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Draft Indian Standard

POLYCARBONATE LATHI — SPECIFICATION

(ICS 83.140.99)

Plastics Sectional Committee,
PCD 12

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FOREWORD

(Formal clause to be added later**)**

The modernization of traditional weaponry has led to innovative adaptations, and the lathi made of polycarbonate is a prime example of this fusion of tradition and technology. Unlike its traditional bamboo counterpart, the polycarbonate lathi is crafted from a durable and lightweight thermoplastic polymer. This material provides increased strength and resistance to impact, making it an ideal choice for those seeking a more resilient and long-lasting alternative. This adaptation not only preserves the essence of the traditional lathi but also highlights the potential for combining heritage with contemporary materials for practical and artistic purposes.

This standard has been established with the primary goal of instilling confidence in users regarding the efficacy of the polycarbonate lathi in fulfilling their duties. By setting forth specific criteria and benchmarks, it aims to assure users that the polycarbonate lathi is a valuable and effective tool when compared to the conventional traditional lathi.

The polycarbonate lathi's are generally used in conjunction with other items of protective clothing and equipment such as helmets, body and limb protectors, shield, gloves and protective footwear.

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

1.1 This standard specifies the requirements, methods of sampling and tests for polycarbonate lathi.

1.2 Polycarbonate lathi is intended for use by the public safety organizations for crowd control in the course of their duties.

2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed in Annex A.

3 TERMINOLOGY

3.1 For the purpose of this standard, the definitions given in IS 2828 shall apply.

4 REQUIREMENTS

4.1 Material Requirements

4.1.1 The polycarbonate material for manufacture of lathi shall be natural conforming to IS 14434.

NOTE ― The polycarbonate material may contain additives, processing aids and stabilizers (for example UV stabilizers), etc.

4.1.2 The polycarbonate material shall also comply with the requirements given in Table 1 when tested as prescribed in col 4 of the Table 1.

Table 1
(*Clause* 4.1.2)

Requirement for Polycarbonate Material

Sl No.	Characteristics	Requirement	Method of Test, Ref to IS
(1)	(2)	(3)	(4)
i)	Melt Flow Index, g/10 min (at 300 ºC under 1.2 kg load when measured after pre-drying of the material at 120 ± 5 ºC up to 4 h)	1.5 to 8 (for extrusion / thermoforming) 8 to 15 (for injection moulding)	IS 13360 (Part 4/Sec 1/Subsec 1) or IS 13360 (Part 4/Sec 1/Subsec 2)
ii)	Specific gravity	1.19 to 1.22	IS 13360 (Part 3 / Sec 10) / IS 13360 (Part 3 / Sec 11) / IS 13360 (Part 3 / Sec 12)
iii)	Flexural modulus, Min, MPa (with crosshead speed of 1.2 mm/min and a span to depth ratio of 16 to 1 (test specimen size, 4 mm × 10 mm)	2200	IS 13360 (Part 5 / Sec 7)
iv)	Izod impact strength, notched, Min, kJ/m2 (test specimen thickness of 3 mm and notch radius of 0.25 mm)	60	IS 13360 (Part 5 / Sec 4)
v)	Deflection temperature under load at 1.82 MPa, *Min*, °C	120	IS 13360 (Part 6 / Sec 17)

4.2 Physical Requirements

4.2.1 *Description*

4.2.1.1 The polycarbonate lathi shall be of cylindrical shape. There shall be no variation in thickness of lathi throughout the length between shoe and hand- grip. The dimensional requirements of the lathi shall be as agreed to between the buyer and supplier.

4.2.2 *Manufacturing Process*

The polycarbonate lathi shall be manufactured by thermoforming or injection moulding process adhering to code of good fabricating practices as given at Annex A of IS 16864.

4.2.3 The total weight of the polycarbonate lathi shall be 275 gm (*Max*). The transparency of the lathi shall be as agreed to between purchaser and supplier.

4.2.4 Polycarbonate sheet formed from the specified material (*see* **4.1.1**) to be used for the manufacturing of lathi shall comply with the requirements given in Table 2.

