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*Indian Standard*

GLOSSARY OF TERMS RELATING TO  
CEMENT CONCRETE

PART VI EQUIPMENT, TOOLS AND PLANT

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

# *Indian Standard*

## GLOSSARY OF TERMS RELATING TO CEMENT CONCRETE

### PART VI EQUIPMENT, TOOLS AND PLANT

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# *Indian Standard*

## GLOSSARY OF TERMS RELATING TO CEMENT CONCRETE

### PART VI EQUIPMENT, TOOLS AND PLANT

#### 0. FOREWORD

**0.1** This Indian Standard ( Part VI ) was adopted by the Indian Standards Institution on 30 August 1972, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

**0.2** Cement concrete is one of the most versatile and extensively used building materials in all civil engineering constructions. There are a number of technical terms connected with the basic materials for concrete as well as the production and use of concrete which quite often require clarification to give precise meaning to the stipulations in the standard specifications, codes of practices and other technical documents. It has, therefore, become necessary to standardize the various terms and definitions used in cement and concrete technology and thus avoid ambiguity in their interpretations. The Sectional Committee has, therefore, decided to bring out a series of glossaries of terms relating to concrete and concrete materials.

**0.3** For convenience of reference, the Indian Standard Glossary of terms relating to cement concrete has been grouped into the following twelve parts:

Part I	Concrete aggregates
Part II	Materials ( other than cement and aggregate )
Part III	Concrete reinforcement
Part IV	Types of concrete
Part V	Formwork for concrete
Part VI	Equipment, tools and plant
Part VII	Mixing, laying, compaction, curing and other construction aspects
Part VIII	Properties of concrete
Part IX	Structural aspects

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Part X	Tests and testing apparatus
Part XI	Prestressed concrete
Part XII	Miscellaneous

**0.3.1** In addition to those given in **0.3**, two separate standards have been brought out concerning terminology relating to hydraulic cement ( IS : 4845-1968\* ) and pozzolanic materials ( IS : 4305-1967† ).

**0.4** In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country. This has been met by deriving assistance from the following publications:

BS : 2787-1956 Glossary of terms for concrete and reinforced concrete. British Standards Institution.

BS : 4340-1968 Glossary of formwork of terms. British Standards Institution.

ACI No. SP-19 Cement and Concrete terminology. American Concrete Institute.

ACI 617-1968 Recommended practice for concrete formwork. American Concrete Institute.

ASTM Designation : C 125 Definitions of terms relating to concrete aggregate. American Society for Testing and Materials.

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## 1. SCOPE

**1.1** This standard ( Part VI ) covers definitions of terms relating to equipment, tools and plant for cement concrete.

## 2. DEFINITIONS

**2.0** For the purpose of this standard, the following definitions shall apply

**2.1 Agitating Speed** — The rate of rotation of the drum or blades of a transit mixer or truck mixer or similar other device when used for agitation of mixed concrete.

**2.2 Agitating Truck (Transit Agitator, Truck Agitator)** — A mobile equipment mounted on a truck or some other suitable mobile haulage unit, in which freshly mixed concrete may be agitated by rotating the drum continuously or intermittently during transit.

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\*Definitions and terminology relating to hydraulic cement.

†Glossary of terms relating to pozzolana.

**2.3 Agitation**

- a) The process of providing gentle motion in mixed concrete just sufficient to prevent segregation or loss of plasticity.
- b) The mixing and homogenization of slurries or finely ground powders by air or mechanical means ( *see also 2.4* ).

**2.4 Agitator** — A device for maintaining plasticity and preventing segregation of mixed concrete by agitation.

**2.5 Air-Blow Pipes** — Air jet used in shotcrete work to remove rebound or other loose material from the work area.

**2.6 Air Gun ( Cement Gun )** — A machine in which a mixture of cement and small aggregate is forced by compressed air through a hose to a nozzle, where requisite quantity of water brought through a separate hose is added, and the combined materials are driven with force from the nozzle to the point of placement.

