भारतीय मानक

Indian Standard

IS 2046 (Part 6): 2024
ISO 4586-6 : 2018

सजावटी थर्मोसेटिंग सिंथेटिक रेज़िनबॉन्डेड लैमिनेटेड चादरें — विशिष्टि

भाग 6 2 मिमी और उससे अधिक मोटाई के बाहरी-ग्रेड कॉम्पैक्ट लैमिनेट्स के लिए वर्गीकरण और विशिष्टियाँ

(तीसरा पुनरीक्षण)

Decorative Thermosetting Synthetic Resin Bonded Laminated Sheets — Specification

Part 6 Classification and Specifications for Exterior-Grade Compact Laminates of Thickness 2 mm and Greater

(Third Revision)

ICS 83.140.20

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

December 2024 **Price Group 8**

Plastics Sectional Committee, PCD 12

NATIONAL FOREWORD

This Indian Standard (Part 6) (Third Revision) which is identical to ISO 4586-6 : 2018 'High-pressure decorative laminates (HPL, HPDL) — Sheets based on thermosetting resins (usually called laminates) — Part 6: Classification and specifications for exterior-grade compact laminates of thickness 2 mm and greater' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendations of the Plastics Sectional Committee and approval of the Petroleum, Coal and Related Products Division Council.

This standard was first published in 1962 and subsequently revised in 1969 and 1995. The revision was published to meet the general demand for a standard to cover the use of synthetic resin bonded sheets as a decorative material having a surface which is characterized by its hardness and the materials covered were suitable for use as wall panels or as veneer for wood or other surfaces.

The first revision of this standard was based on BS 3794 : 1964 'Specification for decorative laminated plastics sheets' issued by the British Standards Institution. The second revision was necessitated to harmonize the standard with EN 438-1 : 1991 and EN 438-2 : 1992 issued by the European Committee for Standardization (CEN).

This revision has been brought out to align the Indian Standard with the ISO 4586 (all parts) High-pressure decorative laminates (HPL, HPDL) — Sheets based on thermosetting resins (usually called laminates). Since the ISO standard is published in 8 parts, the standard (IS 2046) has been also bifurcated in 8 parts.

This standard is published in various parts. Other parts in this series are:

Part 1	Introduction and general information
Part 2	Determination of properties
Part 3	Classification and specifications for laminates less than 2 mm thick and intended for bonding to supporting substrates
Part 4	Classification and specifications for compact laminates of thickness 2 mm and greater
Part 5	Classification and specifications for flooring grade laminates less than 2 mm thick intended for bonding to supporting substrates
Part 7	Classification and specifications for design laminates
Part 8	Classification and specifications for alternative core laminates

The text of ISO standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

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Introduction

Exterior-grade compact laminates are characterized by their high tensile strength, high impact resistance, thermal shock resistance, and resistance to weather and corrosion. They are available in a variety of decorative colours, with high resistance to colour change and aging in outdoor applications. When they are self-supporting exterior-grade compact laminates are ready for installation, and only require cutting to size, drilling, etc. to suit the application.

In an effort to harmonize ISO 4586 with other high-pressure decorative laminate standards, multiple methods may be published that demonstrate similar properties. In these instances, the same test method title is given and is annotated as either “Method A” or “Method B”. This is the case in the following tests: Edge squareness — 8/9, Dry heat — 17/18 Dimensional stability at elevated temperatures — 19/20, Dimensional stability at ambient temperature — 21/22, Staining — 30/31, Lightfastness — 32/33, Formability — 38/39, and Blistering — 40/41. In these instances, either method may be utilized in testing. Compliance to both methods is not required. While these tests are similar they are by no means identical and results of one method do not necessarily correspond to the results of the accompanying test. In these situations, it is intended that the documentation in specific parts of ISO 4586 for performance requirements be consulted. Each specific method has performance requirements particular to that method for individual grades of high-pressure decorative laminate.

This document has been harmonized with EN 438-6 whenever possible.

Indian Standard

DECORATIVE THERMOSETTINGS SYNTHETIC RESIN BONDED LAMINATED SHEETS — SPECIFICATION

PART 6 CLASSIFICATION AND SPECIFICATIONS FOR EXTERIOR-GRADE COMPACT LAMINATES OF THICKNESS 2 MM AND GREATER

(Third Revision)

1 Scope

This document applies to exterior-grade compact laminates of thickness 2 mm and greater. It specifies requirements for standard and flame-retardant laminates intended for use under outdoor weather conditions such as direct sunlight, rain, and frost. Two levels of performance are specified; one for moderate exterior conditions, and the other for severe exterior conditions.

