

- c) The Engineer-in-Charge may require the Contractor to prove, that the concrete prepared with water, proposed to be used, shall have average 28 days compressive strength not lower than 90% of the strength of concrete prepared with distilled water.
- d) The Engineer-in-Charge may require the Contractor to get the water tested from an approved laboratory before starting the construction work and in case the water contains any oil/ organic matter or an excess of acid, alkalies or any injurious amount of salts etc., beyond the permissible maximum limits given in IS 456, the Engineer-in-Charge may refuse to permit its use. In case the water is supplied by the owner, contractor shall get himself satisfied regarding its quality before using the same in his works at his own expense. In case there is any change in source of water, water samples shall be tested again to meet the specified requirements.
- e) Water for curing shall be of the same quality as used for concreting and masonry works. Sea water shall not be used for preparation of cement mortar, concrete as well as for curing of plain/reinforced concrete and masonry works. Sea water shall not be used for hydrotesting.

3.3 Aggregate (for Concrete)

3.3.1 General

Coarse and Fine aggregates for Civil and Structural Works shall conform in all respects to IS 383 (Specification for Coarse and Fine Aggregates from Natural Sources for Concrete). Aggregates shall consist of naturally occurring (crushed or uncrushed) stones, gravel and sand or a combination thereof. These shall be chemically inert, hard, strong, dense, durable, clean and free from veins, adherent coatings, injurious amounts of alkalies, vegetable matter and other deleterious substances such as iron pyrites, coal, lignite, mica, shale, sea shells etc. Naturally occurring aggregates shall be obtained from an approved source known to produce the same satisfactorily.

Manufactured aggregates shall consist of Iron and Steel slag aggregates, Copper slag aggregates or aggregates made from Construction & Demolition (C&D) waste such as Recycled Aggregates (RA) and Recycled Concrete Aggregates (RCA). RA shall comprise of waste from concrete, brick, tiles, stone, etc. and RCA shall be derived from concrete after requisite processing. Extent of utilization of manufactured aggregates in RCC and PCC works shall be as per Table-1 of IS 383.

Source and type of aggregates shall be got approved by the Engineer-in-Charge prior to procurement. Change in source and type of aggregates, at later stage, shall not be generally permitted; but under specific circumstances, Engineer-in-Charge can allow a change in source and type of aggregate. Contractor shall produce necessary test certificates from approved laboratories regarding the quality and suitability of the proposed aggregates and submit fresh mix design for approval of the Engineer-in-Charge. Any such change, if permitted by the Engineer-in-Charge, shall be without any time and cost implication to the owner.

Aggregates which may chemically react with alkalies of cement or might cause corrosion of the reinforcement shall not be used.

The maximum quantities of deleterious materials in the aggregates as determined in accordance with IS 2386 - Part II (Methods of Test for aggregates for concrete), shall not exceed the limits defined in IS 383. No special test is required to prove the absence of such deleterious matters if the aggregates are from a known source with satisfactory prior data on the properties of concrete made with them. In case of newly developed quarry sites, the contractor shall submit necessary test results as per IS 383

and IS 2386 to the Engineer-in-Charge prior to his acceptance and approval. The method of Sampling shall be in accordance with the requirements given in IS 2430.

Coarse and fine aggregates shall be batched separately. All-in-aggregate shall be used only where specifically permitted by the Engineer-in-Charge.

Separate sieve analysis and grading curves shall be prepared by the Contractor for any/ all batches of coarse and fine aggregates, and submitted to the Engineer-in-Charge, whenever asked for, to ensure conformity with those submitted along with the mix design.

Whenever required by Engineer-in-Charge, the aggregates (coarse/ fine) shall be washed and/ or sieved by the contractor before use in the works to obtain clean and graded aggregate at no extra cost to the owner

Aggregates not in conformity with the specifications shall be rejected and the Contractor shall immediately remove them from the site of work.

3.3.2 Coarse Aggregates

- a) Coarse aggregates are the aggregates, which are retained on 4.75 mm IS Sieve. It shall have a specific gravity not less than 2.6 (saturated surface dry basis).

The grading of the aggregates shall be as per IS 383 or as required by the mix design, to obtain densest possible concrete. For this purpose, the contractor shall submit to the Engineer-in-Charge at least three sets of mix design and test results, each with different gradings of coarse aggregates, proposed to be used. The Engineer-in-Charge may allow "All-in-aggregates" to be used provided they satisfy the requirements of IS 383.

