Requirements for Outer Layer made from PP Woven Fabric

Sl No.	Characteristics	Requirements	Method of Test, Ref to
(1)	(2)	(3)	(4)
i)	Tensile strength at break, N, *Min*		IS 1969 (Part 1)
	a) Warp	1950	
	b) Weft	1450	
ii)	Elongation at break, percent, *Min*		IS 1969 (Part 1)
	a) Warp	15	
	b) Weft	15	
iii)	Retention of tensile strength after UV exposure of 192 h (Warp and weft direction), N, *Min*	85 percent of original actual value (fabric)	Annex D
iv)	Seam strength, N, *Min*	80 percent of original actual value (fabric), before UV exposure	IS/ISO 13935-1
v)	Seam strength after UV exposure of 192 h (Warp direction), N, *Min*	80 percent of the actual original value	Annex D and IS/ISO 13935-1
vi)	Environmental stress cracking resistance	There shall be no evidence of stress cracking	Annex E
vii)	Cold crack resistance at (–) 20 °C	No specimen shall damage or broken	Annex F

IS 17358 (Part 1 & 2) : 2020 Agro textiles — Fencing nets for agriculture and horticulture purposes — Specification

This standard has two parts:

1. Part 1 Fencing Nets Made from Extruded Polymer Mesh

Scope: This standard (Part 1) prescribes constructional and other performance requirements for HDPE fencing nets for agriculture, horticulture, gardens, forestry, animal husbandry, poultry purposes in protecting from stray animals and for restricted entry etc.

2. Part 2 Fencing Nets Made from Mono Filament Yarns and Combination of Tape and Mono Filament Yarns

Scope: This standard (Part 2) prescribes constructional and other performance requirements for fencing nets manufactured from mono filament yarns and combination of tape and mono filament yarns for agriculture, horticulture, forestry, animal husbandry (poultry), purposes in protecting from stray animals, for restricted entry.

- **FENCING NETS**

  Fencing is being provided to keep the stray animal, unwanted person etc. away from agriculture, horticulture, forest or other areas. Additionally, it also provides the aesthetic to the fenced area and also helps in defining boundaries and better organization of any specified place. Monofilament fencing nets are a good alternate to galvanized metal fencing and have an advantage of light weight, easy to install and no problem of corrosion.

- **TYPES**

  IS 17358 (Part 1) : 2020 Agro textiles — Fencing nets for agriculture and horticulture purposes — Specification Part 1 Fencing Nets Made from Extruded Polymer Mesh

  Based on the application, the fencing nets are classified as follows:

  a) Light duty;

  b) Medium duty; and

  c) Heavy duty.

IS 17358 (Part 2) : 2020 Agro textiles — Fencing nets for agriculture and horticulture purposes — Specification Part 2 Fencing Nets Made from Mono Filament Yarns and Combination of Tape and Mono Filament Yarns

Based on the mass in g/m^2 and construction, the fencing nets are classified as follows:

a) Type 1 — Having mass of 110 g/m², Min with Mono × Mono construction; and

b) Type 2 — Having mass of 100 g/m², Min with Tape × Mono construction

Fig. FENCING NETS

REQUIREMENTS

The standard specifies the basic performance requirements like Mass g/m^2, Average breaking strength of fencing net fabric, Retention of breaking strength after UV exposure of 144 h, Colour fastness to artificial light, Bursting pressure etc.

Requirements of Light Duty Fencing Nets (Hexagonal Shape)

Sl No.	Characteristics	GSM of Fencing Nets				Tolerances	Method of Test, Ref to
		450	500	550	650		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Mass, g/m^2	450	500	550	650	± 5 percent	IS 1964
ii)	Mesh size, machine direction, mm	27	25	27	25	± 2 mm	Annex B
iii)	Mesh size, transverse direction, mm	28	28	28	28	± 2 mm	Annex B
iv)	Thickness at joint, mm	4	4.8	5	5.3	± 10 percent	Annex B
v)	Filament thickness, mm	2.1	2.3	2.4	2.6	± 10 percent	Annex B
vi)	Dimensions (length and width)	As declared + 1 percent with no negative tolerance				—	Annex B
vii)	Tensile strength before UV exposure, kN/m, *Min*:					—	Annex C
	a) Machine direction	4	5	5	6		
	b) Transverse direction	3.5	4	4	5		
viii)	Elongation before UV exposure, percent, *Min*:					—	Annex C
	a) Machine direction						
	b) Transverse direction						
ix)	Tensile strength after UV exposure of144 h, kN/m, *Min*:						
	a) Machine direction						
	b) Cross machine direction						

Requirements of Medium Duty Fencing Nets (Square Shape)