**2.7 Air Lift** — Equipment whereby slurry or dry powder is lifted through pipes by means of compressed air.

**2.8 Air Meter** — A device for measuring the air content of concrete and mortar.

**2.9 Air Ring** — Perforated manifold in nozzle of wet-mix shotcrete equipment through which high pressure air is introduced into the material flow.

**2.10 Air Separator** — An upright cylindrical-conical pneumatic apparatus, with internal rotating blades, which separates various size fractions of ground materials pneumatically; discharging fine particles as a product and returning oversized ones to the mill as tailings.

**2.11 Amount of Mixing** — The designation of extent of mixer action employed in combining the ingredients for concrete or mortar; it is normally designated by the mixing time in the case of stationary mixers and the number of revolutions of the drum or blades at mixing speed after the intermingling of the cement with water and aggregates in case of transit mixer or truck mixer.

**2.12 Amplitude of Vibration** — The maximum displacement of a vibrating body from its mean position during vibration. It is usually expressed as half of total displacement.

**2.13 Angle Float** — A finishing tool having a surface bent to form a right angle; used to finish re-entrant angles.

**2.14 Arrising Tool** — A tool similar to a float, but having a form suitable for rounding an edge of freshly placed concrete.

**2.15 Batch** — Quantity of concrete or mortar mixed at one time.

**2.16 Batched Water** — The mixing water added by a batcher to a batch of concrete or mortar mixture before or during the initial stages of mixing.

**2.17 Batcher** — A device for measuring ingredients for a batch of concrete. It may consist of the following types:

- a) *Manual Batcher* — A batcher equipped with gates or valves which are operated manually, with or without supplementary power from pneumatic, hydraulic or electrical machinery, the accuracy of the weighing operation being dependent on the operator's observation of the scale.
- b) *Semiautomatic Batcher* — A batcher equipped with gates or valves which are separately opened manually to allow the material to be weighed but which are closed automatically when the designated weight of each material has been reached.
- c) *Automatic Batcher* — A batcher equipped with gates or valves which, when actuated by a single starter switch, will open automatically at the start of the weighing operation of each material and close automatically when the designated weight of each material has been reached, interlocked in such a manner that:  
(1) the charging mechanism cannot be opened until the scale has returned to zero; (2) the charging mechanism cannot be opened if the discharging mechanism is open; (3) the discharge mechanism cannot be opened until the designated weight has been reached within the allowable tolerance; and (4) if different kinds of aggregates or different kinds of cements are weighed cumulatively in a single batcher, interlocked sequential controls are provided.

**2.18 Batching** — Weighing or volumetrically measuring and introducing into the mixer the ingredients for a batch of concrete or mortar.

**2.19 Batch Mixer** — A concrete mixer for cyclic operation in which the ingredients for concrete are charged in batches; each new batch is charged into drum of the mixer only when the preceding batch has been discharged.

**2.20 Batching Plant** — An operating installation of equipment including batchers and mixers as required for batching or for batching and mixing concrete materials; also called mixing plant when mixing equipment is included.

**2.21 Bull Float** — A tool comprising a large, flat, rectangular piece of wood, aluminium, or magnesium usually 20 cm wide and 100 to 150 cm long, and a handle 1 to 5 m in length used to smooth unformed surfaces of freshly placed concrete.

**2.22 Bush-Hammer** — A hammer having a serrated face, as rows of pyramidal points used to roughen or dress a surface; to finish a concrete surface; by application of a bush-hammer.

**2.23 Capacity** — The volume of concrete permitted to be mixed or carried in a particular mixer or agitator, usually limited by specifications to a maximum percentage of total gross volume; also the output of concrete, aggregate, or other product per unit of time ( as plant capacity or screen capacity ).