- b) Coarse aggregates may be obtained from

- (1) Uncrushed gravel or stone which results from natural disintegration of rock
- (2) Crushed gravel or stone which results from crushing of gravel or hard stone.
- (3) Partially crushed gravel or stone which results from blending of (1) and (2) above.
- (4) Manufactured from other than natural sources, by processing materials, using thermal or other processes such as separation, washing, crushing and scrubbing. Manufactured coarse aggregate may be RCA or RA processed from C&D waste and may be supplied as single sized or graded.

3.3.3 Fine Aggregates

- a) Fine aggregates are the aggregates which pass through 4.75 mm IS sieve but not more than ten percent (10%) pass through 150 micron IS sieve. These shall comply with the requirements of grading zones I, II and III of IS 383. Fine aggregates conforming to grade zone IV shall not be used for reinforced concrete works.

Sand from sea shores, creeks or river banks affected by tides, shall not be used for filling or concrete works.

- b) Fine aggregates shall consist of

Natural Sand: Fine aggregate resulting from natural disintegration of rock and which has been deposited by streams or glacial agencies. This may also be called as uncrushed sand.

Crushed Sand –

- i) Crushed Stone Sand: Fine aggregate produced by crushing hard stone
- ii) Crushed Gravel Sand: Fine aggregate produced by crushing natural gravel

Mixed Sand: Fine aggregate produced by blending natural sand and crushed stone sand or crushed gravel sand in suitable proportions.

- c) **Manufactured Fine Aggregate:** Fine aggregate manufactured from other than natural sources, by processing materials, using thermal or other processes such as separation, washing, crushing and scrubbing. Manufactured fine aggregate may be RCA processed from C&D waste

3.3.4 Sampling and Testing

The Contractor shall carry out all tests including mix designs of concrete, at the start of work as well as during any stage of construction as per the requirement. Tests shall be carried out in accordance with IS 516 (Methods of Test for Strength of Concrete) and IS 2386 (Methods of Test For Aggregates for Concrete). The method of sampling shall be in accordance with the requirements given in IS 2430.

3.3.5 Storage of Aggregates

- a) Storage of all types of aggregates at the site of work shall be as specified in IS 4082. Aggregates shall in no case be stored near excavated earth or directly over ground surface.
- b) The Contractor shall maintain sufficient quantities of aggregates, near to the place of work, required for the continuity of the work. Each type and grade of aggregate shall be stored separately on hard, firm surface having adequate slope for drainage of water.
- c) Aggregates delivered at the site in wet condition or becoming wet due to rain or any other means, shall not be used for at least 24 hours. For the use of such aggregates the contractor shall adjust the water content in accordance with IS 2386 to achieve the desired mix. In the absence of test results, and to allow variation in mass of aggregates and water content on account of moisture content, the contractor can make suitable adjustment in the masses as per IS 456, for preparation of nominal mix concrete only.

3.4 Sand (for Masonry & Filling)

3.4.1 Sand for Masonry Mortars

- a) The sand shall consist of natural sand, crushed stone sand or crushed gravel sand, or a combination of any of these. The sand shall be hard, durable, clean and free from adherent coatings and organic matter and shall not contain the amount of clay, silt and fine dust more than specified in IS 2116.
- b) The sand shall not contain any harmful impurities such as iron pyrites, alkalis, salts, coal, or other organic impurities, mica, shale or similar laminated materials, soft fragments, sea shells in such form or in such quantities as to affect adversely the hardening, strength or durability of the mortar.
- c) The maximum quantities of clay, fine silt, fine dust and organic impurities in the sand, when tested in accordance with IS 2386, shall not be more than 5% by mass in natural sand, or crushed gravel sand or crushed stone sand or manufactured sand. For organic impurities, when determined in accordance with IS 2386, colour of the liquid shall be lighter than that indicated by the standard solution specified in IS 2386.

3.4.2 Grading of Sand

- a) The particle size grading of sand for use in mortars shall be within the limits as specified below:

IS Sieve Designation (IS 460 Part-1)	Percentage Passing (by mass)	Reference to method (IS 2386 Part-1)
4.75 mm	100	

IS Sieve Designation (IS 460 Part-1)	Percentage Passing (by mass)	Reference to method (IS 2386 Part-1)
2.36 mm	90 to 100	
1.18 mm	70 to 100	
600 micron	40 to 100	
300 micron	5 to 70	
150 micron	0 to 15	

- b) In case of sand whose grading falls outside the specified limits due to excess or deficiency of coarse or fine particles, this shall be processed to comply with the standard by screening through a suitably sized sieve and/ or blending with required quantities of suitable sizes of natural sand particles or crushed stone screening which are by themselves unsuitable. The various sizes of particles of which the sand is composed shall be uniformly distributed throughout the mass.

