

भारतीय मानक

भूकृत्रिम की पारिभाषिक शब्दावली

भाग 1 सामग्रियों और उनके गुणधर्म में उपयोग की शब्दावली

Indian Standard

GLOSSARY OF TERMS FOR GEOSYNTHETICS

PART 1 TERMS USED IN MATERIALS AND PROPERTIES

UDC 624.13 : [678] : 001.4

© BIS 1992

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Geosynthetics Sectional Committee had been approved by the Civil Engineering Division Council.

With a view to encouraging the use of geosynthetics in civil engineering related applications, the terms in use in the field relating to material and properties have been compiled and have been listed in this standard (Part 1). More terms as may come in the use of geosynthetics would be added in due course. Part 2 of this standard (*under preparation*) would cover terms used in functions and applications of geosynthetics.

In the formulation of this standard, assistance has been derived from the following:

- ASTM D4439 : 1987 Terminology for geosynthetics, published by American Society of Testing Materials.
- BS 6906 (Part 1) : 1987 Method of test for geotextile Part 1 Determination of tensile properties using a wide width strip, published by British Standards Institution.
- 'Standards on Geotextiles', 1988, Published by American Society of Testing Materials, New York.
- 'Geotextiles — Conceiving and designing engineering structures' by Oliver Gicot and Perfetti, J., Published by Rhone-Poulenc Fibres, France (1982).
- 'Designing with geosynthetics by Koerner, R. M. Published by Prentice Hall, NJ (1986).

Indian Standard

GLOSSARY OF TERMS FOR GEOSYNTHETICS

PART 1 TERMS USED IN MATERIALS AND PROPERTIES

1 SCOPE

This standard (Part 1) covers definitions of terms used in defining raw materials and properties of geosynthetics.

2 TERMINOLOGY

2.1 Terms Starting with 'A'

2.1.1 Absorption

The process by which a liquid is drawn into and tends to fill permeable pores in a porous solid body, also, the increase in mass of a porous solid body resulting from penetration of a liquid into its permeable pores.

2.1.2 Apparent Opening Size (AOS)

A property which indicates the approximate largest particle that would effectively pass through the geotextile.

2.1.3 Atmosphere for Testing Geotextiles

Air maintained at a relative humidity of 65 ± 5 percent and a temperature of $21 \pm 2^\circ\text{C}$.

2.2 Terms Starting with 'B'

2.2.1 Biodegradability

Degradation of natural and synthetic geotextiles and related products with micro-organisms such as bacteria or fungi.

2.2.2 Blinding

The condition whereby soil particles block the voids at the surface of a geotextile, thus reducing the hydraulic conductivity of the system.

2.2.3 Bonding

The process of combining fibres, filaments, or films into sheets, webs, or baths by means of mechanical, thermal, or chemical binding.

2.2.4 Breaking Load

The load applied to a specimen in a tensile test carried to rupture (E in Fig. 1) (see 2.12.3 also).

2.2.5 Breaking Toughness

It is proportional to the area under the load elongation curve from the origin to the breaking point. Breaking toughness is calculated from work-to-break, gauge length, and width of a specimen.

2.2.6 Butyl Rubber

A synthetic rubber based on isobutylene and a minor amount of isoprene. It is vulcanizable and features low permeability to gases and water vapor and good resistance to aging, chemicals, and weathering.

2.3 Terms Starting with 'C'

2.3.1 Calender

A precision machine equipped with three or more heavy internally heated or cooled rolls, revolving in opposite directions. Used for preparation of highly accurate continuous sheeting or plying up of rubber compounds and frictioning or coating of fabric with rubber or plastic compounds.

2.3.2 Calendering

Process which consists of passing a sheet or fabric between heated pressure-rollers.

2.3.3 Chemically Bonded Non-woven Fabric

Non-woven fabric, the cohesion of which is achieved by addition of chemical products (binding agents).

2.3.4 Chlorinated Polyethylene (CPE)

Family of polymers produced by chemical reaction of chlorine of the linear backbone chain of polyethylene.

2.3.5 Chlorosulphonated Polyethylene (CSPE)

Family of polymers that are produced by polyethylene reacting with chlorine and sulphur dioxide. (ASTM designation for this polymer is CSM).

