

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS

Draft for comments only

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भारतीय मानक मसौदा

कृषि वस्त्रादि - उच्च घनत्व वाले पॉलिइथाईलीन (एच डी पी ई) के बुने हुए ग्रो बैग-
विशिष्टि

Draft Indian Standard

**AGRO TEXTILE — HIGH DENSITY POLYETHYLENE (HDPE)
WOVEN GROW BAGS — SPECIFICATION**

ICS: 65.020.20, 83.140.01

Technical Textiles for Agro-tech) Applications
Sectional Committee, TXD 35

last date for receipt of comments is
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FOREWORD

(Formal clauses will be added later)

Gardening and flower pots often go hand in hand as flower pots provide a convenient and versatile container for growing plants but there are some limitation of traditional flower pots such as warding off root circulation, resistance to binding, drainage issues, portability, poor aeration, oxygen availability and hinder root ball development in pots due to lack of space.

The concept of grow bags originated as a solution to address some of the limitations and challenges associated with traditional flowerpots. Their popularity and uses in gardening have increased over the year.

Grow bags have gained popularity among gardeners for several reason. They are portable and light weight making them suitable for a range of gardening setups including balconies, rooftops and urban gardening by allowing roots to breathe and become air-prune. Grow bags aim to create a

more efficient and robust root system. Soil mix improve nutrient uptake grow bag facilitate this process by providing better drainage process and ultimately healthier plants. The fabric construction of grow bag also allows for better temperature regulation, preventing overheating of roots and facilitating better root insulation during colder months.

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 constructional and other requirements for high density polyethylene (HDPE) woven grow bags for agriculture and horticulture purpose including gardening.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provision 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 indicated in Annex A.

3 TERMINOLOGY

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

3.1 HDPE Grow Bags — A grow bag is a container specifically designed for plant cultivation. It is typically made of fabric or plastic material and is used to provide a controlled environment for plants to grow, allowing for efficient root development and optimal growing conditions. HDPE grow bags are made from high-density polyethylene. The material composition of HDPE provides durability, resistance to UV radiation, and a long lifespan, making it suitable for plant cultivation.

3.2 Soil Mix — The soil mix used in grow bags is a crucial factor for plant health. This soil mix provides the necessary nutrients, balance the pH and enhance the quality of soil for the plants to thrive in the grow bag. Common soil mixes include peat moss, vermiculite, perlite, and compost.

3.3 Root Ball —The compacted mass of roots that forms within the grow bag as the plant grows. The size and health of the root ball are crucial indicators of a plant's overall root development and ability to absorb nutrients and water.

4 MATERIALS

4.1 HDPE Tapes

Tapes shall be manufactured from HDPE granules (*see* IS 6192), which shall be UV stabilized by adding suitable UV stabilizer (*see* Note). The finished grow bag shall meet the requirements of UV stability and colour fastness to light as given in Table 1. The width of the tape used in the fabric shall be 2.00 mm minimum and linear density of the tape shall be 700 Denier minimum.

NOTE — Carbon black or black master batch shall not be used for UV stabilization.

4.2 HDPE Fabric

Grow bags shall be manufactured by using suitable HDPE woven fabric (*see* IS 6899) so that finished bag meets the requirements given in Table 1 and **5.2**.

4.3 Lamination

4.3.1 The fabric shall be laminated with the low-density polyethylene (LDPE) or suitable combination of LDPE and linear low-density polyethylene (LLDPE) melt of coating grade on each side having thickness not less than 25 microns and the coating shall be suitably UV stabilized by incorporating UV stabilizer (*see* Note under **4.1**). The coating film along with colour master batch to get the desired shade shall be such that the finished grow bag meets the requirements of UV stability and colour fastness to light as given in Table 1.