**2.24 Centrally-Mixed Concrete** — Concrete produced by completely mixing cement, aggregates, and water at a stationary central mixing plant and delivered in containers fitted with agitating devices, except that when so agreed to between the purchaser and the manufacturer, the concrete may be transported without being agitated.

**2.25 Central Mixer** — A stationary concrete mixer from which the freshly mixed concrete is transported to the work.

**2.26 Charging** — Introducing, feeding, or loading materials into a concrete or mortar mixer, or other container or receptacle where they will be further treated or processed.

**2.27 Chute** — A sloping trough or tube for conducting concrete cement, aggregate, or other free flowing materials from a higher to a lower point.

**2.28 Concrete Breaker** — A compressed-air tool specially designed and constructed to break up concrete or for use for similar demolition work.

**2.29 Concrete Finishing Machine** — A machine mounted on flanged wheels which rides on the forms or on specially set tracks, used to finish surfaces, such as those of pavements; or a portable power driven machine for floating and finishing of floors and other slabs.

**2.30 Concrete Paver** — A concrete mixer, usually mounted on crawler tracks, which mixes and places concrete in pavement or in the subgrade.

**2.31 Concrete Pump** — An apparatus which forces concrete to the placing position through a pipeline or hose.

**2.32 Concrete Spreader** — A machine, usually carried on side forms or on rails parallel thereto, designed to spread concrete from heaps already dumped in front of it, or to receive and spread concrete in a uniform layer.

**2.33 Concrete Vibrating Machine** — A machine, commonly carried on side forms or on rails parallel thereto, which compacts a layer of freshly mixed concrete by vibration.

**2.34 Continuous Mixer** — A mixer into which the ingredients of the mixture are fed without stopping, and from which the mixed concrete is discharged in a continuous stream.

**2.35 Conveying Hose** — Hose through which shotcrete materials or pumped concrete pass; also known as material hose or conveying hose.

**2.36 Conveyor** — A device for moving materials; usually a continuous belt, an articulated system of buckets, a confined screw, or a pipe through which material is moved by air or water.

**2.37 Cumulative Batching** — Measuring more than one ingredient of a batch in the same container by bringing the batcher scale into balance at successive total weights as each ingredient is accumulated in the container.

**2.38 Cutting Screed** — Sharp edged tool used to trim shotcrete to finished outline.

**2.39 Darby** — A hand-manipulated straight edge 1 to 2.5 m or more long used in the early stage levelling operations of concrete finishing to supplement floating.

**2.40 Delivery Hose** — Hose through which shotcrete materials or pumped concrete pass; also known as material hose or conveying hose.

**2.41 Devil's Float** — A wooden float with two nails protruding from the toe; used to roughen the surface of the brown plaster coat.

**2.42 Eccentric Shaft** — The rotating shaft of the vibrating unit designed to produce the required frequency and amplitude of vibration.

**2.43 Edger ( Edging Tool )** — A finishing tool used on the edges of fresh concrete to provide a rounded corner.

**2.44 Elephant Trunk ( Down Pipe )** — An articulated tube or chute used in concrete placement.

**2.45 External Vibrator** — *See 2.124.*

**2.46 Feather Edge** — A wood or metal tool having a bevelled edge; used to straighten re-entrant angles in finish plaster coat; also edge of a concrete or mortar placement such as a patch or topping that is bevelled at an acute angle.

**2.47 Feed Wheel** — Material distributor or regulator in certain types of shotcrete equipment.

**2.48 Finishing Machine** — A power-operated machine used to give the desired surface texture to a concrete slab.

**2.49 Float** — A tool ( not a darby ), usually of wood, steel, aluminium or magnesium, used in finishing operations to impart a relatively even ( but not smooth ) texture to an unformed fresh concrete surface.

**2.50 Flush Water** — Water carried on a truck mixer or transit mixer in a special tank for flushing the interior of the mixer after discharge of the concrete.