Table 2
Requirements for Polycarbonate Body of the Lathi

(*Clause* 4.2.4)

Sl No.	Characteristics	Requirement	Method of Test, Ref to IS
(1)	(2)	(3)	(4)
i)	Dart drop impact, Min, J (at 27ºC)	150	Annex B of IS 16864
ii)	Flammability Test(test specimen thickness 3.18 mm + 0.13 mm)	94 HB class	Annex C of IS 16864 / IS 13360 (Part 6 / Section 5)

4.2.5 *Polycarbonate Material Identification*

4.2.5.1 The polycarbonate body of the lathi shall meet all the test requirements detailed below. The test specimen for the following tests shall be taken from flattened area of the polycarbonate lathi.

4.2.5.2 *Fourier transform infrared (FTIR) spectroscopy*

The results are to be recorded as a plot of the percent transmittance of the infrared radiation through the specimen versus the reciprocal wavelength (cm^{-1}) or wavenumber of the radiation. The infrared spectra obtained by this method shall consist of a minimum wavenumber range of 4000 — 400 reciprocal centimetres. Signature peaks for polycarbonate are 1770 cm-1 assigned to C=O and a set of three peaks in the range of 1000-1300 cm-1 assigned to C-O. Library matching shall confirm to at least 95 percent.

4.2.5.3 *Differential scanning calorimetry (DSC)*

The mid-point of glass transition temperature of the test specimen measured in the second heating cycle shall be above 140 °C when tested in accordance with the test method prescribed in ISO 11357-2.

4.2.6 *Protective Shoe / Stud (Optional requirement)*

The protective shoe shall be made up of polymeric fibre or any other material as agreed to between purchaser and supplier and shall be a ring shaped with a length of 50 ± 5 mm. It shall be firm and properly fixed with lathi. It shall also be fire and water resistant.

4.2.7 *Handgrip*

The handgrip shall be made up of polymeric fibre or rubber and shall be of 100 ± 10 mm in length. It shall be firm and properly fixed with lathi. It shall also be fire and water resistant. It shall allow user to comfortably hold the lathi.

4.2.8 *Wrist band*

The wrist band shall be made up of cotton/ nylon and shall be provided on the top of handgrip for providing security from lathi snatching. The loop diameter for wrist band shall be of 6 to 8 inches.

4.3 Performance Requirements

4.3.1 *Resistance to Environmental Stress Cracking*

4.3.1.1 Environment Stress Cracking Resistance (ESCR) test shall be performed on polycarbonate body of the lathi by constant strain method as per IS 13360 (Part 8/Sec 9).

4.3.1.2 The test specimen shall be taken from the polycarbonate lathi as flat strip of size 125 mm × 15 mm cut from centre. The test specimen shall be conditioned at 27 ± 2 °C for at least 24 h to relieve internal stresses.

4.3.1.3 Test shall be carried out on a set of three test specimens under a constant strain of 0.5 percent at 27 ± 2 °C. Chemicals, namely, 10 percent hydrochloric acid solution, 10 percent sulphuric acid solution, kerosene, petrol, diesel and Molotov cocktail, shall be applied on the test specimen. The exposed surface of the test specimen shall be examined after 10 min for signs of cracks, surface changes or pealing of coating, if any.

NOTES

1. Chemical should be applied or wiped gently on/from the surface using cotton. Care should be taken not to touch cut edge of the test specimen; this can adversely affect test results.
2. Another set of test specimen exposed to the same environmental conditions without the chemical acts as control. These test specimens should be used as reference for comparing with exposed strips.

4.3.2 *Resistance to Surface Abrasion*

The test specimen of polycarbonate lathi when tested for resistance to surface abrasion in accordance with ASTM D1044 for 100 cycles under 500 g load, shall have haze percent not more than 20 percent.

5 PACKING AND MARKING

5.1 Packing

The polycarbonate lathi shall be suitably packed as agreed to between the purchaser and the supplier.

5.2 Marking

5.2.1 Each polycarbonate lathi shall be permanently marked/tagged with the following:

a) Indication of the source of manufacture and trademark, or the company responsible for placing the product in the market, if any;
b) Batch No.;
c) Month and year of manufacture;
d) Best use before…….. (month and year to be declared by the manufacturer); and
e) Any other statuary requirements.