2.3.6 Clogging

The movement by mechanical action or hydraulic flow of soil particles into the voids of a fabric and retention therein, thereby reducing the hydraulic conductivity of the system.

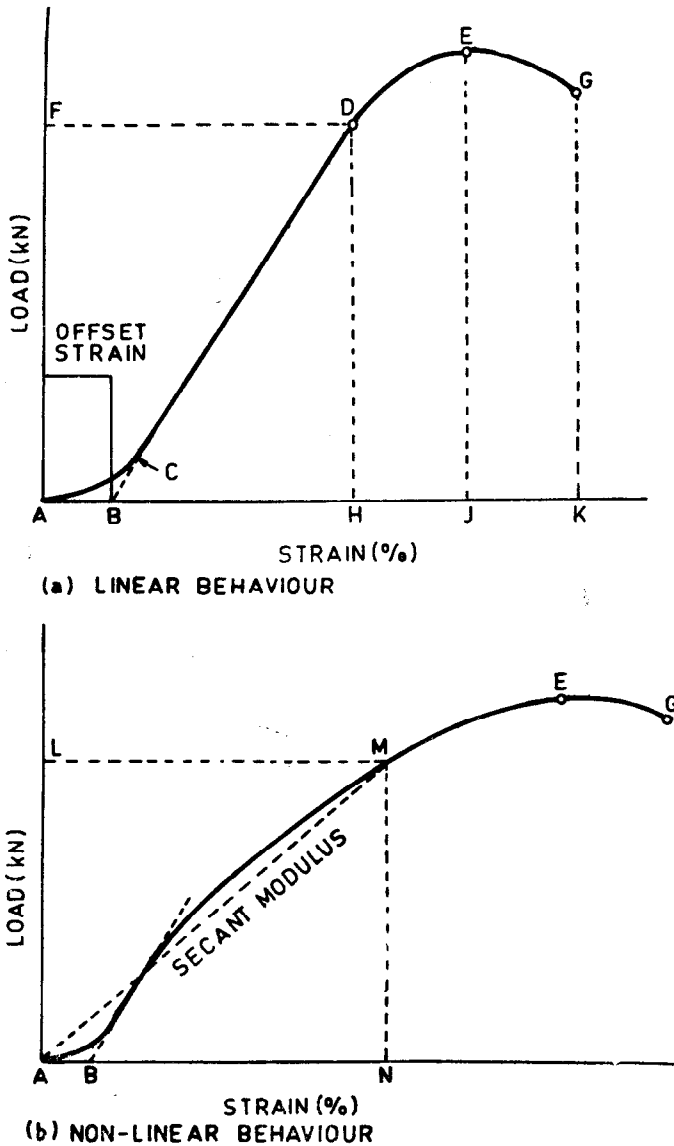


FIG. 1 TYPICAL LOAD-STRAIN GRAPHS

2.3.7 Coated Fabric

Fabric which has been impregnated and/or coated with a rubbery or plastic material in the form of a solution, dispersion, hot melt, or powder. The term also applies to materials resulting from the application of a preformed film to a fabric by means of calendering.

2.3.8 Compressed Thickness

Thickness under a specified stress applied normal to the material.

2.3.9 Constant-Rate-of-Load Tensile Testing Machine (CRL)

A testing machine in which the rate of increase of the load being applied to the specimen is uniform with time after the first 3 s.

2.3.10 Cross Machine Direction

The direction of a geosynthetic which is perpendicular to its long, manufactured, or machine direction. Often referred to in hydraulic situations.

2.4 Terms Starting With 'D'**2.4.1 Denier**

The mass in grams of 9 000 m of yarn.

2.4.2 Density

The mass per unit volume.

2.4.3 Direction, Cross Machine

The direction perpendicular to the machine or manufactured direction.

2.4.4 Direction, Machine

In textiles, the direction in a machine-made fabric parallel to the direction of movement the fabric followed in the manufacturing machine (synonym, lengthwise).

2.4.5 Discontinuous Fibre

Short textile fibre, generally a few centimeters in length.

2.5 Terms Starting With 'E'**2.5.1 Elastic Limit**

The load at the strain at which the load ceases to be linearly proportional to the strain (D in Fig. 1 (a) for the elastic region CD).