Sl No.	Characteristics	GSM of Fencing Nets	Tolerances	Method of Test, Ref to
		500		
(1)	(2)	(3)	(4)	(5)
i)	Mass, g/m^2	500	± 5 percent	IS 1964
ii)	Mesh size, Machine direction, mm	20	± 2 mm	Annex B
iii)	Mesh size, Transverse direction, mm	20	± 2 mm	Annex B
iv)	Thickness at joint, mm	2.2	± 10 percent	Annex B
v)	Filament thickness, mm	1.8	± 10 percent	Annex B
vi)	Dimensions (length and width)	As declared + 1 percent with no negative tolerance	—	Annex B
vii)	Tensile strength before UV exposure, kN/m, *Min*:		—	Annex C
	a) Machine direction	45		
	b) Transverse direction	30		
viii)	Tensile strength after UV exposure of 144 h, kN/m, *Min*:		—	Annex D
	a) Machine direction	85 percent of the actual original value		
	b) Cross machine direction	85 percent of the actual original value		

Requirements of Heavy Duty Fencing Nets (Diamond Shape)

Sl No.	Characteristics	GSM of Fencing Nets			Tolerances	Method of Test, Ref to
		500	820	840		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Mass, g/m^2	500	820	840	± 5 percent	IS 1964
ii)	Mesh size, machine direction, mm	40	55	64	± 2 mm	Annex B
iii)	Mesh size, transverse direction, mm	40	55	62	± 2 mm	Annex B
iv)	Thickness at joint, mm	5.7	7.4	8.5	± 10 percent	Annex B
v)	Filament thickness, mm	3.9	4.2	4.5	± 10 percent	Annex B
vi)	Dimensions (length and width)	As declared + 1 percent with no negative tolerance			—	Annex B
vii)	Tensile strength before UV exposure, kN/m, *Min*:				—	Annex C
	a) Machine direction	6	5	6		
	b) Transverse direction	5.5	4	4		
viii)	Tensile strength after UV exposure of 144 h, kN/m, *Min*:				—	Annex D
	a) Machine direction	85 percent of the actual original value				
	b) Cross machine direction	85 percent of the actual original value				

Requirements of Fencing Nets Made from Monofilament Yarns

Sl No.	Characteristic	Requirement(s)		Method of Test, Ref to
		Type 1, Mono × Mono construction	Type 2, Tape × Mono construction	
(1)	(2)	(3)	(4)	(5)
i)	Mass g/m2, *Min*	110	100	IS 1964
ii)	Average breaking strength of fencing net fabric (Strip method, 325×50 mm test piece with gauge length of 200 mm), N, *Min:* a) Warpway b) Weftway	 350 400	 350 350	IS 1969 (Part 1)
iii)	Retention of breaking strength after UV exposure of 144 h, percent, *Min*	85 percent of original actual value (fabric)		Annex B and IS 1969 (Part 1)
iv)	Colour fastness to artificial light[1)]	4 or better	IS 105-B02	
v)	Bursting pressure, kgf/cm2, *Min*	12	12	IS 1966 (Part 1) or IS 1966 (Part 2)

[1)] Applicable for coloured fencing nets only.

IS 16718:2021 Textiles - Polypropylene Spun Bonded Non-Woven Crop Covers and Fruit Skirting Bags for Agricultural and Horticultural Applications - Specification first revision

1. Polypropylene Spun Bonded Non-Woven Crop Covers and Fruit Skirting Bags

Scope: This standard prescribes the specification and performance requirements for polypropylene spun bonded non-woven fabric used for crop cover and fruit skirting bags for agricultural and horticultural applications.

While the standard refers various crops and vegetables for use of crop covers, and various fruits for fruit skirting bags, one should not interpret that this standard is applicable to only those crops, vegetables and fruits mentioned in this standard. The standard may be applied to other crops, vegetables and fruits, based on the pertinent available scientific data.

- **IMPORTANT DEFINITIONS**

  Crop Covers — Thin sheets of polypropylene non-woven fabrics used as covering for protection of seedling and growing crop from change in climate like fog, rains and sunlight. Crop covers create a micro-climate by keeping soil temperatures higher than environment temperature, thus helping plants to grow faster leading to early harvesting and higher yields.

  Fruit Skirting Bags — These are fabricated bags made of polypropylene non-woven fabrics used as covering for protection of growing fruits from change in climate like fog, rains, sunlight, diseases, insect bites and external damage. Fruit covers provide a suitable microclimate for fruits to grow faster, larger size and glossy skin with higher yields.

  Spunbond Non-woven Fabric — Fabrics produced using continuous filament spinning process technology which also includes randomly laying of spun filaments in a uniform thickness web or fleece which is subsequently thermal bonded to achieve desired inter-fiber cohesion and strength to web. If such fabrics are produced from polypropylene polymer, the fabrics are called polypropylene (PP) spunbond non-woven fabrics.