4.3.2 A 3-layer laminated fabric is manufactured using a combination of single layers of HDPE fabric and 2-layers of coating film for type 1 grow bags, a 5-layer laminated fabric is produced using a combination of 2-layers of HDPE fabric and 3-layers of coating film for type 2 grow bags. The layers of HDPE fabric used to manufacture grow bags shall be joined by sandwich lamination. The lamination as given above shall be such that the finished grow bag meets the requirements given in Table 1. The minimum coating thickness of the sandwich lamination shall be 40 μ .

4.4 Cord Beading

A jute / Polypropylene rope beading of minimum 2.0 mm diameter shall be provided along the top periphery of the grow bag for reinforcement.

5 MANUFACTURE

5.1 General design of the grow bag may be as shown in Fig. 1 and Fig. 2.

5.2 Construction

5.2.1 The grow bag shall be constructed by stitching laminated pieces of woven fabric of the desired dimensions. The panels shall be flat (overlap) joined. The top edges of the grow bag shall be hemmed by heat sealing/stitching along with a jute or polypropylene rope of 2 mm diameter placed inside the hem as reinforcement. The width of the top hem shall be minimum 30 mm. Bottom and sides of the grow bags shall be stitched with a suitable yarn of minimum 2000 denier. The number of stitches/dm shall be 14 ± 2 . The stitching shall be uniform without any loose thread or knot. The bottom of grow bag shall be provided with 2 circular holes of diameter 13 mm, $+3/-0$ mm tolerance.



FIG. 1 ROUND GROW BAG

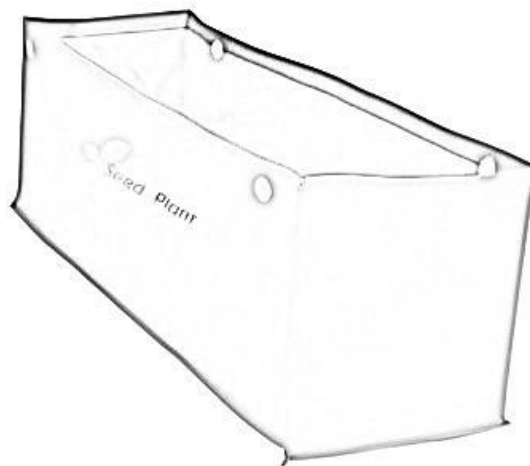


FIG. 2 RECTANGULAR GROW BAG

6 REQUIREMENTS

The laminated HDPE fabric used to manufacture grow bag shall meet the requirements as given in Table 1. Besides the grow bag shall meet the requirements stated in 5.2.

Table 1 Requirements of Grow Bag Made from HDPE Woven Fabrics

(Clauses 4.1, 4.2, 4.3.1, 4.3.2 and 6)

SI No.	Characteristic	Requirements		Method of Test, Ref to
		Type 1	Type 2	
(1)	(2)	(3)	(4)	(5)
i)	Mass, g/m ² , <i>Min</i>	200 (3 layer laminated)	250 (5 layer laminated)	IS 1964
ii)	Breaking strength before UV exposure, N, <i>Min</i>	1 000 (Warp) 750 (Weft)	1 100 (Warp) 900 (Weft)	IS 1969 (Part 2)
iii)	Elongation at break, <i>percent</i>	20 ± 5	20 ± 5	IS 1969 (Part 2)
iv)	Retention of breaking strength after UV exposure, N, <i>Min</i>	85 percent of original actual value (fabric)	85 percent of original actual value (fabric)	Annex B and IS 1969 (Part 2)
v)	Seam strength before UV exposure, N, <i>Min</i>	65 percent of original actual value (fabric)	65 percent of original actual value (fabric)	IS 1969 (Part 2)
vi)	Seam strength after UV exposure, N, <i>Min</i>	85 percent of original actual value	85 percent of original actual value	Annex B and IS 1969 (Part 2)
vii)	Tear strength, N, <i>Min</i>	100 (Warp) 100 (Weft)	130 (Warp) 130 (Weft)	Method A2 of IS 7016 (Part 3)
viii)	Puncture strength, N, <i>Min</i>	250	300	Annex C
ix)	Environmental stress cracking test	There shall be no evidence of stress cracking	There shall be no evidence of stress cracking	Annex D
x)	Resistance to chemicals, change in the mass, percent, <i>Max</i>	0.1 percent	0.1 percent	Annex E
xi)	Colour fastness to artificial light (<i>see Note</i>)	4 or better	4 or better	IS/ISO 105-B02