2.5.2 Elongation

The increase in length produced in the gauge length of the test specimen by a tensile load.

2.5.3 Elongation at Break

The percent elongation corresponding to the breaking load.

2.5.4 Elongation, Percent (See 2.17.9 also)

For geosynthetics, the increase in length of a specimen expressed as a percentage of the original gauge length (i. e., strain).

2.5.5 Ethylene Propylene Diene Monomer (EPDM)

A synthetic elastomer based on ethylene, propylene, and a small amount of a nonconjugated diene to provide sites for vulcanization.

2.5.6 Extruded Mesh

A determined or non-determined netlike polymeric material produced by a process of continuous integral extrusion, used with foundation, soil, rock, earth or any other geotechnical engineering related material as an integral part of the human made project structure or system.

2.5.7 Extruder

A machine with a driven screw for continuous forming of rubber by forcing through a die; can be used to manufacture films and sheeting,

2.5.8 EVA

Family of copolymers of ethylene and vinyl acetate used for adhesives and thermoplastic modifiers.

2.6 Terms Starting With 'F'**2.6.1 Fabric, Composite**

A textile structure produced by combining nonwoven, woven, or knit manufacturing methods.

2.6.2 Fabric Knit

A textile structure produced by interlooping one or more ends of yarn or comparable material.

2.6.3 Fabric, Nonwoven

For geotextiles, a planar and essentially random textile structure produced by bonding, interlocking of fibres, or both, accomplished by mechanical, chemical, thermal, or solvent means, and combinations thereof.

2.6.4 Fabric Reinforcement

A fabric, scrim, and so on, used to add structural strength to a two or more ply polymeric sheet. Such sheeting is referred to as 'supported'.

2.6.5 Fabric, Woven

A planar textile structure produced by interlacing two or more sets of elements, such as yarns, fibres, roving, or filaments, where the elements pass each other, usually at right angles and one set of elements are parallel to the fabric axis.

2.6.6 Breaking Load

The maximum load which can be withstood by specimen in a tension test, conducted to failure point.

2.6.7 Filament Yarn

The yarn made from continuous filament fibres.

2.6.8 Fill

As used in textile technology refers to the threads or yarns in a fabric running at right angles to the warp. Also called filler threads or weft threads.

2.6.9 *Filling*

Yarn running from selvage to selvage at right angles to the warp in an woven fabric.

2.6.10 *Film*

Sheeting having nominal thickness not greater than 254 μm (0.254 mm).

2.6.11 *Filler Cloth*

The deprecated term for geotextile.

2.7 Terms Starting With 'G'

2.7.1 *Geocell*

A three-dimensional structure filled with soil, thereby forming a mattress for increased bearing capacity and maneuverability on loose or compressible subsoils.

2.7.2 *Geocomposite*

A manufactured material using geotextiles, geogrids, and/or geomembranes in laminated or composite form.

2.7.3 *Geogrid*

A deformed or nondeformed netlike polymeric material used with foundation, soil, rock, earth, or any other geotechnical engineering-related material as an integral part of the human-made project structure or system.

2.7.4 *Geomembrane*

An essentially impermeable membrane (liner or barrier) used with foundation, soil, rock, earth, or any other geotechnical engineering-related material as an integral part of human-made project, structure, or system, used to control fluid migration.

2.7.5 *Geosynthetics*

The generic classification of all synthetic materials used in geotechnical engineering applications, it includes geotextiles, geogrids, geomembranes, and geocomposites.

2.7.6 *Geotextile*

Any permeable textile (natural or synthetic) used with foundation, soil, rock, earth, or any other geotechnical engineering-related material as an integral part of a human-made project, structure, or system.

2.7.7 *Geotechnics*

The application of scientific methods and engineering principles to the acquisition,

interpretation, and the use of knowledge of materials of the earth's crust to the solution of engineering problems.

2.7.8 *Grab Test* (See 2.20.4 also)

In fabric testing, a tension test in which only a part of the width of the specimen is gripped in the clamps.

2.8 Terms Starting With 'H'

2.8.1 *Heat Bonded*

Thermally bonded by melting the fibres to form weld points.

2.8.2 *Heat Seaming*

The process of joining two or more thermoplastic films of sheets by heating areas in contact with each other to the temperature at which fusion occurs. The process is usually aided by a controlled pressure. In dielectric seaming the heat is induced within films by means of radio-frequency waves.