POLYPROPYLENE SPUN BONDED NON-WOVEN CROP COVERS AND FRUIT SKIRTING BAGS FOR AGRICULTURAL AND HORTICULTURAL APPLICATIONS

Crop covers are generally non-woven fabrics made from polypropylene. Crop covers are generally placed over plants and seedlings to create a micro-climate which encourages early growth and development of crop with the valuable result of both improvement in quality and yield. The crop covers are also used to protect plants from cold and frost. Up to 5 °C circulating moisture is trapped by it and in the event of a frost, the fabric freezes like film providing the plant with natural frost protection.

a) Crop covers maintains comfortable temperature conditions by reducing convection heat loss, which provide protection against frosts and cold climatic conditions during winter season;

b) Crop covers allow adequate air, moisture, light and water transmission which provide optimum growing conditions for plants and seedlings underneath; and

c) Crop covers prevents crop from being damaged by insects, birds, small animals, etc.

Crop cover fabrics can be used very successfully by small and large farmers including kitchen gardeners for vegetables, fruits and flowers.

The weight of the crop cover used is a direct function of the degree of exposure that the field is subject to and the anticipated weather conditions. The greater the anticipated climatic exposure and the more severe the weather conditions the heavier the weight and stronger the fabric needs to be. Typical weights of spun-bond non-woven polypropylene fabric used as crop cover are 17 g/m2 and 22 g/m2 . Being very light; it is very economical. The fabric has specialized UV absorbers incorporated in it which ensures protection against the sun's rays.

Experience has shown that,

a) in isolated cases, where lightweight fabric is used in more exposed conditions than would normally be recommended, the fabric can get adversely damaged thus affecting the crop underneath.

b) a lot of the fabric is being reused for several different growing seasons. Consequently, a longer product life is expected than the fleece was originally intended to provide.

c) sometimes, there is a reluctance to use heavier weight fabric, in circumstances where it would be more appropriate, as this would reduce light transmission through the fabric has adversely affect the crop.

TYPES

Based on the fabric mass, non-woven fabrics used to produce crop covers and fruit skirting bags are classified into two types:

a) Type 1 — Having minimum mass of 17 g/m²; and

b) Type 2 — Having minimum mass of 22 g/m²

Fig. Fruits Skiriting Bags

REQUIREMENTS

The standard specifies the basic performance requirements like GSM , Breaking load, Puncture resistance, Tear resistance etc.

Requirement for Laminated HDPE Woven Geomembrane for Water Proof Lining

Sl No.	Characteristic	Requirement(s)				Method of Test, Ref to
		Type I	Type II	Type III	Type IV	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Thickness (mm), *Min*	0.25	0.50	0.75	1.00	IS 7016 (Part 1)
ii)	Mass (g/m2), *Min*	250	420	650	950	IS 7016 (Part 1)
iii)	Dimensions (length and width)	As declared + 1 percent with no negative tolerance				Annex A of IS 11652
iv)	Carbon black content, percent	2.5 ± 0.5	IS 2530			
v)	Breaking load on 20 × 10 cm strip,N, Min before U.V exposure: a)Warpway b)Weftway	 3 300 3 000	 6 600 6 000	 8 200 7 400	 10 700 9 700	IS 13162 (Part 5)
vi)	Strain at maximum load, percent	20 ± 5	20 ± 5	20 ± 5	20 ± 5	IS 13162 (Part 5)
vii)	Breaking load on 20 × 10 cm strip, N, Min after U.V exposure of 1000 h for warp and weft	80 percent of the actual original value				Annex B and IS 13162 (Part 5)
viii)	Impact failure load, at 1524 mmdrop, Min, gram force at 50percent failure	1 150	1 840	2 875	4 025	Annex C
ix)	Tear resistance, N, *Min*	100	250	300	350	Method A1 of IS 7016 (Part 3)
x)	Puncture resistance, N, *Min*	300	500	725	900	Annex D
xi)	Bursting strength (Ball burst),N/cm², *Min*	60	110	135	200	IS 7016 (Part 6)
xii)	Seam strength before UV exposure (N/mm), *Min*	15	30	40	42	IS 15060
xiii)	Seam strength after UV exposure N/mm, *Min*	80 percent of the actual original value				Annex B and IS 15060
xiv)	Hydrostatic resistance	No leakage at 10 Kg/cm²	No leakage at 15kg/cm²	No leakage at 20kg/cm²	No leakage at 25kg/cm²	Annex E
xv)	Hydrostatic resistance after UV exposure of 1000 h	80 percent of the actual original value				Annex B and Annex E
xvi)	Ash content, percent, *Max*	1	1	1	1	Annex F

NOTE — For hydrostatic resistance test, the test specimen shall be selected such that at least one joint is covered, if provided.