				(Xenon lamp method)
NOTE— Applicable for coloured bags only				

6.1 Dimensions

The preferred dimensions of the circular and round grow bag shall be as given in Table 2 and Table 3. Bags of other dimensions may also be manufactured as agreed to between the buyer and the seller.

Table 2 Circular Grow Bags Dimensions
(Clause 6.1)

SI No.	Height, mm	Diameter, mm
(1)	(2)	(3)
1	150	150
2	150	230
3	230	230
4	230	300
5	300	300
6	300	380
7	300	455
8	380	150
9	380	230
10	380	380
11	380	455
12	455	610
13	455	455
14	610	610
Tolerance, percent	+2	+2
	-2	-2

Table 3 Rectangular Grow Bags Dimensions
(Clause 6.1)

SI No.	Length, mm	Width, mm	Height, mm
(1)	(2)	(3)	(4)
1	600	450	300
2	900	600	300

3	910	910	300
4	1220	610	300
5	1500	300	300
6	1500	380	380
7	1800	900	300
Tolerance, percent	+2		
	-2		

7 MARKING

Each bag shall be legibly marked with the following information at one corner on one side either with tag or by printing on it with the ink:

- a) Name and address of the manufacturer,
- b) Dimensions and mass (g/m²), and
- c) Year of manufacture.

7.2 BIS Certification Marking

The high-density polyethylene woven grow bags conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provision of Bureau of Indian Standards Act, 2016 and the rules and regulations framed there under, and the products may be marked with the Standard Mark.

8 PACKING

The grow bags shall be packed as agreed to between the buyer and the seller.

9 SAMPLING

9.1 Lot

The quantity of grow bag of same size and mass (g/m²) manufactured under similar conditions and delivered to a buyer against one dispatch note shall constitute a lot.

9.2 Unless otherwise agreed to between the buyer and the seller, the number of bags to be selected at random from a lot shall be as given in col (3) of Table 4.

10 NUMBER OF TEST SPECIMENS AND CRITERIA FOR CONFORMITY

Number of test specimens and criteria for conformity shall be as given in Table 5.

Table 4 Scale of Sampling
(Clause 9.2)

SI No.	No. of Bags in Lot	Sample Size	Sub-sample Size	Permissible No. of Defective bags
(1)	(2)	(3)	(4)	(5)
i)	Up to 50	3	2	0
ii)	51 to 150	5	2	0
iii)	151 to 300	8	3	1
iv)	301 to 500	13	5	2
v)	501 and above	20	5	3

Table 5 Number of Test Specimens and Criteria for Conformity
(Clause 10)

SI No.	Characteristic	No. of bags/Test Specimens	Criteria for Conformity
i)	Dimensions, average mass (g/m ²), manufacture and material	According to col (3) of Table 4	The defective bags do not exceed the corresponding number given in col (5) of Table 4
ii)	All other requirements	According to col (4) of Table 4	The test specimens shall meet the requirements as given in Table 1

ANNEX A
(Clause 2)

LIST OF REFERRED STANDARDS

<i>IS NO.</i>	<i>Title</i>
IS 1964 : 2001	Textiles — Methods for determination of mass per unit length and mass per unit area of fabrics (<i>second revision</i>)
IS 1969 (Part 2) : 2018	Textiles — Tensile properties of fabrics — Part 2 Determination of maximum force using the grab method (<i>fourth revision</i>)