**2.51 Free Fall** — Descent of freshly mixed concrete into forms without dropchutes or other means of confinement; also the distance through which such descent occurs; also uncontrolled fall of aggregate.

**2.52 Free Fall Mixer** — A free fall mixer having a drum with a series of blades fitted internally, which rotates about a horizontal or inclined axis. The mixing action is achieved by causing each part of the mix to be lifted in turn as the drum rotates and at a certain point in each revolution allowing it to be dropped or directed towards the bottom of the drum where it combines with other parts of the mix in continuously changing sequence to form a homogeneous mix. The free fall mixer is generally of the following types:

- a) *Tilting Type* — The free fall mixer in which the drum has an inclinable axis and is a single compartment;
- b) *Non-tilting Type* — The free fall mixer in which the drum rotates in one direction on a horizontal axis and comprises a single compartment drum having two openings; and
- c) *Reversing Drum Type* — The free fall mixer in which the drum rotates on a horizontal axis, the direction being reversed to discharge.

**2.52.1 Free Fall Barrow Tipping Mixer** — The free fall mixer in which the drum rotates about an inclined axis; the drum is mounted on a wheel barrow which can be tilted forward to discharge the mixed concrete from the drum; usually small capacity hand operated mixer.

**2.53 Go-Devil** — A ball of rolled-up burlap, paper, or specially fabricated device put into the pump end of a pipeline and forced through the pipe by water pressure to clean the pipeline.

**2.54 Grade Strip** — Usually a thin strip of wood tacked to inside of forms at the line to which the top of the concrete lift is to come, either at a construction joint or the top of the structure.

**2.55 Grizzly** — A simple, stationary screen or series of equally spaced parallel bars set at an angle to remove oversize particles in processing aggregate or other material.

**2.56 Groover** — A tool used to form grooves or weakened plane joints in a concrete slab before hardening to control crack location or provide pattern.

**2.57 Gross Volume (of Concrete Mixers)** — In the case of a revolving-drum mixer, the total interior volume of the revolving portion of the mixer drum; in the case of an open top mixer, the total volume of the trough or pan calculated on the basis that no vertical dimension of the container exceeds twice the radius of the circular section below the axis of the central shaft.

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**2.58 Ground Wire** — Small gauge high-strength steel wires used to establish line and grade as in shotcrete work; also called alignment wire or screed wire.

### **2.59 Gun**

- a) Shotcrete material delivery equipment, usually consisting of double chambers under pressure; equipment with a single pressure chamber is used to some extent.
- b) Pressure cylinder used to propel freshly mixed concrete pneumatically.

**2.60 Hamm Tip** — Flared shotcrete nozzle having a diameter larger at the midpoint than either at the inlet or at the outlet; also designated premixing tip.

**2.61 Hawk** — A tool used by plasterers to hold and carry plaster mortar; generally a flat piece of wood or metal approximately 25 to 30 cm square, with a wooden handle centered and fixed to the underside.

**2.62 High-Discharge Mixer** — *See 2.65.*

**2.63 Hod** — A portable trough for carrying mortar, bricks, etc, fixed crosswise on top of a pole and carried on the shoulder.

**2.64 Horizontal-Axis Mixer** — A concrete mixer of the revolving drum type in which the drum rotates about a horizontal axis.

**2.65 Inclined-Axis Mixer** — A truck with revolving drum which rotates about an axis inclined to the bed of the truck chassis.

**2.66 Inclined Drum Mixer** — Free fall batch mixer with an inclined drum in the shape of two truncated cones connected at wide bases by a cylindrical insert. The drum rotates on a horizontal axis the direction being reversed to discharge the concrete mix.

**2.67 Jointer** — A metal tool about 15 cm long and from 5 to 10 cm wide and having shallow, medium, or deep bits (cutting edges) ranging from 5 to 20 mm or deeper used to cut a joint partly through fresh concrete.