IS 16089 : 2013 Jute Agro-textile — Sapling Bags for Growth of Seedling/Sapling — Specification

1. Sapling Bags for Growth of Seedling/Sapling

Scope: This standard specifies requirements of jute sapling bag made from hessian cloth to use for growth of sapling in nursery.

- **IMPORTANT DEFINITIONS**

  Woven Jute Agro-Textile — Interlacement of warp and weft yarn to form a fabric, conforming to the specified weight, thickness, tensile strength, open area percentage, water holding capacity.

  Open Area Ratio — Ratio between total area of openings in a jute agro-textile (JAT) and total area covered by the JAT expressed as percentage.

  Tensile Strength — The stretching load at which a JAT sample breaks. The JAT is stretched by gripping it at two ends till its failure or break. It is expressed, in kN/m.

  Drapability — Measure of a jute agro-textile to shape itself to the contours of any surface. It is a measure of 'flex-stiffness' that is binding of jute agrotextile under its own weight between two points on a surface.

SAPLING BAGS FOR GROWTH OF SEEDLING/SAPLING

Jute is a natural bio-degradable eco-friendly textile grade bast fibre. Various conventional products, like, sacks, Hessian cloth made from jute fibre are widely used all over the world with distinct environmental advantage. Diversified jute products, in the name of technical textiles, that is geo-textiles (for example, soil saver) and agrotextiles have entered into the fields of civil engineering, agri-horticulture and forestry. Apart from its wide uses as geo-textile for river bank protection, road construction, control of railway track settlement, embankment protection, mine spoil stabilization, etc, it has also been effectively used as agro-textile for growth of seedling/sapling in nursery. Jute agro-textile for use as sapling bag which is made from plain weave hessian cloth has been developed by Indian Jute Industries' Research Association (IJIRA). The fabric is cut and stitched with conventional lock stitch or chain stitch sewing machine to make a bag.

Jute Agro-Textiles (JAT) provides the natural answer to faster sapling growth in the nurseries. JAT is a natural fabric, made of jute fibre, that helps retain soil humidity at a conducive level, arrest desiccation of soil and attenuates extremes of temperature due to the intrinsic characteristics of jute and capacity to absorb water/moisture up to about 5 times of its dry weight. On bio-degradation, jute coalesces with soil, increasing its permeability and supplementing its nutrient level. JAT provides all these advantages without affecting eco-ambience adversely.

Fig. Jute Sapling Bags

REQUIREMENTS

The standard specifies the basic performance requirements like GSM, Open area Percent, Water holding capacity, Tensile strength etc.

Requirements for Woven Jute Agro-Textile for Sapling Bag

Sl No.	Characteristic(s)	Requirement(s)	Tolerance	Method of Test, Ref to	
				IS No.	Annex
(1)	(2)	(3)	(4)	(5)	(6)
i)	Mass, g/m², *Min*	272	± 10 percent	IS 2387	—
ii)	Thickness, mm	1.2	± 10 percent	IS 7702	—
iii)	Open area, percent	20	± 10 percent	—	B
iv)	Threads/dm: a) Warp b) Weft	 47 47	 +4 percent -2 percent	 +4 percent -2 percent	
v)	Width of Hessian fabric, cm	101	± 10 percent	IS 1954	—
vi)	Length and width of sapling bags, cm, *Min*	As agreed		IS 9113	—
vii)	Water holding capacity, percent	400	± 10 percent	—	C
Viii)	Tensile strength, kN/m: a) Warp b) Weft	 11 12	 ± 10 percent ± 10 percent	IS 1969 (Part 1)	

IS 15907:2010 Agro textiles — High density polyethylene HDPE woven beds for vermiculture — Specification

High density polyethylene HDPE woven beds for vermiculture

Scope: This standard prescribes constructional and other requirements for high density polyethylene (HDPE) woven beds for vermiculture used in producing compost for agricultural purposes.

- IMPORTANT DEFINITIONS

  Vermicompost — It is well decomposed stable, fine granular byproduct from composting process mediated through the activities of earthworm.

  Vermiculture — The process of producing vermicompost is called vermiculture. The earth worm gives excreta fast, after eating any kind of decayed decomposed organic material. Hence, the crop/plants can get the additional nutrients from vermicompost. Eisena foetida worm may be used in the process.

  Vermiwash — The liquid collected at the drain of the bed is called vermiwash. This liquid consists of different micro-nutrients vitamins and digestive elements. Earthworm excretes a sticky liquid from its glandor. This contains Colamic pyulite and antifungal liquid.