IS 6192 : 2023	Textiles — Monoaxially Oriented High-Density Polyethylene (HDPE)/Polypropylene (PP) Tapes — Specification (<i>third revision</i>)
IS 6899 : 2023	Textile — High Density Polyethylene (HDPE)/Polypropylene (PP) Woven Fabrics — Specification (<i>third revision</i>)
IS 7016 (Part3/Sec1) : 2022	Methods of Test for Rubber or Plastics Coated Fabrics Part 3 Determination of Tear Resistance Section 1 Constant rate of tear methods (<i>third revision</i>)
IS/ISO 105 Part B02 : 2014	Textiles — Test for colour fastness Part B02 colour fastness to artificial light: xenon arc fading test

ANNEX B

[Table 1, Sl No. (iv) and (vi)]

UV RESISTANCE TEST

B-1 TEST SPECIMENS

The test specimens for breaking and seam strength shall be cut from the sample as specified in IS 1969 (Part 2) for modified grab test.

B-2 TEST CONDITIONS

B-2.1 The test shall be carried out with fluorescent UVB lamp (313 nanometer or its equivalent).

B-2.2 The duration of the test shall be 144 h (that is 6 days).

B-2.3 The test cycle shall be 8 h at 60 °C + 3 °C with UV radiation alternating after 4 h at 50 °C + 3 °C with condensation.

B-2.4 Irradiation level throughout the test shall be maintained at $0.63 \text{ W/m}^2 \pm 0.03 \text{ W/m}^2$.

B-3 TEST PROCEDURE

B-3.1 Determine the original average breaking strength and seam strength of bag specimens separately as per the modified grab test specified in IS 1969 (Part 2).

B-3.2 Expose the specimens alternately to ultraviolet light alone and to condensation in one respective cycle.

B-3.2.1 The type of fluorescent UV lamp, the timing of the UV exposure and the temperature of condensation shall be specified in **B-2**.

B-3.3 Determine the average breaking strength and seam strength of the specimens separately after UV exposure as mentioned above.

B-3.4 Determine the percent retention of original strength and seam strength as follows:

Percent retention of original breaking strength or seam strength = $\frac{b}{a} \times 100$

Where,

a = average breaking strength or seam strength before UV exposure as obtained in **B-3.1**, and

b = average breaking strength or seam strength after UV exposure as obtained in **B-3.3**.

NOTES

1 The UV source is an array of fluorescent lamps (with lamp emission concentrated in the UV range).

2 Condensation is produced by exposing the test surface to a heated, saturated mixture of air and water vapour, while the reverse side of the test specimen is exposed to the cooling influence of ambient room air.

ANNEX C

[Table 1, Sl No. (viii)]

TEST METHOD FOR INDEX PUNCTURE RESISTANCE

C-1 PRINCIPLE

A test specimen is clamped without tension between circular plates of a ring clamp attachment secured in a tensile testing machine. A force is exerted against the centre of the unsupported portion of the test specimen by a solid steel rod attached to the load indicator until rupture of the specimen occurs. The maximum force recorded is the value of puncture resistance of the specimen.

C-2 APPARATUS

C-2.1 Tensile/Compression Testing Machine, of the constant-rate-of extension (CRE) type.

C-2.2 Ring Clamp Attachment, consisting of concentric plates with an open internal diameter of $45 \text{ mm} \pm 0.025 \text{ mm}$ capable of clamping the test specimen without slippage. A suggested clamping arrangement is shown in Fig. 2. The external diameter is suggested to be $100 \text{ mm} \pm 0.025 \text{ mm}$. The diameter of the six holes used for securing the ring clamp assembly is suggested to be 8 mm and equally spaced at a radius of 37 mm. The surfaces of these plates can consist of grooves with a rings or coarse sandpaper bonded onto opposing surfaces.

C-2.3 Solid Steel Rod, with a diameter of $8 \text{ mm} \pm 0.01 \text{ mm}$ having a flat end with a $45^\circ \times 0.8 \text{ mm}$ chamfered edge contacting the test specimen's surface (*see* Fig. 2 and Fig. 3).