2.9 Terms Starting With 'I'

2.9.1 *In-plane*

The direction of a geosynthetic which is parallel to its long, manufactured, or machine direction. (Usually referred to in hydraulic situations).

2.9.2 *Impervious or Water-tight Membrane*

Flexible continuous product or article, such as film, coated or impregnated geotextile, film-geotextile complexes, to provide imperviousness usually to water.

2.9.3 *Impregnated Cloth*

Cloth which has been dipped in an impregnating bath (polymer resin). The purposes of this treatment is the strengthening of the product, protection against external wear, and in certain cases, watertightness.

2.9.4 *Index Test*

A test procedure which may contain a known bias but which may be used to establish an order for a set of specimens with respect to the property of interest.

2.9.5 *Initial Tensile Modulus*

For geotextiles the ratio of the change in tensile load to a change in strain (slope) of the initial portion of a load strain curve [see A-C in Fig. 1(a)].

2.10 Terms Starting With 'K'**2.10.1 Knitted Fabric**

Cloth made of a textile material, arranged in successive stitches (the term knit may also be used).

2.11 Terms Starting With 'L'**2.11.1 Laboratory Sample**

A portion of material taken to represent the lot sample, or the original material, and used in the laboratory as a source of test specimens.

2.11.2 Lot

A unit of production or a group of other units or packages, taken for sampling or statistical examination having one or more common properties and being readily separable from other similar units.

2.11.3 Laminated Cloth

Cloth to which an adhesive film has been attached either by means of heat-sealing or by application of binding agents. The aims of this pretreatment are the strengthening of the product, protection against external wear and/or water-tightness.

2.11.4 Lapped Joint

A joint made by placing one surface to be joined partly over another surface and bonding the overlapping portions.

2.12 Terms Starting With 'M'**2.12.1 Mass per Unit Area**

The proper term to represent and compare to amount of material per unit area (units are g/m^2).

2.12.2 Machine Direction

The direction in the plane of the fabric parallel to the direction of manufacture.

2.12.3 Maximum Load

The maximum tensile force (in kN) observed during a test (*E* on Fig. 1).

2.12.4 Membrane

A continuous sheet of material, whether pre-fabricated as a flexible polymeric sheeting or sprayed or coated in the field, such as a sprayed-on asphalt.

2.13 Terms Starting With 'N'**2.13.1 Needle Punched**

Mechanically bonded by needling with barbed needles.

2.13.2 Neoprene (Polychloroprene)

Generic name for a synthetic rubber, based primarily on chloroprene (i.e., chlorobutadiene).

2.13.3 Nitrile Rubber

A family of copolymers of butadiene and acrylonitrile that can be vulcanized into tough oil-resistant compounds. Blends with PVC are used where ozone and weathering are important requirements in addition to its inherent oil and fuel resistance.

2.13.4 Non-woven Fabric

A cloth obtained by mechanical and/or chemical and/or thermal binding of textile fibres arranged to form a fabric (fabrics), but excluding weaving and knitting, or a combination of these latter.

2.13.5 Normal Direction

For geotextiles, the direction perpendicular to the plane of a geotextile.

2.13.6 Nylon

Generic name for a family of polyamide polymers characterized by the presence of the amide group C-O-N-H.

2.14 Terms Starting With 'O'**2.14.1 Offset Tensile Modulus**

For geotextiles the ratio of the change in load per unit width to a change in strain (slope) below the proportional limit point and above the tangent point on the load-strain curve.

2.15 Terms Starting With 'P'**2.15.1 Permeability**

The rate of flow of a liquid through a material under a differential pressure.

2.15.2 Permittivity

For a geotextile, the volumetric flow rate of water per unit cross-section area, per unit head, under laminar flow conditions, in the normal direction through the fabric.

2.15.3 Polyamide_n (PA)

Linear macromolecule, the chain of which is characterized by the repetition of the functional amide group C-C-O-N-H. May be either aliphatic or aromatic.

2.15.4 Polyester (PES)

Linear macromolecule, the chain of which is characterized by at least 85 percent in mass of ester of diol and terephthalic acid.