VERMIBEDS

Today's agriculture or farming is in great threat due to regular use of chemical fertilizers. The soil texture is being deteriorated and becoming salinated. There is no incremental output and even quality of soil is also deteriorating and crops are increasingly becoming prone to various diseases. This leads to increased expenditure on agromedicines. Most important is the decay of various/useful organic factors from the soil. Here organic fertilizers play a major role in maintaining the texture, quality and yield of the soil. Organic fertilizer is nothing but fertilizer produced by decomposition of organic waste of agro based products. This fertilizer provides all sixteen types of main, subsidiary and micro-nutrients with different vitamins and digestive elements. Traditionally cement structures were used for the purpose but of late portable beds made from plastics have made entry into the market. These synthetic beds enjoy greater advantages over the traditional ones in terms of space, durability, ease of handling, yield of compost, cost, etc.

Fig. HDPE LAMINATED VERMIBEDS

REQUIREMENTS

The standard specifies the basic performance requirements like GSM , Breaking strength before UV exposure, Puncture resistance, Tear resistance, Bursting pressure, Resistance to chemicals etc.

Requirements of Beds Made from HDPE Woven Fabrics

S.N.	Characteristic	Requirements	Method of Test, Ref to
(1)	(2)	(3)	(4)
i)	Mass, g/m², *Min*	340 (see 6.1)	IS 1964
ii)	Breaking strength before UV exposure, N, *Min*	1 900 (Warp)1 300 (Weft)	IS 1969
iii)	Elongation at break, percent	20 ± 5	IS 1969
iv)	Retention of breaking strength after UV exposure,N, *Min*	85 percent of original actual value (fabric)	Annex B and IS 1969
v)	Welded seam strength before UV exposure, N, *Min*	65 percent of original actual value (fabric)	IS 1969
vi)	Welded seam strength after UV exposure, N, *Min*	85 percent of original actual value	Annex B and IS 1969
vii)	Tear strength, N, *Min*	100 (Warp)100 (Weft)	Method A2 of IS 7016 (Part 3)
viii)	Puncture strength, N, *Min*	325	Annex C
ix)	Environmental stress cracking test	There shall be no evidence of stress cracking	Annex D
x)	Resistance to chemicals, change in the mass, percent, *Max*	0.1 percent	Annex E
xi)	Colour fastness to artificial light[1)]	4 or better	IS 2454 (Xenon lamp method)
xii)	Bursting pressure, kgf/cm², *Min*	35	IS 1966
[1)] Applicable for coloured beds only.			

IS 16202 : 2014 Agro Textiles — Woven Ground Covers for Horticulture Application — Specification

Woven Ground Covers for Horticulture Application

Scope: This standard prescribes constructional and other requirements for high density polyethylene (HDPE) woven beds for vermiculture used in producing compost for agricultural purposes.

- **IMPORTANT DEFINITIONS**

  Horticulture — Horticulture is the science or art of cultivating fruits, vegetables, flowers, or ornamental plants. Etymologically, "horticulture" can be broken down into two Latin words: hortus (garden) and cultus (tilling).

  Woven Fabrics — Fabric composed of at least two sets of yarns — one warp (longitudinal) and one filling (crosswise) — laced at right angles to each other.

  Ground Covers — Ground covers are made up of natural or synthetic materials that are either woven or non-woven products used to suppress weed growth around the crop by covering the soil, blocking extreme climatic conditions of sunlight or cold.

WOVEN GROUND COVERS FOR HORTICULTURE APPLICATIONS

Weed control has been an on-going problem in horticultural crops. However, a wide range of agrotextiles fabrics like polypropylene woven ground covers are now available, which offer perfect solution for successfully suppressing the weed growth and providing other benefits as provided by traditionally used materials for this application.

The ground covers made up of natural or synthetic materials are either woven or non-woven products and are used to meet diverse needs of crops in the horticulture sector like suppression of weed growth around the plant, water conservation, soil temperature moderation, increase in yield etc, by blocking extreme climatic conditions of sunlight or cold.

UV stabilized woven ground covers made out of polypropylene tape yarn fabric are durable and ideal product for weed free surfaces around the crops besides providing other benefits and promoting the growth of crops. They allow roots to breathe and water, air and nutrients to permeate through. This maintains higher soil temperatures and promotes more rapid and even plant growth. Ground covers made of woven fabric of UV stabilized polypropylene tape yarns survive through the effect of continuous exposure to sunlight.