C-3 SAMPLING

C-3.1 Laboratory Sample

For the laboratory sample take a swatch extending the full width of the product, of sufficient length along the selvage from each sample roll so that the requirements of **C-3.2** can be met.

C-3.2 Test Specimens

Select from the laboratory sample, sufficient number of samples each having a minimum diameter of 100 mm to facilitate clamping. Space the specimens along a diagonal on the unit of the laboratory sample. Take no specimens nearer the selvage or edge of the bag.

C-4 CONDITIONING

Bring the specimens to moisture equilibrium in the atmosphere for testing bags (65 percent \pm 5 percent relative humidity and $27 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$ temperature). Equilibrium is considered to have been reached when the increase in the mass of the specimen, in successive weightings made at intervals of not less than 2 h, does not exceed 0.1 percent of the mass of the specimen.

C-5 PROCEDURE

C-5.1 Select the load range of the tensile/compression testing machine such that the rupture occurs between 10 percent and 90 percent of the full-scale load.

C-5.2 Centre and secure the specimen between the holding plates ensuring that the test specimen extends to or beyond the outer edges of the clamping plates.

C-5.3 Test at a machine speed of $300 \text{ mm/min} \pm 10 \text{ mm/min}$ until the puncture rod completely ruptures the test specimen.

NOTE — The rate of testing specified is not an indication of the performance of the specimen for its end use.

C-6 CALCULATION

Calculate the average puncture resistance and standard deviation for all tests as read directly from the recording instrument.

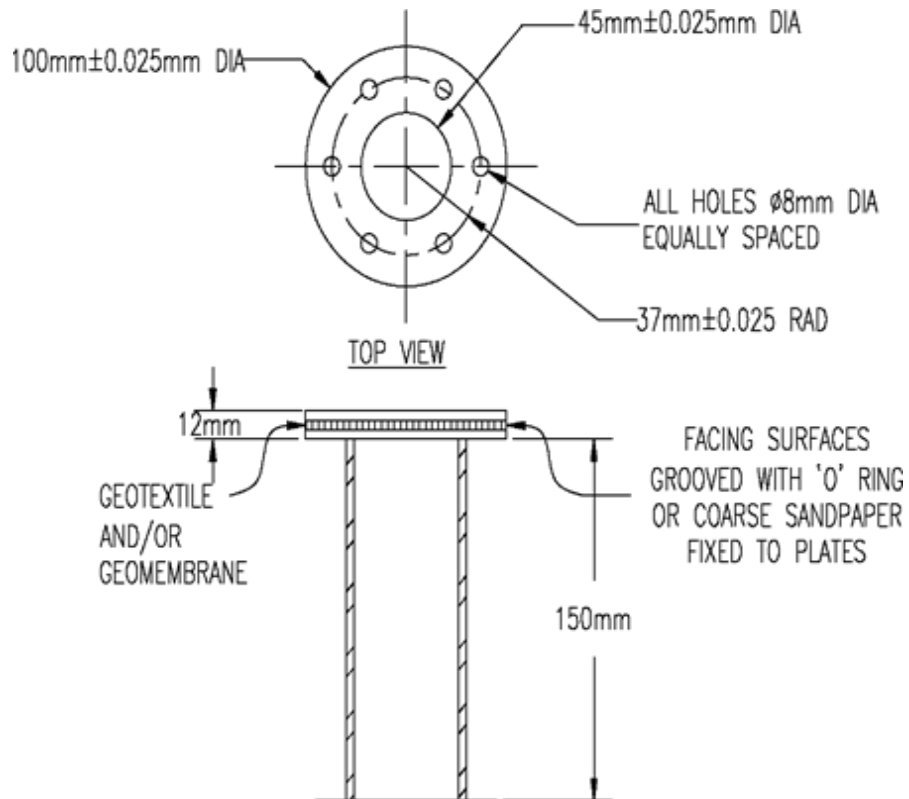


FIG. 2 TEST FIXTURE DETAIL (NOT TO SCALE)