ISO 4586-2 specifies the methods of test relevant to this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 178, *Plastics — Determination of flexural properties*

ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pyknometer method and titration method*

ISO 4586-2:2018, *High-pressure decorative laminates (HPL) — Sheets based on thermosetting resins (usually called laminates) — Part 2: Determination of properties*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
high-pressure decorative laminate
HPL
HPDL
sheet consisting of layers of cellulosic fibrous material (normally paper) impregnated with thermosetting resins and bonded together by the *high pressure process* (3.2)

Note 1 to entry: This is a general definition of high-pressure decorative laminate(s). More specific product definitions can be found in ISO 4586-3 to ISO 4586-8.

Note 2 to entry: The surface layer(s) on one or both sides, having decorative colours or designs, are typically impregnated with melamine based resins. The core layers are typically impregnated with phenolic based resins.

Note 3 to entry: The back of the sheet(s) may be made suitable for adhesive bonding to a substrate.

3.2
high-pressure process
simultaneous application of heat (temperature ≥ 120 °C) and high specific pressure (≥ 5 MPa), to provide flowing and subsequent curing of the thermosetting resins to obtain a homogeneous non-porous material with increased density (≥ 1,35 g/cm^3), and with the required surface finish

3.3
surface layer
upper decorative layer consisting in one or more sheets of fibrous material (usually paper) impregnated with aminoplastic thermosetting resins (usually melamine based resins) or other curable resins or other decorative design surfaces such as metal foils, wood-veneers, and textiles, etc. which are not necessarily treated with thermosetting resin

3.4
core layer
fibrous material (usually paper) impregnated with thermosetting resins (usually phenolic based resins) or other curable resins, possibly reinforced by metal layer(s) or metal mesh(es) and others which are not necessarily treated with thermosetting resin

4 Material types and classification system

Exterior-grade compact laminates are defined using the three letter classification system shown in Table 1.

Table 1 — Classification system

First letter	Second letter	Third letter
E (Exterior grade)	G (Moderate use) or D (Severe use)	S (Standard grade) or F (Flame-retardant grade)

For example an exterior-grade flame-retardant HPL for severe outdoor conditions is specified as HPL/ ISO 4586-6/EDF.

Laminate grades EGS and EGF are intended for moderate outdoor conditions, for example applications involving medium term exposure to average levels of sunlight and weathering.

Laminate grades EDS and EDF are intended for severe outdoor conditions, for example applications involving long term exposure to strong sunlight and weather.

5 Requirements

5.1 Compliance

Exterior-grade compact laminate types EGS, EGF, EDS and EDF shall meet all appropriate requirements specified in 5.2, 5.3 and 5.4. This applies to both full-size sheets and cut-to-size panels.

5.2 Inspection requirements

5.2.1 General

Inspection shall be carried out in accordance with ISO 4586-2:2018, Clause 4 at a distance of 0,75 m to 1,5 m.

5.2.2 Colour and pattern

When inspected in daylight or D65 standard illuminant and again under tungsten illuminant A, there shall be no significant difference between the corresponding colour reference sample held by the supplier and the specimen under test.

Where colour and surface finish are critical, it is recommended that sheets be checked for colour and surface finish compatibility before fabrication or installation.

5.2.3 Surface finish

When inspected at different viewing angles, there shall be no significant difference between the corresponding surface-finish reference sample held by the supplier and the specimen under test.

Where colour and surface finish are critical, it is recommended that sheets be checked for colour and surface finish compatibility before fabrication or installation.

5.2.4 Visual inspection

5.2.4.1 General

The following inspection requirements are intended as a general guide, indicating the minimum acceptable quality for each decorative face of a laminate supplied as a full-size sheet.

Cut-to-size panels and certain applications involving full-size sheets may call for special quality requirements which can be negotiated between supplier and purchaser. In such cases, the following requirements may be used as a basis for agreement.

It should be noted that only a small percentage of sheets in a batch (the level to be agreed with the customer) should contain defects of the minimum acceptable level.

It may be agreed between purchaser and supplier that the visual quality standard applies to one decorative face only.

5.2.4.2 Surface quality

The following surface defects are permissible.

— Dirt, spots and similar surface defects.