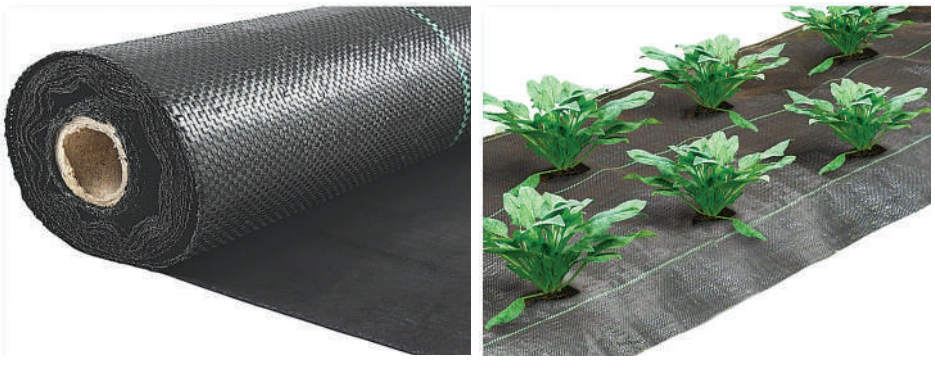


Fig. WOVEN GROUND COVERS

REQUIREMENTS

The standard specifies the basic performance requirements like Tensile Strength in war and weft way, Tear strength, Index puncture resistance, Air permeability, Water permeability etc.

Table 1 Requirements for 100 gsm Woven Ground Covers Made from PP

(*Clause* 5.1)

Sl No.	Characteristic(s)	Requirement(s)	Method of Test, Ref to
(1)	(2)	(3)	(4)
i)	Mass, g/m^2, *Min*	100	IS 1964
ii)	Tensile strength (grab), kgf, *Min*		IS 1969 (Part 2)
	a) Warp way	65	
	b) Weft way	35	
iii)	Tear strength, kgf, *Min*		IS 6489 (Part 1)
	a) Warp way	30	
	b) Weft way	18	
iv)	Air permeability, cft/ft^2/s, *Min*	20	IS 11056
v)	Index puncture resistance, kgf, *Min*	25	Annex B
vi)	UV accelerated exposure testing, percent strength retained, *Min*	70	Annex C
vii)	Water permeability lt/m^2/s, *Min*	7	IS 14324
viii)	Water vapour permeability, g/m^2/day, *Min*	730	ISO 11092

IS 16627 : 2017 Agro Textiles — High Density Polyethylene (HDPE) Laminated Woven Lay Flat Tube for Use in Mains and Submains of Drip Irrigation System — Specification

LAY FLAT TUBE FOR USE IN MAINS AND SUBMAINS OF DRIP IRRIGATION SYSTEM

Scope: This standard prescribes constructional, performance and other requirements for high density polyethylene (HDPE) laminated woven lay flat tube for use in mains and submains of drip irrigation system. These lay flat tubes are not suitable for use in sprinkler system.

High Density Polyethylene (HDPE) Laminated Woven Lay Flat Tube for Use in Mains and Submains of Drip Irrigation System

Water resources have been diminishing day-by-day. There is an urgent need to conserve and retain whatever water resources that we have. In order to retain and wisely use the limited water resources, drip irrigation system was developed and by this crops could be grown by using the optimal quantity of water.

The drip irrigation used today comprises mainly of (a) Main line pipe, and (b) Lateral pipe. The main pipes most commonly used are of HDPE/PVC material. The lateral pipes are of LLDPE/LDPE material. The lateral pipes have outlets of water in the forms of holes according to the distance between plants so that the water used for irrigation drips directly to the roots of the plants. This saves significant amount of water in many cases.

This network of HDPE/PVC and LDPE/LLDPE pipes can be installed in many types of ground and can be altered as per the requirement of the plantation. Government of India is already promoting this drip irrigation system so that farmers in all parts of India are motivated to use this technique.

Drip irrigation systems using HDPE/PVC pipes as main lines have limitation of installation at undulated surfaces, cost and storage constrains, etc. The flexible, foldable, light weight, easy to install drip irrigation system has been developed so that farmers with low resources (having small land holding) can take advantage of the drip technique. In areas where land is undulated, these lay flat tubes can be installed very easily. HDPE laminated woven lay flat tube can be install single-handedly by a farmer, by using manual hand-held tool. Secondly, these lay flat tubes are usually supplied in lengths of 100 m which enable the farmers to incur lesser cost for accessories like clamps, joiners to increase length as compare to HDPE/PVC pipes.