5.2.2 *BIS Certification Marking*

The polycarbonate lathi may also be marked with the Standard Mark.

5.2.2.1 The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 2016 and the Rules and Regulations made thereunder. The details of the conditions under which the licence for use of the Standard Mark may be granted to manufacturers or producers, may be obtained from the Bureau of Indian Standards.

6 SAMPLING

The samples of the polycarbonate lathi shall be drawn and the criteria for conformity determined as prescribed in Annex B.

ANNEX A
(*Clause* 2)

REFERENCE

IS No./Other publication	*Title*
IS 2828 / ISO 472 : 2013	Plastics — Vocabulary (*second revision*)
IS 4905 : 2015 / ISO 24153 : 2009	Random sampling and randomization procedures (*first revision*)
IS 13360	Plastics — Methods of testing
(Part 3/Sec 10) : 2016 / ISO 1183-1 : 2012	Physical and dimensional properties, Section 10 Determination of density of non-cellular plastics — Immersion method, Liquid pyknometer method and titration method
(Part 3/Sec 11) : 2016 / ISO 1183-2 : 2004	Physical and dimensional properties, Section 11 Determination of density of non-cellular plastics — Density gradient column method
(Part 3/Sec 12) : 2016 / ISO 1183-3 : 1999	Physical and dimensional properties. Section 12 Determination of density of non-cellular plastics — Gas pyknometer method
(Part 4/Sec 1/Subsec 1) : 2018 / ISO 1133-1 : 2011	Rheological properties, Section 1 Determination of melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics, Subsection 1 Standard method (*first revision*)
(Part 4/Sec 1/ Subsec 2) : 2018 / ISO 1133-2 : 2011	Rheological properties, Section 1 Determination of melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics, Subsection 2 Method for materials sensitive to time-temperature history and/or moisture (*first revision*)
(Part 5/Sec 4) : 2021 / ISO 180 : 2019	Mechanical properties, Section 4 Determination of Izod impact strength (*second revision*)
(Part 5/Sec 7) : 2022 / ISO 178 : 2019	Mechanical properties, Section 7 Determination of flexural properties (*second revision*)
(Part 6/See 5): 2001	Thermal properties, Section 5 Determination of flammability of plastic materials for parts and devices in appliances
(Part 6/Sec 17) : 2013 / ISO 75-2 : 2004	Thermal properties, Section 17 Determination of temperature of deflection under load — Plastics and ebonite (*first revision*)
(Part 8/Sec 9) : 1997 / ISO 4599 : 1986	Permanence / Chemical properties, Section 9 Determination of resistance to environmental stress cracking (ESC) - Bent Strip method
IS 14434 : 2023	Polycarbonate moulding and extrusion materials — Specification (*first revision*)
IS 16864 : 2018	Polycarbonate protective shield — Specification
ASTM D1044 - 19	Standard test method for resistance of transparent plastics to surface abrasion by the taber abraser

ANNEX B
(*Clause* 6)

SAMPLING OF POLYCARBONATE LATHI

B-1 SCALE OF SAMPLING

B-1.1 Lot

In a single consignment all the lathi's of identical dimensions belonging to the same batch of manufacture shall be grouped together to constitute a lot.

B-1.2 For judging conformity to the specified requirements each lot shall be considered separately.

B-1.3 The number of sample lathi's from a lot for determining the conformity shall be in accordance with col 2 and col 3 of Table 3.

B-1.4 The sample lathi's shall be taken at random from the lot. In order to ensure randomness of selection, random number tables may be used (see also IS 4905).

B-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

B-2.1 Each of the sample lathi's selected according to **B-1.3** shall be tested for all the requirements of this specification. The lot shall be declared to be in conformity if each sample sheet individually meets the specified requirements.

Table 5
(*Clause* B-1.3)

Number of Sample Sheets

Sl No.	Number of Shields in a Lot, *N*	Number of Sample Shields, *n*
(1)	(2)	(3)
1.	Up to 25	1
2.	26 to150	2
3.	151 to300	3
4.	301 to 500	4
5.	501 and above	5