2.15.5 Polyethylene (PE)

Linear macromolecule saturated with aliphatic hydrocarbons, non-substitutive.

2.15.6 Polymer

A macromolecular material formed by the chemical combination of monomers having either the same or different chemical composition. Plastics, rubbers, and textile fibres are all high-molecular-weight polymers.

2.15.7 Polymeric Liner

Plastic or rubber sheeting used to line disposal sites, pits, ponds, lagoons, canals, and so on.

2.15.8 Polyolefine (PO)

Class of polymer which includes polyethylenes and polypropylenes.

2.15.9 Polypropylene (PP)

Linear macromolecule, saturated with aliphatic hydrocarbons, in which one out of every two carbons carries a methyl radical, generally in isotactical arrangement, and without further substitution.

2.15.10 Puncture Resistance

The inherent resisting mechanism of the test specimen to the failure by a penetrating or puncturing object. Also to the extent to which a material is able to withstand the action of a sharp object without perforation.

2.16 Terms Starting With 'R'

2.16.1 Resin Bonded

The joining of fibers at their intersection points by resin in the formation of a nonwoven geotextile or geocomposite.

2.16.2 Rubber

A polymeric material which, at room temperature, is capable of recovering substantially in shape and size after removal of a deforming force. Refers to both synthetic and natural rubber. Also called an elastomer.

2.17 Terms Starting With 'S'

2.17.1 Scrim

A woven, open-mesh reinforcing fabric made from continuous-filament yarn. Used in the reinforcement of polymeric sheeting.

2.17.2 Seam Strength

Strength of a seam measured either in shear or peel modes. Strength of the seams is reported either in absolute unit (e. g., kN per m of

width) or as a percent of the strength of the materials.

2.17.3 Secant Tensile Modulus

For geotextiles, the ratio of change in load per unit width to a stated value of strain, (slope) between two points on the strain curve, shown in Fig. 1 (b). (The 10 percent secant modulus is $MN/AN \times 100$).

2.17.4 Sheeting

A form of plastic or rubber in which the thickness is very small in proportion to length and width and in which the polymer compound is present as a continuous phase throughout, with or without fabric.

2.17.5 Specimen

A specific portion of a material or laboratory sample upon which a test performed or which is taken for that purpose.

2.17.6 Staple

Short fibres (cut fibres) in the range 7-70 mm.

2.17.7 Staple Yarn

Yarn made from staple fibres.

2.17.8 Stiffness

Resistance to flexure or torsion.

2.17.9 Strain (See 2.5.4 also)

The increase in length of a test specimen under tensile load expressed as the percentage increase in length of the initial gauge length.

2.17.10 Strain at Breaking Load

The strain from the origin (*A* in Fig. 1) to the strain corresponding to the breaking load (*AK* in Fig. 1).

2.17.11 Strain at Maximum Load

The strain from the origin (*A* in Fig. 1) to the strain corresponding to the maximum load (*AJ* in Fig. 1).

2.17.12 Strain at 10% Elongation

The strain from the origin (*A* in Fig. 1) to the strain corresponding to 10% elongation [point *N* in Fig. 1 (b)].

2.18 Terms Starting With 'T'

2.18.1 Tangent Point

For geosynthetics, the first point of the load strain curve at which a major decrease in slope occurs (Point *E* in Fig. 1)

2.18.2 Tear Strength

The maximum force required to tear a specified specimen, the force acting substantially parallel to the major axis of the test specimen.

2.18.3 Tape

A flat tape having a high ratio of width to thickness. Tapes are produced by slitting films of polymeric material and then stretching to 7 to 9 times its length and stability.

2.18.4 Tearing Strength

The force required to either start, or continue or propagate a tear in a fabric under specified conditions. This test method uses the test maximum of the tearing force as the tearing strength.

2.18.5 Temperature Stability

For a geotextile, the percentage change in tensile strength and elongation measured at a specified temperature as compared to the values obtained at the standard conditions of temperature for testing.

2.18.6 Tenacity

The fibre strength expressed as force per unit linear density (gram force per denier).

2.18.7 Tensile Modulus

For geosynthetics, the ratio of change in tensile force per unit width (N/m) to corresponding change in strain (slope).

2.18.8 Tensile Strength

The maximum tensile stress per unit of original cross-sectional area applied during stretching of a specimen to break.