**2.68 Loading Hopper** — A hopper in which concrete or other free flowing material is placed for loading by gravity into buggies or other conveyances for transport to the forms or to other place of processing, use, or storage.

**2.69 Material Hose** — *See 2.40.*

**2.70 Mixer** — A machine employed for blending the constituents of concrete, grout, mortar or other mixture.

**2.71 Mixer, Batch** — *See 2.19.*

**2.72 Mixer, Colloidal** — A mixer designed to produce colloidal grout.

**2.73 Mixer Efficiency** — The adequacy of a mixer in rendering a homogeneous product within a stated period; homogeneity is determinable by testing for relative differences in physical properties of samples extracted from different portions of a freshly mixed batch.

**2.74 Mixer, Forced Action ( or Mixer, Counterflow )** — A mixer comprising a horizontal pan or drum in which mixing is accomplished by means of the rotating pan or fixed or rotating paddles or both; rotation is about a vertical axis.

**2.75 Mixer, Tilting** — A horizontal-axis mixer the drum of which can be tilted; the materials are fed in when the discharge opening of the drum is raised and the mixture is discharged by tilting the drum [ see 2.52 (a) ].

**2.76 Mixing Cycle** — The time taken for a complete cycle in a batch mixer, that is, the time elapsing between successive repetitions of the same operation ( for example, successive discharges of the mixer ).

**2.77 Mixing Plant** — See 2.20.

**2.78 Mixing Speed** — Rotation rate of a mixer drum or of the paddles in an open-top, pan, or trough mixer, when mixing a batch expressed in revolutions per minute ( rev/min ), or in peripheral feet per minute of a point on the circumference at maximum diameter.

**2.79 Mixing Time** — The period during which the constituents of a batch of concrete are mixed by a mixer; for a stationary mixer, time is given in minutes from the completion of mixer charging until the beginning of discharge; for a truck mixer, time is given in total minutes at a specified mixing speed or expressed in terms of total revolutions at a specified mixing speed.

**2.80 Mixing Water** — The water in freshly mixed sand-cement grout, mortar, or concrete, exclusive of any water previously absorbed by the aggregate ( for example, water considered in the computation of the net water-cement ratio ).

**2.81 Non-agitating Unit** — A truck-mounted container, for transporting central-mixed concrete, not equipped to provide agitation ( slow mixing ) during delivery.

**2.82 Nozzle** — Attachment at end of shotcrete material hose from which material is jetted at high velocity; also attachment at end of hose used in machine applied Portland-cement plaster.

**2.83 Nozzle Liner** — Replaceable rubber insert in nozzle tip to prevent wear of metal nozzle.

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**2.84 Nozzleman** — Workman on shotcrete crew who manipulates the nozzle, controls consistency, and makes final disposition of the material.

**2.85 Nozzle Tip** — *See 2.82.*

**2.86 Nozzle Velocity** — Velocity of shotcrete material particles at exit from nozzle, usually stated in cm per second.

**2.87 Open-Top Mixer** — A mixer consisting essentially of a trough within which mixing paddles revolve about the horizontal axis or a pan within which mixing blades revolve about the vertical axis.

**2.88 Paddle Mixer** — *See 2.87.*

### **2.89 Pan**

- a) A prefabricated form unit used in concrete joist floor construction.
- b) A container that receives particles passing the finest sieve during mechanical analysis of granular materials.

**2.90 Pan Mixer** — *See 2.87.*

**2.91 Paving Train** — An assemblage of equipment designed to place and finish a concrete pavement.

**2.92 Pneumatic Feed** — Shotcrete delivery equipment in which material is conveyed by a pressurized air stream.

**2.93 Positive Displacement** — Wet-mix shotcrete delivery equipment in which the material is pushed through the material hose in a solid mass by a piston or auger.

**2.94 Power Float** — A motor-driven revolving disc that smoothens, flattens, and compacts the surface of concrete floors or floor toppings.