3.4.3 Sampling and Testing

- a) The method of sampling shall be in accordance with IS 2430. The amount of material required for each test shall be as specified in relevant parts of IS 2386. All tests shall be carried out in accordance with the relevant parts of IS 2386.
- b) If further confirmation as to the satisfactory nature of the material is required, compressive test on cement mortar cubes (1:6) may be made in accordance with IS 2250 using the supplied material in place of standard sand and the strength value so obtained shall be compared with that of another mortar made with a sand of acceptable and comparable quality.

3.4.4 Sand for Filling

Sand for filling shall meet the requirements of IS 383 and shall be natural sand, hard, strong, free from any organic and deleterious materials. Sand obtained from sea shores, creeks or river banks affected by tides shall not be used for filling. Fine aggregates suitable for concreting works shall be suitable for filling also. No sand below grading zone-III as per IS 383 shall be allowed for filling.

3.5 Cement

Cement shall be as specified in the Engineering Design Basis.

Cement to be used for civil and structural works shall be one of the following. Specific requirement for the type of cement to be used shall be as shown in the drawings or as specified in the contract or as directed by the Engineer-in-Charge.

- Specification for 33/43/53 grade ordinary Portland cement IS 269
- Specification for Portland slag cement IS 455
- Specification for Portland pozzolana cement (fly ash based) IS 1489 Pt.1
- Specification for Portland pozzolana cement (calcined clay based) IS 1489 Pt.2
- Specification for Masonry Cement IS 3466
- Specification for high alumina cement for structural use IS 6452
- Specification for rapid hardening Portland cement IS 8041
- Specification for Sulphate Resisting Portland cement IS 12330

3.6 Steel

3.6.1 General

All steel bars, sections, plates, and other miscellaneous steel materials, etc. shall be free from loose mill scales, rust as well as oil, mud, paint or other coatings. The materials,

construction specifications such as dimensions, shape, weight, tolerances, testing etc, for all materials covered under this section, shall conform to respective BIS codes.

3.6.2 Reinforcement Bars

Reinforcement shall be TMT (Thermo-mechanically treated) bars of minimum Grade Fe500D (unless specified otherwise in the EDB/ Job Specifications), conforming to IS 1786 and bearing standard mark of the Bureau of Indian Standards.

Corrosion protection to reinforcement bars, if any shall be as specified in the EDB/ Job Specification.

3.6.3 Structural Steel

Structural Steel shall be of minimum Grade E250A/BR/B0 (unless specified otherwise in the EDB/ Job Specifications) conforming to IS 2062 and bearing standard mark of the Bureau of Indian Standards, excluding bars and rods of diameter/ thickness less than 6 mm and structural (angle) below ISA 50x50x6.

Hollow Sections shall be of minimum Grade YSt 310 (unless specified otherwise in the EDB/ Job Specifications) conforming to IS 4923 (for SHS/RHS) and IS 1161 (for CHS) and bearing standard mark of the Bureau of Indian Standards.

3.6.4 Miscellaneous Steel Materials

Miscellaneous steel materials shall conform to the following BIS codes:

- | | |
|--|---------|
| a) Specification for Expanded Metal Steel Sheets for General Purposes | IS 412 |
| b) Mild Steel and Medium Tensile Steel Bars and Hard-Drawn Steel Wire for Concrete Reinforcement | IS 432 |
| c) Hexagon Head Bolts, Screws and Nuts of Product Grade 'C' - Part 1: Hexagon Head Bolts | IS 1363 |
| d) Cold formed light gauge structural steel sections. | IS 811 |
| e) Technical supply conditions for threaded steel fasteners. | IS 1367 |
| f) Plain washers | IS 2016 |
| g) Steel wire ropes for general engineering purposes | IS 2266 |
| h) Thimbles for wire ropes. | IS 2315 |
| i) Bulldog grips | IS 2361 |
| j) Mild Steel Tubes, tubular and other wrought steel fillings | IS 1239 |
| k) Drop forged sockets for wire ropes for general engineering purposes | IS 2485 |
| l) Steel chequered plates. | IS 3502 |
| m) High Strength Structural Nuts | IS 6623 |
| n) Washers for High Strength Structural Bolts & Nuts | IS 6649 |

