



**PRODUCT MANUAL FOR
GEOSYNTHETICS - HIGH DENSITY POLYETHYLENE (HDPE)
GEOMEMBRANES FOR LINING
ACCORDING TO IS 16352:2020**

This Product Manual shall be used as reference material by all Regional/Branch Offices & licensees to ensure coherence of practice and transparency in operation of certification under Scheme-I of Bureau of Indian Standards (Conformity Assessment) Regulations, 2018 for various products. The document may also be used by prospective applicants desirous of obtaining BIS certification licence/certificate.

1.	Product	:	IS 16352 : 2020
	Title	:	GEOSYNTHETICS - HIGH DENSITY POLYETHYLENE (HDPE) GEOMEMBRANES FOR LINING
	No. of Amendments	:	0
2.	Sampling Guidelines:		
a)	Raw material	:	Clause 3 of IS 16352:2020
b)	Grouping guidelines	:	Please refer ANNEX – <u>A</u>
c)	Sample Size	:	15m x full width
3.	List of Test Equipment	:	Please refer ANNEX – <u>B</u>
4.	Scheme of Inspection and Testing	:	Please refer ANNEX – <u>C</u>
5.	Possible tests in a day :		
	(i)	Dimensions (Clause 6)	
	(ii)	Colour, Surface Characteristics and Freedom from defects(Claue 7)	
	(iii)	Tensile test(Claue 3.1 table 1)	
6.	Scope of the Licence :		
	“Licence is granted to use Standard Mark as per IS 16352:2020 with the following scope:		
	Name of the product	Geosynthetics - High Density Polyethylene (HDPE) Geomembranes For Lining	
	Finish	Smooth Geomembranes and/or Textured Geomembranes (Single or double sided)	
	Type	Smooth Geomembranes - Type I, II, III, IV, V, VI, VII Textured Geomembranes (Single or double sided) - Type I, II, III, IV, V, VI	

ANNEX A
Grouping Guidelines

Geosynthetics - High Density Polyethylene (HDPE) Geomembranes For Lining are grouped as given below for GoL/CSoL:

Group	Varieties
I	Smooth Geomembranes - Type I, II, III, IV, V, VI, VII
II	Textured geomembranes (Single or double sided) - Type I, II, III, IV, V, VI

Considering the above following grouping guidelines for GoL/CSoL have been developed:

Higher thickness material has higher yield strength, breaking strength, tear resistance and puncture resistance. One sample of higher thickness from the group shall be tested to cover all the lower thickness in the group.

For example, if sample of Smooth Geomembrane of Type VI (thickness of 2.50mm) is tested, then all Smooth Geomembranes of lower thicknesses (Type I to Type V) may also be covered in the scope of licence.

The Firm shall declare the thickness of the membranes they intend to cover in the Licence. The Scope of Licence may be restricted based on the Manufacturing and Testing capabilities of the Manufacturer.

During the operation of the Licence, BO shall ensure that all the thickness covered in the Licence are tested in rotation, to the extent possible.