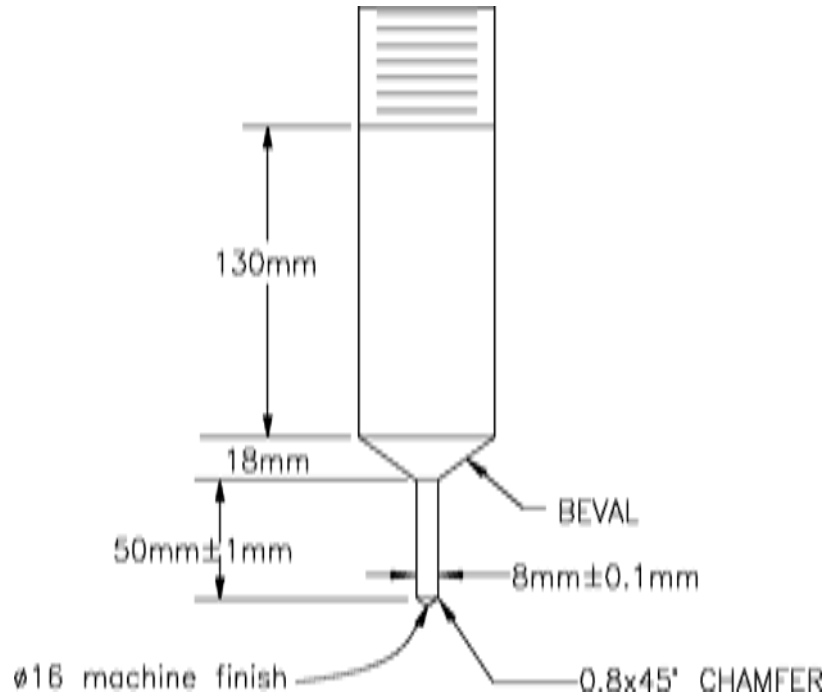


FIG. 3 TEST PROBE DETAIL (NOT TO SCALE)

ANNEX D

[Table 1, *Sl No.* (ix)]

METHOD OF TEST FOR RESISTANCE TO ENVIRONMENTAL STRESS CRACKING

D-1 APPARATUS

An air oven controlled at $60\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.

D-2 TEST LIQUID

A 0.5 percent aqueous solution of polyoxyethylatednonylphenol.

NOTE — Teepol B 300 has been found suitable.

D-3 TEST SPECIMEN

The test specimens shall be cut from the bag and shall have a length of $150\text{ mm} \pm 3\text{ mm}$ and width of $50\text{ mm} \pm 3\text{ mm}$.

D-4 PROCEDURE

The test specimen shall be dipped in the test liquid contained in a beaker at $27\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$. The beaker along with test specimen shall be kept in the oven at $60\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for 48 h. The test specimen shall then be inspected for cracks, the test specimen being sectioned where necessary.

ANNEX E
[Table 1, Sl No. (x)]

TEST FOR RESISTANCE TO CHEMICAL ACTION

E-1 TEST SPECIMEN

The test specimens shall be cut from the bag and shall have a length of $150\text{ mm} \pm 3\text{ mm}$ and width of $50\text{ mm} \pm 3\text{ mm}$.

E-2 PROCEDURE

For test in each solution as mentioned herein under below, three specimens each of length of $150\text{ mm} \pm 3\text{ mm}$ and width of $50\text{ mm} \pm 3\text{ mm}$ taken from three position of bag shall be cleaned, wiped dry and weighed and then totally immersed without prior conditioning in each of 10 percent aqueous solution of sulphuric acid, hydrochloric acid, sodium hydroxide, sodium chloride and ammonium hydroxide at ambient temperature for 72 h separately. After the specified time, the specimens shall be removed from each solution, washed in running water for 5 min, dried with a clean cloth and re-weighed immediately.

E-3 ASSESSMENT OF RESULT

The average change in mass of all three specimen in each solution shall not exceed the value given in Table1.