3.6.5 Connection Bolts

Connection bolts shall be High Strength Hot-dip Galvanised Structural bolts of minimum Property Class 8.8, material and installation shall comply to requirements of IS 3757 and IS 4000 respectively. The acceptable methods of tightening the bolts in order of preference are listed below:

- "Automatic Torque Control" where tightening is by a torque control impact wrench with automatic cut-off, calibrated to shut off at the desired bolts tension.
- "Stall Torque Control" where tightening is by a standard impact wrench, calibrated by regulation of air pressure to "stall" at the desired bolt tension.
- "Turn-of Nut" where tightening is by a standard impact wrench, by turning the nut $\frac{1}{2}$ to $\frac{3}{4}$ turn beyond the "snug" position. The snug position is that position where the wrench begins to impact.

- d) "Manual Torque Control" where tightening is by hand wrench equipped with a torque indicator and calibrated for the desired bolt tension.

All the bolts in a joint shall be tightened to a minimum tension value as per Table 3 of IS 4000.

Properties of Bolt Class 4.6 wherever specified shall conform to IS 1367. Black hexagonal nuts and washers wherever specified shall be as per IS 1363.

3.6.6 Anchor Bolts

Material for Anchor Bolts such as bars, washers, nuts, pipe sleeves and plates etc. shall be as per relevant BIS codes mentioned in the EDB.

3.7 Brick

3.7.1 General

All Bricks used for masonry works shall conform to the requirements of following BIS Codes:

• Common Burnt Clay Bricks- Specifications	IS 1077
• Pulverized Fuel Ash Cement Bricks- Specifications	IS 16720
• Pulverized Fuel Lime Ash Bricks- Specifications	IS 12894
• Burnt Clay Fly Ash Bricks- Specifications	IS 13757

3.7.2 Common Burnt Clay Bricks

Bricks for masonry works shall conform to IS 1077 - Specification for common burnt clay building bricks and shall be of class 5.0 (with minimum compressive strength of 5.0 N/mm²). Specific requirement for any other class of bricks shall be as shown in drawings or as described in the contract for a particular site or type of work. Physical requirements, quality, dimensions, tolerances etc. of common burnt clay building bricks shall conform to the requirements of IS 1077.

Bricks shall be hand - moulded or machine moulded and shall be made from suitable soils. The bricks shall have smooth rectangular faces with sharp corners and shall be well burnt, sound, hard, tough and uniform in colour. These shall be free from cracks, chips, flaws, stone or humps of any kind.

3.7.3 Pulverized Fuel Ash Cement Bricks

Pulverized fuel ash-cement bricks shall conform to IS 16720. The bricks shall be sound, free from visible cracks and uniform in shape and colour. The brick shall have total pulverized fuel ash content not less than 35 percent of the mass of bricks. Pulverized fuel ash shall conform to IS 3812 (Part 1) or IS 3812 (Part 2).

3.7.4 Fly Ash Lime Bricks (FALG Bricks)

The Fly Ash Lime Bricks (FALG Bricks) shall conform to IS 12894. Visually the bricks shall be sound, compact and uniform in shape free from visible cracks, warpage, flaws and organic matter. Fly ash shall conform to IS 3812.

3.7.5 Burnt Clay Fly Ash Bricks

The burnt clay fly ash bricks shall conform to IS 13757. The bricks shall be sound, compact and uniform in shape and colour. Bricks shall have smooth rectangular faces with sharp and square corners. The bricks shall be free from visible cracks, flaws, warpage, nodules of free lime and organic matter, the bricks shall be hand or machine moulded. The bricks shall have frog of 100 mm in length 40 mm width and 10 to 20 mm deep on one of its flat sides. If made by extrusion process may not be provided with frogs. Fly Ash shall conform to grade I or grade II of IS 3812.

3.7.6 Mechanized Autoclave Fly Ash Lime Brick

These bricks shall be machine moulded and prepared in plant by appropriate proportion of fly ash and lime. The autoclave fly ash bricks shall conform to IS 12894. Visually, the bricks shall be sound, compact and uniform shape, free from visible cracks, warpage and organic matters. The brick shall be solid with or without frog, and of 100/80 mm in length, 40 mm width and 10 to 20 mm deep one of its flat side as per IS 12894. The brick shall have smooth rectangular faces with sharp corners and shall be uniform in shape and colour. Fly ash shall conform to IS 3812 and lime shall conform to class 'C' hydrated lime of IS 712.