  The admissible size of such defects is based on a maximum contamination area equivalent to 2,0 mm^2/m^2 of laminate and is proportional to the sheet size under inspection.

  The total admissible area of contamination may be concentrated in one spot or dispersed over an unlimited amount of smaller defects:

— Fibres, hairs and scratches.

The admissible size of defects is based on a maximum contamination length equivalent to 20 mm/m^2 of laminate and is proportional to the sheet size under inspection.

The total admissible length of contamination may be concentrated in one defect or dispersed over an unlimited amount of smaller defects.

5.2.4.3 Edge quality

Edge chipping up to 3 mm on each side is permissible.

5.3 Dimensional tolerance requirements

Dimensional tolerance requirements are specified in Table 2.

Table 2 — Dimensional tolerances

Property	Test method (ISO 4586-2:2018 Clause No.)	Requirement
Thickness	5	2,0 mm ≤ *d* < 3,0 mm: ±0,20 mm maximum variation 3,0 mm ≤ *d* < 5,0 mm: ±0,30 mm maximum variation 5,0 mm ≤ *d* < 8,0 mm: ±0,40 mm maximum variation 8,0 mm ≤ *d* < 12,0 mm: ±0,50 mm maximum variation 12,0 mm ≤ *d* < 16,0 mm: ±0,60 mm maximum variation 16,0 mm ≤ *d* < 20,0 mm: ±0,70 mm maximum variation 20,0 mm ≤ d < 25,0 mm: ±0,80 mm maximum variation 25,0 mm ≤ *d*: to be agreed between supplier and customer (where *d* = nominal thickness
Length and width[a]	6	+10 mm/−0 mm
Straightness of edges[a]	7	1,5 mm/m maximum deviation
Squareness (Method A)[a]	8	1,5 mm/m maximum deviation
Squareness (Method B)[a]	9	≤ 6 mm
Flatness[b]	10	2,0 mm ≤ *d* < 6,0 mm: 8,0 mm/m maximum deviation 6,0 mm ≤ *d* < 10,0 mm: 5,0 mm/m maximum deviation 10,0 mm ≤ *d*: 3,0 mm/m maximum deviation (where *d* = nominal thickness

[a] Tolerances for cut-to-size panels shall be agreed between supplier and purchaser.

[b] Provided that the laminates are stored in the manner and conditions recommended by the manufacturer. The flatness values specified apply to laminates with two decorative faces. Limits for laminates with one face sanded shall be agreed between supplier and customer.

5.4 Test requirements

5.4.1 Physical property requirements

Physical property requirements are specified in Table 3.

Table 3 — Physical property requirements

Property	Test method (ISO 4586-2:2018, **Clause No. unless otherwise stated)**	Property or attribute	Unit (max. or min.)	Laminate grade	
				EGS and EDS	EGF and EDF
Resistance to wet conditions[a]	16	Mass increase	% (max.) $2 \leq d < 5$		
			$d \geq 5$	7	10
		Appearance	(where d = nominal thickness)	5	8
			Surface rating (min.)	4	4
			Edge rating	3	3
Dimensional stability at elevated temperature (Method A) or	19	Cumulative dimensional change	% (max.) 2 mm ≤ d < 5 mm		
			L[b]	0,40	0,40
			T[c]	0,80	0,80
			$d \geq 5$ mm		
			L[b]	0,30	0,30
			T[c]	0,60	0,60
			(where d = nominal thickness)		
Dimensional stability at elevated temperature (Method B)	20	Cumulative dimensional change	% (max.) 2 mm ≤ d < 5 mm		
			L[b]	0,40	0,40
			T[c]	0,80	0,80
			$d \geq 5$ mm		
			L[b]	0,30	0,30
			T[c]	0,60	0,60
			(where d = nominal thickness)		
Dimensional stability at ambient temperature (Method A) or	21	Cumulative dimensional change	% (max.) 2 mm ≤ d < 5 mm		
			L[b]	0,40	0,40
			T[c]	0,80	0,80
			$d \geq 5$ mm		
			L[b]	0,30	0,30
			T[c]	0,70	0,70
			(where d = nominal thickness)		
Dimensional stability at ambient temperature (Method B)	22	Cumulative dimensional change	% (max.)		
			L[b]	0,30	0,30
			T[c]	0,70	0,70
			(where d = nominal thickness)		