2.18.9 Tensile Strength of Geotextiles

Is the characteristic of a sample as distinct from a specimen and is expressed in force per unit width.

2.18.10 Tensile Test

A test in which a material is stretched in one direction to determine the load strain characteristics, tensile strength and elongation at break.

2.18.11 Tex

Mass in grams of 1 000 m of thread.

2.18.12 Thermoplastic Elastomers (TPE)

New materials which are being developed and which are probably related to elasticized polyolefins. Polymers of this type behave similarly to cross-linked rubber. They have a

limited upper-temperature service range which, however, is substantially above the temperature encountered in waste disposal sites (95° C may be too high for some TPEs).

2.18.13 Transmissivity

For a geotextile, the volumetric flow rate per unit thickness under laminar flow conditions, in the in-plane direction of the fabric.

2.18.14 Transverse Direction

Synonym for cross-machine direction.

2.18.15 Thread Count

The number of threads per dm in each direction with the warp mentioned first and the weft second [e. g., a thread count of 80 × 40 means 80 threads per dm in the warp and 40 threads per inch in the weft direction].

2.19 Terms Starting With 'U'**2.19.1 Ultraviolet Degradation**

The breakdown of polymeric structure when exposed to ultraviolet light.

2.19.2 Unsupported Sheeting

A polymeric sheeting consisting of one or more plies without a reinforcing-fabric layer or scrim.

2.20 Terms Starting With 'W'**2.20.1 Warp Direction**

Synonym for machine direction.

2.20.2 Water Vapour Transmission (WVT)

Water vapour flow normal to two parallel surfaces of a material, through a unit area, under the conditions of a specified test.

2.20.3 Weft

Synonym for cross-machine direction.

2.20.4 Wide Strip Tensile Test for Geotextiles

Uniaxial tensile test in which the entire width of a 200 mm wide specimen or at least five complete tensile elements within the width of the test specimen is gripped in the clamps to ensure a gauge length of 100 mm, measured to +/−3 mm or at least one row of nodes or cross-members, excluding the nodes or cross-members by which the test specimen is held in the clamps.

2.20.5 Width

For a geotextile, the cross-direction edge-to-edge measurement of a fabric in a relaxed condition on a flat surface.

2.20.6 Work to Break (*W*, *LF*)

The total energy required to rupture a specimen in a tensile testing. For geosynthetics, work to break is proportional to the area under the load elongation curve from the origin to the break point, and is commonly expressed in joules.

2.20.7 Woven Monofilament

The woven fabric produced with monofilament yarns.

2.20.8 Woven, Multifilament

The woven fabric produced with multifilament yarns.

2.20.9 Woven, Slit Film

The woven fabric produced with yarns produced from slit film.

2.21 Terms Starting With 'Y'

2.21.1 Yarn

A generic term for continuous strands of textile fibres or filaments in a form suitable for knitting, weaving, or otherwise intertwining to form a textile fabric. It may comprise (1) a number of fibres twisted together, (2) a number of filaments laid together without twist (a zero-twist yarn), (3) a number of filaments laid together with more or less twist, or (4) a single filament without twist (a monofilament).

2.21.2 Yield Point

The first point of the load strain curve above the proportional (linear) section at which an increase in elongation occurs without a corresponding increase in load [*D* in Fig. 1 (a)].

Standard Mark

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Bureau of Indian Standard

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Revision of Indian Standards

Indian Standards are reviewed periodically and revised, when necessary and amendments, if any, are issued from time to time. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition. Comments on this Indian Standard may be sent to BIS giving the following reference:

Doc : No CED 52 (4913)

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 : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all Offices)

Regional Offices :

	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	{ 311 01 31 331 13 75
Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola CALCUTTA 700054	37 86 62
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	53 38 43
Southern : C. I. T. Campus, IV Cross Road, MADRAS 600113	235 02 16
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) BOMBAY 400093	6 32 92 95
Branches : AHMADABAD, BANGALORE, BHOPAL, BHUBANESHWAR, COIMBATORE, FARIDABAD, GHAZIABAD, GUWAHATI, HYDERABAD, JAIPUR, KANPUR, LUCKNOW, PATNA, THIRUVANANTHAPURAM.	