3.7.7 Tests after Delivery

The Contractor shall take samples of each type of brick as directed by the Engineer-in-Charge as per the requirements of IS 5454 and tests shall be carried out as per IS 3495. The cost for carrying out any or all the tests, shall be borne by the Contractor. The bricks, when tested, as per IS 3495 shall have a minimum average compressive strength, as given in the Code, for a particular class of brick. Water absorption shall not be more than 20% by its dry weight, when soaked in cold water for 24 hours.

Brick samples so approved, shall be deposited with the Engineer-in-Charge. All subsequent deliveries shall be upto the standards of the approved samples.

3.7.8 Local Bricks/ Class 3.5 Bricks.

Where shown on drawings, locally available bricks of non modular size (230 mm x 110 mm x 70 mm) in place of bricks of modular-size (190 mm x 90 mm x 90 mm) can be used in case the bricks satisfy the other requirements of respective BIS codes. Minimum compressive strength of these bricks shall not be less than 3.5 N/mm².

All external brick masonry walls shall be of minimum 230 mm thickness (except for fire walls).

3.8 Stone

3.8.1 General

All Stones used for masonry works shall conform to the requirements of following BIS codes:

- | | | |
|----|--|---------|
| a) | Method of identification of natural building stones | IS 1123 |
| b) | Recommendations for dimensions and workmanship of natural building stones for masonry work | IS 1127 |
| c) | Recommendations for dressing of natural building stones | IS 1129 |

3.8.2 Quality of Stones

- Stones shall be hard, dense, strong, sound, durable, clean and uniform in colour. These shall also be free from veins, adherent coatings, injurious amounts of alkalis, vegetable matters and other deleterious substances such as iron pyrites, coal, lignite, mica, sea shells etc. As far as possible, stones from one single quarry shall be used for any one work. The strength of stones should be adequate to carry the imposed load and shall meet all the requirements of IS 1905, taking into account the appropriate crushing strength of stone and type of the mortar used. The percentage of water absorption, when tested in accordance with IS 1124, shall not exceed 5%.
- The length of the stone shall not exceed 3 times the height. Width of stone on base shall not be less than 150 mm and in no case exceed $\frac{3}{4}$ th thickness of the wall. Height of the stone shall not be more than 300 mm.

3.9 Admixtures

3.9.1 General Requirements

- a) All concrete admixtures shall comply with the following Indian standards:
 - i. Specification for integral cement water proofing compounds IS 2645
 - ii. Specification for other admixtures for concrete IS 9103

Generally, admixtures shall have ISI certification marks. However, even in case of BIS certified admixtures, Engineer-in-Charge may require the Contractor to carry out and submit any or all the tests (as specified in relevant BIS Codes), from BIS approved laboratories, over and above the manufacturer's test certificate, before giving his final approval.

In case, admixtures certified by BIS are not available, the contractor shall submit to the Engineer-in-Charge the type and/or proprietary brand of the admixture from only reputed manufacturers along with necessary test certificates from BIS recognized/ BIS approved laboratories or any other document directed by Engineer-in-Charge for the latter's final approval. In such cases, names of at least two manufacturers shall be submitted to the Engineer-in-Charge for his selection. In case, both the names are rejected, the contractor shall submit a fresh list of two manufacturers for approval by the Engineer-in-Charge.

The Engineer-in-Charge may direct the contractor to submit test results as required by IS 2645 or IS 9103 for any admixture proposed to be used in the concrete in any approved laboratory at his discretion at any stage of the work. The cost of any/all tests required to satisfy compliance with this specification shall be borne by the Contractor.

In case of non-availability of any BIS code for testing and acceptability criteria, relevant American, British or German Code shall be applicable.

The suitability and effectiveness of any admixture shall be verified by trial with the designed concrete mixes using cement, aggregates together with any other materials to be actually used in the works as per the direction of Engineer-in-Charge. If two or more admixtures are to be used simultaneously in the same concrete mix, the Contractor must submit necessary test results from an approved laboratory to show their interaction and compatibility. Any/all tests specified in BIS Codes shall be carried out only with the type of material and mix design, to be actually used in the work site.

- b) No admixture shall impair the durability of the concrete nor combine with the ingredients to form harmful compounds, nor increase the risk of corrosion of reinforcement. Use of admixtures shall not reduce the dry density of concrete. Once the proportion of admixtures has been established, strict check shall be maintained not to alter the proportions of ingredients and water-cement ratio of the Design Mix during execution.
- c) The chloride contents in admixtures shall not exceed 2% by mass of the admixture or 0.03% by mass of the cement.
- d) Admixtures which do not meet the requirements stipulated in this document shall not be used.