Table 3 *(continued)*

Property	Test method (ISO 4586-2:2018, **Clause No. unless otherwise stated)**	Property or attribute	Unit (max. or min.)	Laminate grade	
				EGS and EDS	EGF and EDF
Resistance to impact by large diameter ball (shatter resistance)	25	Drop height	mm (min.)		
			$2 \leq d < 6$ mm	1 400	1 400
			$6 \geq d$ mm	1 800	1 800
			(where d = nominal thickness)		
		Indentation diameter	mm (max.)	10	10
Flexural modulus[d]	ISO 178	Stress	MPa (min.)	9 000	9 000
Flexural strength[d]	ISO 178	Stress	MPa (min.)	80	80
Tensile strength[e]	ISO 527-2	Stress	MPa (min.)	60	60
Density	ISO 1183-1	Density	g/cm^3 (min.)	1,35	1,35

[a] See Annex B.

[b] L = in the longitudinal (or machine) direction of the fibrous sheet material (normally the direction of the longest dimension of the laminate).

[c] T = in the cross-longitudinal (cross-machine) direction of the fibrous sheet material (at right angles to direction L).

[d] Machine crosshead speed 10 mm/min.

[e] Specimen type 1A. Machine crosshead speed 5 mm/min.

5.4.2 Weather resistance requirements

Weather resistance requirements are specified in Table 4.

Weather resistance is the behaviour of exterior-grade laminates in relation to degradation of the surface, colour fading and reduction of mechanical properties, due to exposure to sunlight, rain, frost, etc.

Table 4 — Weather resistance requirements

Property	Test method (ISO 4586-2:2018 Clause No.)	Property or attribute	Unit (max. or min.)	Laminate grade	
				EGS and EGF	EDS and EDF
Resistance to climatic shock	23	Appearance	Rating (min.)	4	4
		Flexural strength index, D_s	(min.)	0,80	0,80
		Flexural modulus index, D_m	(min.)	0,80	0,80
Resistance to UV light	34	Contrast	Grey scale rating (not worse than)	No requirement	3 (after 1 500 h exposure)
		Appearance	Rating (min.)	No requirement	4 (after 1 500 h exposure)
Resistance to artificial weathering (including light fastness)	35	Contrast	Grey scale rating (not worse than)	3 (after 325 MJ/m radiant exposure)	3 (after 650 MJ/m^2 radiant exposure)
		Appearance	Rating (min.)	4 (after 325 MJ/m^2 radiant exposure)	4 (after 650 MJ/m^2 radiant exposure)

5.4.3 Notes on requirements for reaction to fire (see Annex A)

The requirements for reaction to fire are determined by the fire regulations of the country in which the material is to be used. The reaction-to-fire of construction products is classified in accordance with various test methods specific to individual nation where the material is installed. For applications other than construction, fire test methods and performance requirements may vary from one country to another, and at present it is not possible, with any test, to predict compliance with all national and other requirements. No fire performance test is therefore included in this specification, however Annex B gives examples of how high-pressure laminates relate to ASTM E84[4] and EN 13501-1[2] and some of the most common fire test scenarios.

Annex A
(informative)

Addendum to 5.4.3, relating to fire performance

In Europe, laminate panels intended for construction applications are tested in accordance with EN 13823[3] (SBI test) and ISO 11925-2[1] (Small-burner test), and the resulting reaction-to-fire performance is expressed in accordance with EN 13501-1.

Table A.1 shows typical EN 13501-1 reaction-to-fire classifications of exterior-grade compact laminates.

Table A.1 — Typical EN 13501-1 classifications of exterior-grade compact laminates

Product type	EN 13501-1 classification
EGF and EDF ≥ 6mm thick	B-s2,d0
EGF and EDF < 6mm thick	C-s2,d0 or better
EGS and EDS	D-s2,d0 or better
NOTE The laminate manufacturer should be contacted for details of fire test reports and certifications held, and for information on fire test methods and specifications.	

For applications other than construction, test methods and specifications may vary from one country to another.

Table A.2 shows some examples of how exterior-grade compact laminates typically relate to some of the more common European test methods.

Table A.2 — Examples of typical fire performance of exterior-grade compact laminates

Test method	Test standard	Typical performance levels	
		EDF and EGF	EGS and EDS
Spread of flame	BS 476-7	Class 1	Class 2
Brandschacht	DIN 4102-1	B1	B2
Epiradiateur	NF P92–501	M1	M3 or better
Smoke density and toxicity	NF F16–101	F2 or better	F2 or better
NOTE The laminate manufacturer should be contacted for details of fire test reports and certifications held, and for information on fire test methods and specifications.			