ANNEX B
List of Test Equipment

Major test equipment required to test as per the Indian Standard

S. No.	Test Used in with Clause reference	Test Equipment
1.	Length and Width, SI no i- Table 1 and 2	Steel scale of desired range and least count, flat table, cutting and marking tools
2.	Average thickness at a pressure of 2 ± 0.01 kPa, SI no ii- Table 1 Lowest Individual of 10 thickness value , SI no iii- Table 1 and 2	Thickness tester with interchangeable presser foot, reference plate and gauge as per IS 13162 (Part 3):1992
3.	Average Core thickness- SI no ii- Table 2	Thickness gauge capable of exerting force of 0.56 ± 0.05 N as per Annex K of IS 16352:2020
4.	Tensile Properties, SI no iv- Table 1 and SI no v - Table 2	Tensile Testing machine as per Annex B of IS 16352:2020, Conditioning Chamber
5.	Average Asperity Height, , SI no iv- Table 2	Depth Gauge as per Annex L of IS 16352:2020, Conditioning Chamber
6.	Tear Resistance, SI no v- Table 1 and SI no vi - Table 2	Testing machine as per Annex C of IS 16352:2020, Conditioning Chamber
7.	Puncture Resistance, SI no vi- Table 1 and SI no vii - Table 2	Tensile/Compression Testing Machine, Ring Clamp Attachment and Solid Steel Rod as per Annex D of IS 16352:2020, Conditioning Chamber
8.	Low Temperature Crack resistance, SI no vii- Table 1 and SI no viii - Table 2	Impact Device, Cooling Chamber, Thermometer, Conditioning Chamber as per Annex E of IS 16352:2020
9.	Hydrostatic Resistance, SI no viii- Table 1 and SI no ix - Table 2	Mullen Type Hydrostatic Tester as per Annex F of IS 16352:2020
10.	Seam Strength, SI no ix- Table 1 and SI no x - Table 2	Tensile Testing Machine as described in Appendix B of IS 2076
11.	Carbon Black Content and Dispersion, SI no x- Table 1 and SI no xi - Table 2	Combustion Boat, Combustion Tube, Gas Flow meter, Thermometer, Furnace, gases and reagents as per Cl. 10 of IS 2530:1963 Microscope slides, Hot Plate, Weighing Balance, Calipers, Deadweight type Dial-Thickness gauge, magnifier as per Cl. 16 of IS 2530:1963
12.	Oxidative Induction Time, SI no vii- Table 1 and SI no viii - Table 2	Differential Scanning calorimeter as per ISO 11357-6:2018, High pressure differential scanning calorimeter as per ASTM D 5885:2017
13.	Oven ageing at 85°C, Retention of Oxidative Induction Time after 90 days, SI no vii- Table 1 and SI no viii - Table 2	Differential Scanning calorimeter as per ISO 11357-6:2018, High pressure differential scanning calorimeter as per ASTM D 5885:2017
14.	Retention of breaking strength after UV Exposure of 144 hours, SI no vii- Table 1 and SI no viii - Table 2	UV Resistance test apparatus with Fluorescent UV-Lamp Type B as per Annex H of IS 13652:2020
15.	Stress Crack resistance, SI no vii- Table 1 and SI no viii - Table 2	Blanking Die, Notching Device, Blade, Stress Cracking Apparatus and reagent as per Annex J of IS 13652:2020

The above list is indicative only and may not be treated as exhaustive

ANNEX C

Scheme of Inspection And Testing

1. LABORATORY - A laboratory shall be maintained which shall be suitably equipped (as per the requirement given in column 2 of Table 1) and staffed, where different tests given in the specification shall be carried out in accordance with the methods given in the specification.

1.1 The manufacturer shall prepare a calibration plan for the test equipments.

2. TEST RECORDS – The manufacturer shall maintain test records for the tests carried out to establish conformity.

3. LABELLING AND MARKING – The Standard Mark, as given in the Schedule of the licence, shall be marked on each roll of HDPE Geomembrane or on a label affixed to it, provided always that the product thus marked conforms to every requirements of the specification.

3.1 Labelling and marking shall be done as per the provisions of the Indian Standard. In addition, the following details shall be marked on the label of each roll:-

a) BIS Licence No. CM/L-----.

b) BIS website details i.e. –“For details of BIS certification please visit www.bis.gov.in

3.2 **Guidelines for installation of HDPE Geomembrane** as per Annex N of IS 16352:2020 may be supplied with each consignment/order of HDPE Geomembranes bearing Standard Mark.

4. CONTROL UNIT – For the purpose of this scheme, all HDPE geo-membranes, for lining, of same Finish and Type manufactured from same material under similar conditions in a day shall constitute a control unit.

5. LEVELS OF CONTROL - The tests as indicated in column 1 of Table 1 and the levels of control in column 3 of Table 1, shall be carried out on the whole production of the factory which is covered by this plan and appropriate records maintained in accordance with paragraph 2 above.

6. REJECTIONS – Disposal of non-conforming product shall be done in such a way so as to ensure that there is no violation of provisions of BIS Act, 2016.