**2.95 Primary Crusher** — A heavy crusher suitable for the first stage in a process of size reduction.

**2.96 Revolving-Blade ( or Paddle ) Mixer** — *See 2.87.*

**2.97 Rod** — Sharp-edged cutting screed used to trim shotcrete to forms or ground wires.

**2.98 Rotary Float** — *See 2.94.*

**2.99 Runway ( for Concreting or Temporary Track )** — Decking over area of concrete placement, usually of movable panels and supports, on which buggies of concrete travel to points of placement.

**2.100 Scalper** — A screen for removing oversize particles.

**2.101 Screed**

- a) Firmly established grade strips or side forms for unformed concrete which will guide the strike off in producing the desired plane or shape
- b) To strike off concrete lying above the desired plane or shape.
- c) A tool for striking off the concrete surface, preferably referred to as a strike off.

**2.102 Screed Wire** — *See 2.58.*

**2.103 Secondary Crusher** — A crusher used for the second stage in a process of size reduction.

**2.104 Semiautomatic Batcher** — *See 2.17.*

**2.105 Sieve** — A metallic plate or sheet, a woven wire cloth, or other similar device, with regularly spaced apertures of uniform size, mounted in a suitable frame or holder for use in separating material according to size; in mechanical analysis an apparatus with square openings is a sieve.

**2.106 Slick Line** — End section of a pipe line used in placing concrete by pump which is immersed in the placed concrete and moved as the work progresses.

**2.107 Split Batch Charging** — Method of charging a mixer in which the solid ingredients do not all enter the mixer together; cement, and sometimes different sizes of aggregate, may be added separately.

**2.108 Spreader** — A device consisting of reciprocating paddles, a revolving screw, or other mechanism for distributing concrete to required uniform thickness in a paving slab; also a piece of lumber, usually about 2.5 × 5 cm, cut to thickness of wall or other form and inserted to hold it temporarily at the correct dimensions against tension of form ties; wires are usually attached to spreaders so that they can be pulled up out of the forms as the pressure of concrete permits their removal.

**2.109 Stationary Hopper** — A container used to receive and temporarily store freshly mixed concrete.

**2.110 Steel Trowel** — A flat, broad-blade steel hand tool used in the final stages of finishing operations to impart a relatively smooth surface to concrete floors and other unformed concrete surfaces; also a flat triangular-blade tool used for applying mortar to masonry.

**2.111 Storage Hopper** — *See 2.109.*

**2.112 Straightedge** — A rigid, straight piece of wood or metal used to strike off or screed a concrete surface to proper grade.

**2.113 Tamper** — A hand-operated device for compacting floor topping or other unformed concrete by the impact caused by dropping it repeatedly from a small height, in preparation for strike off and finishing; contact surface often consists of open-mesh screen or a grid of bars to force coarse

aggregate below the surface to prevent interference with floating or trowelling.

**2.114 Tamping Rod** — A round, straight steel rod, having one end rounded to a hemispherical tip.

**2.115 Template** — A thin plate or board frame used as a guide in positioning or spacing form parts, reinforcement, or anchors; also a full-size mold, pattern or frame, shaped to serve as a guide in forming or testing contour or shape.

**2.116 Tilting Concrete Mixer** — *See 2.75.*

**2.117 Tremie** — A pipe or tube through which concrete is deposited under water, having at its upper end a hopper for filling and a bail by means of which the assembly can be handled by a derrick.

**2.118 Trough Mixer** — *See 2.87.*

**2.119 Trowel** — A flat, broad-blade steel hand tool used in the final stages of finishing operations to impart a relatively smooth surface to concrete floors and other unformed concrete surfaces; also a flat triangular-blade tool used for applying mortar to masonry.

**2.120 Trowelling Machine** — A motor driven device which operates orbiting steel trowels on radial arms from a vertical shaft.

**2.121 Truck Mixer** — A concrete mixer suitable for mounting on a truck chassis and capable of mixing concrete in transit.