3.9.2 Corrosion Inhibiting Admixtures

Bipolar Concrete Penetrating Corrosion Inhibiting Admixture (CPCIA) shall be added to the concrete matrix for protection of embedded steel in concrete against corrosion.

The CPCIA shall be concrete penetrating type which upon addition into the concrete matrix inhibits the corrosion process. It need not be in direct contact with the steel. Its vapour penetrates through fissures, honeycomb structure of concrete, pure water solution added in concrete and seals steel reinforcement at both anodic & cathodic sites, for inhibition. This is due to the bipolar mechanism property of the system.

Non-concrete penetrating, nitrite & nitrate corrosion inhibitors shall not be used.

The dosage shall be 1% by weight of cement or as recommended by the manufacturer.

In case the product is not as per the Suppliers List, the same shall be got approved by the Owner/ Owner's representative.

3.9.3 Water Proofing Compounds (Crystalline/ Non-crystalline)

Water proofing compounds shall be mixed with cement only.

- a) The permeability of the specimen with the admixture shall be less than half of the permeability with a similar specimen without the use of these compounds. These compounds shall be used in such proportion as recommended by manufacturer but in no case, it shall exceed 3% by weight of cement.
- b) The initial setting time of the cement with the use of these compounds shall not be less than 30 minutes and final setting time shall not be more than 10 hours. Tests shall be carried out in accordance with IS 4031.
- c) Compressive strength of the specimen at 3 days shall not be less than 160 kg/cm² nor 80% of the 3 days compressive strength of mortar cubes prepared with same cement and sand only, whichever is higher. Similarly compressive strength at 7 days shall not be less than 220 kg/cm² nor less than 80% of the 7 days compressive strength prepared with the same cement and sand only, whichever is higher. The test to determine the compressive strength shall conform to IS 4031.

3.10 Water Bars (Water Stops)

- a) PVC water bars shall be used in reinforced concrete construction of liquid retaining structures or any other structure to safeguard them from hydrostatic pressure and water leakage and any relative movement between two parts of the structure due to thermal loading shrinkage or differential movement of foundations. These shall be preformed and shall provide a permanent water tight seal along the entire joint in the poured concrete structures. These shall also be flexible enough to withstand deflection/ displacements at joints arising due to variation of temperatures or settlement of foundations.
- b) Performance requirements of PVC water bars shall meet the requirements of IS 12200. These shall be of an approved make and of ribbed/ serrated/ plain type with a bulb at the centre. The thickness and width of water bars shall in no case be less than 5 mm and 150 mm respectively. However, for concrete sections greater than 300 mm thick, the width of water bars shall not be less than 230 mm.

3.11 Bitumen/ Bituminous Materials

Bitumen to be used for various types of work shall meet all the requirements of relevant BIS codes as given below:

- | | |
|---|---------|
| i. Specification of Paving Bitumen | IS 73 |
| ii. Specification for bitumen mastic for flooring. (Grade IV) | IS 1195 |
| iii. Specification for Bitumen felts for water proofing and damp proofing | IS 1322 |
| iv. Specification for Bituminous compounds for water proofing and caulking purposes | IS 1834 |

- v. Specification for preformed fillers for expansion joint in concrete pavements and structures IS 1838
- vi. Specification for bitumen mastic for use in water proofing of roofs IS 3037
- vii Specification for bitumen primer for use in water proofing and damp proofing IS 3384
- vii Specification for Bitumen Mastic for Tanking and Damp proofing IS 5871
- ix. Specification for Glass fibre base coal tar pitch & bitumen felts IS 7193
- x. Code of practice for damp proofing using bitumen mastic IS 7198
- xi. Specification for bitumen Mastic, Anti Static and electrically conducting grade IS 8374

Tests and acceptable criteria shall be as per relevant BIS codes.

3.12 PVC Pipes

PVC Pipes shall conform to the requirements of IS 4985.

3.13 Wood/ Timber

- a) Wood recommended for platforms of cold vessels or below cold vessels/ exchangers shall be hard and shall be of group A, grade I, and shall have safe permissible stress of 7 N/mm² in compression, perpendicular to grains on outside location as per IS 883. General characteristics like durability, treatability etc. shall conform to IS 883 and IS 3629.
- b) Timber required to be used for form work shall be fairly dry before use. It should maintain its shape during the use and even when it comes into contact with moisture from the concrete. Storage of Wood/ Timber shall be as per the requirements of IS 4082.
- c) For proper identification and selection of suitable timber for form work, following codes shall be referred.
 - i. Classification of commercial timbers & their zonal distribution IS 399
 - ii. Specification for ballies for general purposes IS 3337
 - iii. Specification for Ply wood for concrete shuttering work IS 4990

3.14 Concrete Block Masonry

Grade of solid and hollow concrete block masonry shall be as follows:

- a) Solid concrete blocks : Grade C (5.0).
- b) Hollow concrete blocks : Grade A (5.5) closed cavity.