The drip irrigation system used today requires use of control compression to make water flow to all the plants. This is again an additional cost to the farmers as pressure instruments and electricity is used. In some parts of the country where there is crisis of electricity, and for smaller fields, water pressure is maintained through gravity by installing the water container (above the ground) so that the water flows directly to the roots of the plants. The water container can be filled by using a ladder. HDPE laminated woven lay flat tube for use in main and submain of drip irrigation system is ideally suited for gravity mechanism

TYPES

Based on the mass of the multi-layer laminated fabric, lay flat tubes for drip irrigation system are of following types:

a) Type I — Lay flat tubes for drip irrigation system made from multi-layer laminated fabric of minimum 400 g/m².

b) Type II — Lay flat tubes for drip irrigation system made from multi-layer laminated fabric of minimum 550 g/m².

Fig. HDPE Lay Flat Tube for Drip Irrigation

REQUIREMENTS

The standard specifies the basic performance requirements like Mass in g/m^2,Trapezoid Tear strength, puncture strength, stress cracking test etc

Requirements of HDPE Woven Laminated Fabric
(Clause 6)

Sl No.	Characteristic	Requirement		Method of Test, Ref to	
		Type I	Type II	Annex	IS No.
(1)	(2)	(3)	(4)	(5)	(6)
i)	Mass, g/m², *Min*	400	550	—	IS 1964
ii)	Breaking strength on 5 cm × 20 cm strip before UV exposure, N, *Min*	1 900 (Warp) 1 500 (Weft)	3 300 (Warp) 3 000 (Weft)	—	IS 1969 (Part 1)
iii)	Elongation at break, percent	20 ± 5	20 ± 5	—	IS 1969 (Part 1)
iv)	Retention of breaking strength after UV exposure of 500 h, N, *Min*	← 85 percent of original actual value (fabric) →		B	—
v)	Abrasion resistance	← Loss in breaking strength shall not be more than 15 percent →		—	IS 14714
vi)	Trapezoid tear strength, N, *Min*	650 (Warp) 600 (Weft)	750 (Warp) 700 (Weft)	—	IS 14293
vii)	Puncture strength, N, *Min*	700	1 100	C	—
viii)	Environmental stress cracking test	← There shall be no evidence of stress cracking →		D	—
ix)	Accelerated ageing test for 72 h at 70 ± 1°C	← Loss in breaking strength shall not be more than 15 percent →		—	IS 7016 (Part 8) (Oven method)
x)	Cold cracking resistance test at –5°C	← No specimen shall damage or broken →		E	—

IS 17728 : 2021 Agro Textiles — High Density Polyethylene (HDPE) Laminated Woven Lay Flat Tube and Fittings for use in Rain Irrigation System — Specification

LAY FLAT TUBE AND FITTINGS FOR USE IN RAIN IRRIGATION SYSTEM

Scope: This standard prescribes constructional, performance and other requirements for high density polyethylene (HDPE) laminated woven lay flat tube and their fittings for use in rain irrigation system.

This standard applies to high density polyethylene (HDPE) laminated woven lay flat tube for use in rain irrigation system. These tubes are laser perforated to replicate the rain effect when used for irrigation of horticulture and agriculture crops. This standard also applies to the fittings used for connecting these perforated lay flat tubes.

High Density Polyethylene (HDPE) Laminated Woven Lay Flat Tube and Fittings for use in Rain Irrigation System

Water resources have been diminishing day-by-day. There is an urgent need to conserve and retain whatever water resources that we have. In order to retain and wisely use the limited water resources, rain irrigation system was developed and by this vegetable crops like tomato, brinjal, cabbage, capsicum etc. could be grown by using the optimal quantity of water.

Rain irrigation system provides continuous distribution of water from perforated lay flat tube with 180° angle covering, provides uniform distribution and 100 percent humidity and fast capability to irrigate the field with drizzle like rain. Rain irrigation system is widely used for closely spaced crops like onion, vegetable crops, leafy vegetables etc. This system is comparatively less in weight, flexible and easy to maintain and also helps in water saving as compared to other irrigation systems.

Supply of saline water through the rain irrigation shall be avoided which may result in blocking of the holes of perforated lay flat tube. This irrigation is most effective for crop height up to 75 cm after which effectiveness is reduced. Irrigation of crops, with some foliar diseases which multiplies in high humidity at a particular stage, shall be avoided with rain irrigation system.

Fig. HDPE LAY FLAT TUBE FOR DRIP IRRIGATION

REQUIREMENTS

The standard specifies the basic performance requirements like Breaking Strength, Puncture strength, cold cracking resistance, accelerated ageing test for 72h etc.