**2.122 Turbine Mixer** — *See 2.87.*

**2.123 Vibrator** — An oscillating machine used to agitate fresh concrete so as to eliminate gross voids including entrapped air but not entrained air and produce intimate contact with form surfaces and embedded materials.

**2.124 Vibration** — Energetic agitation of freshly mixed concrete during placement by mechanical oscillating devices at moderately high frequency to assist in its consolidation:

- a) External vibration employs a vibrating device attached at strategic positions on the forms and is particularly applicable to manufacture of precast items and for vibration of tunnel-lining forms;
- b) Internal vibration employs a vibrating element which can be inserted into the concrete at selected locations, and is more generally applicable to in-place construction; and
- c) Surface vibration employs a portable horizontal platform on which a vibrating element is mounted.

**2.125 Wash ( or Flush ) Water** — *See 2.50.*

**2.126 Water Ring** — Perforated manifold in nozzle of dry-mix shotcrete equipment through which water is added to the materials.

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*Members*

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 Cement Research Institute of India, New Delhi

## BUREAU OF INDIAN STANDARDS

### Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones: 323 0131, 323 3375, 323 9402

Fax : 91 11 3234062, 91 11 3239399, 91 11 3239382

Telegrams : Manaksanst

(Common to all Office

Telephor

### Central Laboratory :

Plot No. 20/9, Site IV, Sahibabad Industrial Area, Sahibabad 201010

8-77 00 :

### Regional Offices:

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002 323 76 1

\*Eastern : 1/14 CIT Scheme VII M, V.I.P. Road, Maniktola, CALCUTTA 700054 337 86 6

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022 60 38 43

Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113 235 23 1

†Western : Manakalaya, E9, Behind Marol Telephone Exchange, Andheri (East), MUMBAI 400093 832 92 9

### Branch Offices::

'Pushpak', Nurmohamed Shaikh Marg, Khanpur, AHMEDABAD 380001 550 13 4

‡Peenya Industrial Area, 1st Stage, Bangalore-Tumkur Road, BANGALORE 560058 839 49 5

Gangotri Complex, 5th Floor, Bhadbhada Road, T.T. Nagar, BHOPAL 462003 55 40 21

Plot No. 62-63, Unit VI, Ganga Nagar, BHUBANESHWAR 751001 40 36 27

Kalaikathir Buildings, 670 Avinashi Road, COIMBATORE 641037 21 01 41

Plot No. 43, Sector 16 A, Mathura Road, FARIDABAD 121001 8-28 88

Savitri Complex, 116 G.T. Road, GHAZIABAD 201001 8-71 19

53/5 Ward No.29, R.G. Barua Road, 5th By-lane, GUWAHATI 781003 54 11 37

5-8-56C, L.N. Gupta Marg, Nampally Station Road, HYDERABAD 500001 20 10 83

E-52, Chitaranjan Marg, C- Scheme, JAIPUR 302001 37 29 25

117/418 B, Sarvodaya Nagar, KANPUR 208005 21 68 76

Seth Bhawan, 2nd Floor, Behind Leela Cinema, Naval Kishore Road, LUCKNOW 226001 23 89 23

NIT Building, Second Floor, Gokulpat Market, NAGPUR 440010 52 51 71

Patliputra Industrial Estate, PATNA 800013 26 23 05

Institution of Engineers (India) Building 1332 Shivaji Nagar, PUNE 411005 32 36 35

T.C. No. 14/1421, University P. O. Palayam, THIRUVANANTHAPURAM 695034 6 21 17

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\*Sales Office is at 5 Chowringhee Approach, P.O. Princep Street, CALCUTTA 700072 27 10 85

†Sales Office is at Novelty Chambers, Grant Road, MUMBAI 400007 309 65 2

‡Sales Office is at 'F' Block, Unity Building, Narashimaraja Square, BANGALORE 560002 222 39 7