TABLE 1: LEVELS OF CONTROL

(1) Test Details				(2) Test equipment requirement R: required (or) S: Sub-contracting permitted	(3) Levels of Control		
Cl.	Requirement	Test Method		No. of Sample	Frequency	Remarks	
		Clause	Reference				
3.1	Material	3.1	IS 16352	S	One	Each Consignment See Note 3	
3.1	Manufacture	3.1	IS 16352	R	Each roll		
3.2	Joints	3.2	IS 16352	R	Six	Every Control Unit Two samples from each shift	
Sl no i- Table 1 and 2	Length	-	IS 7016 (Part 1)	R	Six	Each Control Unit Two samples from each shift	
-do-	Width	-	IS 7016 (Part 1)	R	Six	Each Control Unit Two samples from each shift	
Sl no ii- Table 1	Average thickness at a pressure of 2±0.01kPa	Method A	IS 13162 (Part 3)	R	Six	Each Control Unit Two samples from each shift (For Smooth HDPE Geomembranes)	
Sl no ii- Table 2	Average Core thickness	Annex K	IS 16352	R	Six	Each Control Unit Two samples from each shift (For Textured HDPE Geomembranes)	
Sl no iii- Table 1 and 2	Lowest individual of 10 thickness value	Method A	IS 13162 (Part 3)	R	Six	Each Control Unit Two samples from each shift	
Sl no iv- Table 1 and Sl no v - Table 2	Tensile Properties	Annex B	IS 16352	R	Three	Each Control Unit One samples from each shift	
Sl no iv- Table 2	Average Asperity Height	Annex L	IS 16352	R	Three	Each Control Unit One samples from each shift (For Textured HDPE Geomembranes)	

SI no v- Table 1 and SI no vi - Table 2	Tear Resistance	Annex C	IS 16352	R	Three	Each Control Unit	One samples from each shift
SI no vi- Table 1 and SI no vii - Table 2	Puncture Resistance	Annex D	IS 16352	R	Six	Each Control Unit	Two samples from each shift
SI no vii- Table 1 and SI no viii - Table 2	Low temperature Crack resistance at minus 30°C±1°C	Annex E	IS 16352	R	Six	Each Control Unit	Two samples from each shift
SI no viii- Table 1 and SI no ix - Table 2	Hydrostatic Resistance	Annex F	IS 16352	R	Six	Each Control Unit	Two samples from each shift
SI no ix- Table 1 and SI no x - Table 2	Seam Strength	Annex G	IS 16352	R	Six	Each Control Unit	Two sample from each shift
SI no x- Table 1 and SI no xi - Table 2	Carbon Black content	-	IS 2530	R	Three	Each Control Unit	One sample from each shift
-do-	Carbon Black Dispersion	-	IS 2530	R	Three	Each Control Unit	One sample from each shift
SI no vii- Table 1 and SI no viii - Table 2	Oxidative Induction Time a) Standard OIT, or b) High pressure OIT		a) ISO 11357 (Part 6) b) ASTM D 5855	S	One	Once in six months	Samples of all types to be tested by rotation.
SI no vii- Table 1 and SI no viii - Table 2	Oven ageing at 85°C, Retention of Oxidative Induction Time after 90 days	-	Oven method of IS 7016 (Part 8), ISO 11357 (Part 6) and ASTM D 5855	S	One	Once in six months	-do-
SI no vii- Table 1 and SI no viii - Table 2	Retention of Breaking Strength after UV Exposure	Annex H	IS 16352	S	One	Once in six months	-do-

	of 144 hrs							
Sl no vii- Table 1 and Sl no viii - Table 2	Stress resistance	Crack	Annex J	IS 16352	S	One	Once in six months	-do-
6	Dimension tolerances	and	-	IS 7016 (Part 1)	R	Six	Every Control Unit	Two samples from each shift
7.1, 7.2	Colour, Characteristics and freedom from defects	Surface and from	Annex M	IS 16352	R	Each Roll	-	-

Note-1: Whether test equipment is required or sub-contracting is permitted in column 2 shall be decided by the Bureau and shall be mandatory. Sub-contracting is permitted to a laboratory recognized by the Bureau or Government laboratories empaneled by the Bureau.

Note-2: Levels of control given in column 3 are only recommendatory in nature. The manufacturer may define the control unit/batch/lot and submit his own levels of control in column 3 with proper justification for approval to BO head.

Note-3: No testing is required, In case consignment of material (HDPE) is accompanied with manufacturer's test certificate, or BIS Recognized Lab's test report indicating conformity or is ISI marked.