Requirements of HDPE Laminated Woven Fabric

Sl No.	Characteristic	Requirement	Method of Test, Ref to
(1)	(2)	(3)	(4)
i)	Mass, g/m², *Min*	260	IS 1964
ii)	Breaking strength on 5 cm × 20 cm strip before UV exposure, N, *Min*	1 200 (Warp) 900 (Weft)	IS 1969 (Part 1)
iii)	Elongation at break, percent	15 to 25	IS 1969 (Part 1)
iv)	Retention of breaking strength after UV exposure of 500 h, N, *Min*	85 percent of original actual value (fabric)	Annex B
v)	Abrasion resistance	Loss in breaking strength shall not be more than 15 percent	IS 14714
vi)	Trapezoid tear strength, N, *Min*		IS 14293
	a) Warp	100	
	b) Weft	100	
vii)	Puncture strength, N, *Min*	300	Annex C
viii)	Accelerated ageing test for 72 h at 70 ± 1 °C	Loss in breaking strength shall not be more than 15 percent	IS 7016 (Part 8) (Oven method)
ix)	Cold cracking resistance test at −5 °C	No specimen shall damage or broken	Annex E

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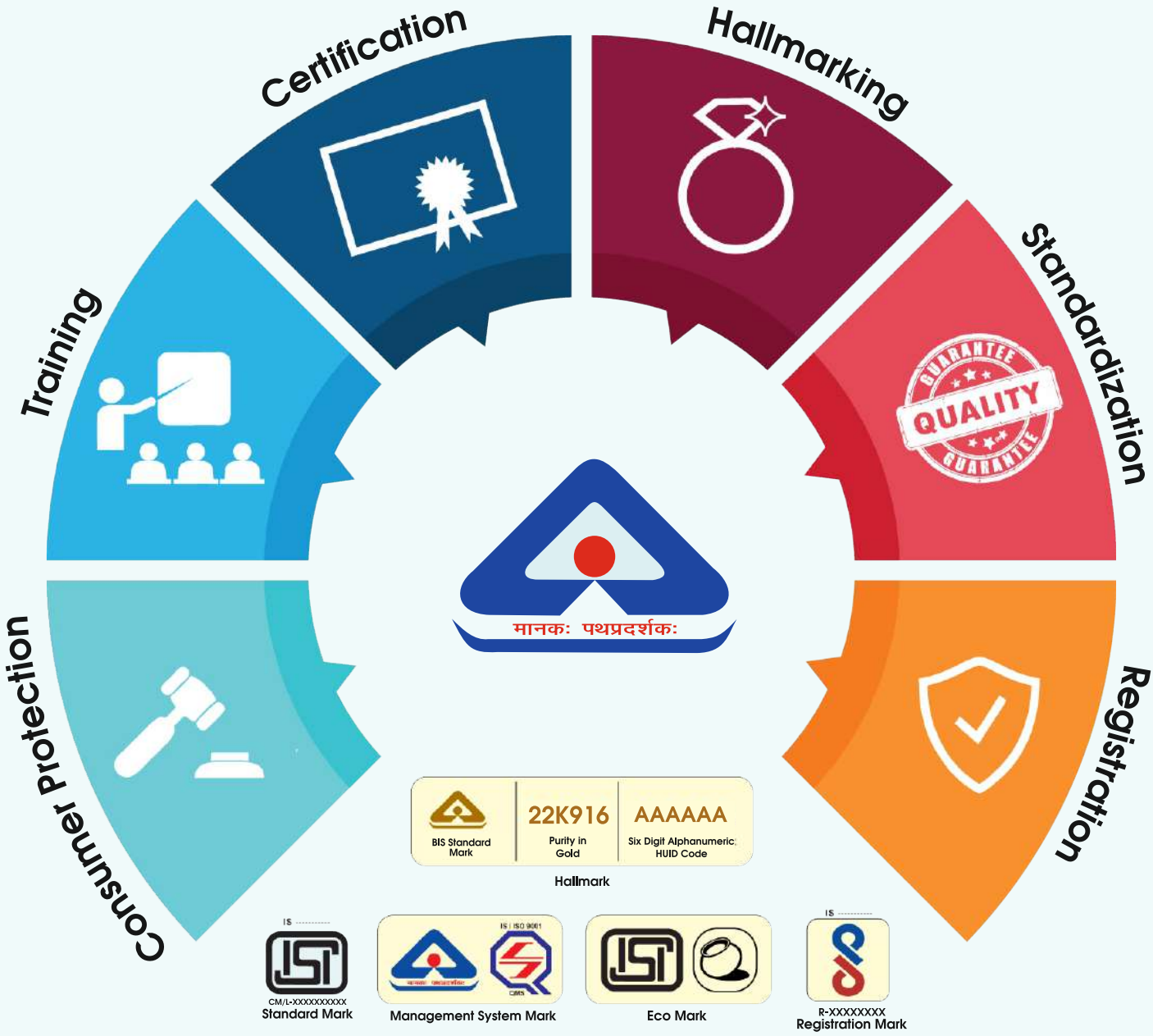

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