The nominal dimensions (length, height & width), density, compressive strength of solid & hollow concrete block masonry units shall be in conformance to IS 2185 (Part-1) corresponding to the above-mentioned grades.

Concrete block masonry of following thicknesses shall preferably be used:

- a) 100 mm thickness : Solid concrete block masonry.
- b) 200 mm thickness : Hollow concrete block (closed cavity) masonry.
- c) 400 mm thickness (fire walls) : Hollow concrete block (closed cavity) masonry.

3.15 Autoclaved Cellular (Aerated) Concrete Blocks (AAC Block Masonry)

AAC Block masonry units shall be in conformance to IS 2185 (Part-3).

3.16 Anti-termite Compounds

Following chemicals as per IS 6313 (Part 2 and 3) shall be used for treatment of soil for protection of buildings against attack by subterranean termites.

S.No.	Chemical	Relevant Standard	Dosage* (Chemical Emulsion)
1	Chlorpyrifos 20% Emulsifiable Concentrate (EC)	IS 8944	250ml in 5 litre water 50ml in 1 litre water
2	Imidacloprid 30.5% Suspension Concentrate (SC)	IS 16131	10.5ml in 5 litre water 2.1ml in 1 litre water
3	Bifenthrin 2.5% Emulsifiable Concentrate (EC)	IS 15936	100ml in 5 litre water 20ml in 1 litre water

3.17 Poly-sulphide Sealants

All Poly-sulphide Sealants shall conform to IS 12118. Test conditions and requirements shall be as given in the above referred BIS code.

4.0 CONSTRUCTION REQUIREMENTS

4.1 Construction

- 4.1.1 All concrete works shall be carried out as per the provisions of IS 456, IS 3370, IS 2974 and other relevant BIS Codes. Concrete mix proportioning and design mix; sampling and strength test of concrete, production and control of concrete, tolerances and placing of reinforcement and for cover; transporting, placing, compacting and curing etc, inspection and testing of structure (including requirement of non-destructive testing) shall be as specified in IS 456.
- 4.1.2 Continuous concreting shall be done for structures supporting dynamic equipment as per the provisions of IS 2974.
- 4.1.3 The damp proof course shall be laid in two layers of equal thickness and each layer given two coats of hot bitumen on top (grade VG-10 conforming to IS 73) at the rate of 1.7 kg/m². Dry sharp sand shall be sprinkled evenly over the top layer of bitumen before hardening.
- 4.1.4 Form work and stripping of form work shall be as per the provisions of IS 456.
- 4.1.5 Only steel shuttering shall be used for civil construction.
- 4.1.6 Assembly of reinforcement in RCC structures shall conform to IS 456.
- 4.1.7 Fabrication of all structural steel works shall be carried out as per the provisions of IS 800/ IS 801/ IS 802/ IS 806 and other relevant BIS codes. Fabrication shall include cleaning, straightening, cutting, bending, holding, bolting, welding, machining, painting, marking, assembling, erecting, inspecting and testing etc. Welding procedure and welder qualification shall be as per IS 800 and/ or referenced BIS codes only.
- 4.1.8 Erection of all structural steel works including supply of plant & equipment, storing and handling, setting out, field connections, field welding and security during erection shall conform to IS 800/ IS 801/ IS 802/ IS 806.

- 4.1.9 All masonry works shall be carried out as per the provisions of IS 1597/ IS 2185/ IS 2212/ IS 4326 and other relevant BIS codes.
- 4.1.10 Construction of all other items of works shall conform to relevant Indian Standards and sound engineering practices.
- 4.1.11 The Contractor shall be responsible for the complete safety pertaining to all construction works.

4.2 Tolerances

- 4.2.1 The limits of dimensional tolerances for Plain and Reinforced Cement Concrete Structures shall be as follows:

- a. Deviation from specified dimensions of cross section of columns and beams -6 mm to +12 mm
- b. Deviation from dimensions of footings (refer note below)
 - i. Dimensions in plan -12 mm to +50 mm
 - ii. Eccentricity 0.02 times the width of footing in the direction of deviation but not more than 50 mm
 - iii. Thickness ± 0.05 times the specified thickness

Note: Tolerances apply to cast-in-situ concrete dimensions only, not to positioning of vertical reinforcing steel or dowels.