In North America, laminate panels intended for construction applications are tested in accordance with ASTM E84 and rated accordingly.

Table A.3 shows typical ASTM E84 reaction-to-fire classifications of compact laminates.

Table A.3 — Typical ASTM E84 classifications of compact laminates

Product type	Typical ASTM E84 classification
CGF ≥ 6mm thick	Class A
CGF < 6mm thick	Class B
CGS	Class C

NOTE 1 Fire test performance will depend on laminate thickness and construction, substrate type and thickness, and adhesive used. The laminate manufacturer should be contacted for details of test reports and certifications held, and for information on fire test methods and specifications.

NOTE 2 Flame-retardant additives used in exterior-grade compact laminates are not halogen based and remain effective throughout the service life of the product.

Annex B
(informative)

Assessment of conformity

The key performance characteristics for exterior-grade compact laminates are:

— Density (ISO 1183-1)

— Flexural modulus (ISO 178)

— Flexural strength (ISO 178)

— Resistance to wet conditions (ISO 4586-2:2018, Clause 16)

Bibliography

[1] ISO 11925-2, *Reaction to fire tests — Ignitability of products subjected to direct impingement of flame — Part 2: Single-flame source test*

[2] EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using test data from reaction to fire tests*

[3] EN 13823, *Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item*

[4] ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*

[5] BS 476-7, *Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products*

[6] DIN 4102-1, *Fire behaviour of building materials and building components — Part 1: Building materials; concepts, requirements and tests*

[7] NF P92-501, *Sécurité contre l'incendie — Bâtiment — Essais de réaction au feu des matériaux — Essai par rayonnement applicable aux matériaux rigides ou rendus tels (matériaux de revêtement collés) de toute épaisseur et aux matériaux souples d'épaisseur supérieure à 5 mm*

[8] NF F16-101, *Matériel roulant ferroviaire — Comportement au feu — Choix des matériaux*

[9] EN 438-6, *High-pressure decorative laminates (HPL) — Sheets based on thermosetting resins (usually called laminates) — Part 6: Classification and specifications for exterior-grade compact laminates of thickness 2 mm and greater*

NATIONAL ANNEX C

(*National Foreword*)

C-1 PACKING AND MARKING

C-1.1 Packing

The material shall be supplied in packages as agreed to between the purchaser and the supplier.

C-1.2 Marking

C-1.2.1 The consignment shall be marked suitably with the following information:

a) Manufacturer details and trade mark, if any;

b) Type and class of the material;

c) Month and year of manufacture; and

d) Batch number and code number.

C-1.2.2 *BIS Certification Marking*

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the rules and regulations framed thereunder, and the products may be marked with the Standard Mark.

(*Continued from second cover*)

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their respective places, are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 178 Plastics — Determination of flexural properties	IS 13360 (Part 5/Sec 7) : 2022/ ISO 178 : 2019 Plastics — Method of testing: Part 5 Mechanical properties, Section 7 Determination of flexural properties (*second revision*)	Identical
ISO 527-2 Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics	IS 13360 (Part 5/Sec 2) : 2017/ ISO 527- 2 : 2012 Plastics — Methods of testing: Part 5 Mechanical properties, Section 2 Determination of tensile properties — Test conditions for moulding and extrusion plastics (*first revision*)	Identical
ISO 1183-1 Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pyknometer method and titration method	IS 13360 (Part 3/Sec 10) : 2021/ ISO 1183-1 : 2019 Plastics — Methods of testing: Part 3 Physical and dimensional properties, Section 10 Determination of density of non-cellular plastics — Immersion method, liquid pyknometer method and titration method (*first revision*)	Identical
ISO 4586-2 : 2018 High -pressure decorative laminates (HPL) — Sheets based on thermosetting resins (usually called laminates) — Part 2: Determination of properties	PCD 12 (25647) Decorative thermosetting synthetic resin bonded laminated sheets – Specification: Part 2 Determination of properties (*third revision*) (*under printing*)	Identical

The standard makes a reference to the packing and marking of the product, details of which are given in National Annex C.

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.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

This Indian Standard has been developed from Doc No.: PCD 12 (25651).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
Eastern	: 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	2367 0012 2320 9474
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Published by BIS, New Delhi