- c. Deviation in length (major dimension of single unit)
 - i. Up to 3.0m ± 6 mm
 - ii. 3.0m to 4.5m ± 9 mm
 - iii. 4.5m to 6.0m ± 12 mm
 - iv. additional deviation for every subsequent 6m ± 6 mm
- d. Deviation in straightness or bow (deviation from specified line) for a single or continuous member), e.g., beam, column or slab edge:
 - i. Up to 3.0m 6 mm
 - ii. 3.0m to 4.5m 9 mm
 - iii. 4.5m to 6.0m 12 mm
 - iv. additional deviation for every subsequent 6m 6 mm
- e. Deviation in squareness shall be measured taking the longer of two adjacent sides as the base line. The shorter side shall not vary in its distance from a perpendicular so that the difference between the greatest and shortest dimensions exceeds 6mm. For this purpose, any error due to lack of straightness shall be ignored. Squareness shall be checked with respect to the straight lines that are most nearly parallel with the features being checked. When the nominal angle is other than 90 degrees, the included angle between check lines shall be varied accordingly.
- f. Deviation in twists shall be within a limit such that any corner shall not be more than the limit given below from the plane containing other three corners:
 - i. Up to 600mm wide and up to 6m in length : 6 mm
 - ii. over 600mm wide and for any length : 12 mm

- g. Maximum deviation in flatness from a 1.5 m straight edge placed in any position on a nominally plain surface shall not exceed 6mm.

4.2.2 The limits of dimensional tolerances for Steel Structures shall be as follows:

4.2.2.1 For columns and tower-type structures:

- a. Deviation of column axes at foundation top level with respect to true axes
 - i. In longitudinal direction ± 5 mm
 - ii. In lateral direction ± 5 mm
- b. Deviation in the level of bearing surface of columns at foundation top with respect to true level ± 5 mm
- c. Out of plumb (verticality) of column axis from true vertical axis, as measured at top
 - i. Up to and including 30m height lesser of $\pm H/1000$ or ± 25 mm
 - ii. Over 30m height lesser of $\pm H/1200$ or ± 35 mm
- d. Deviation in straightness in longitudinal & transverse planes of column at any point along the height lesser of $\pm H/1000$ or ± 10 mm
- e. Difference in the erected positions of adjacent pairs of columns along length or across width of building prior to connecting trusses/ beams with respect to true distance ± 5 mm
- f. Deviation in any bearing or seating level with respect to true level Up to 600mm wide and up to 6m in length ± 5 mm
- g. Deviation in difference in bearing levels of a member on adjacent pair of columns both across & along the building ± 5 mm

Notes:

1. Tolerance specified for out-of-plumbness should be read in conjunction with 'Deviation in straightness....' & 'Difference in the erected positions....'.
2. 'H' is the column height in mm.
3. Tolerance limits as given under clause 4.2.2.1 above for steel structures are applicable to concrete columns/ pedestals also.

4.2.2.2 Trusses

- a. Shift at the centre of span of top chord member with respect to the vertical plane passing through the centre of bottom chord $\pm 1/250$ of height of truss in mm at centre of span or ± 15 mm, whichever is less
- b. Lateral shift of top chord of truss at the centre of span from the vertical plane passing through the centre of supports of the truss $\pm 1/1500$ of span of truss in mm or ± 10 mm, whichever is less
- c. Lateral shift in location of truss from its true position ± 10 mm
- d. Lateral shift in location of purlin from true position ± 5 mm
- e. Deviation in difference of bearing levels of truss from the true level $\pm 1/1200$ of span of truss in mm or 20mm, whichever is less

4.2.2.3 Gantry girders and Rails

- a. Shift in the centre line of crane rail with respect to centre line of web of gantry girder $\pm [\text{web thickness of girder}(\text{mm}) + 2\text{mm}] / 2$
- b. Shift of alignment of crane rail (in plan) with respect to true axis of crane rail at any point ± 5 mm

- c. Deviation in crane track gauge with respect to true gauge
 - i. For track gauge up-to and including 15m ± 5 mm
 - ii. For track gauge more than 15m $\pm [5 + 0.25(S - 15)]$ subject to maximum ± 10 mm, where S in metres is true gauge
- d. Difference in level between crane track rails (across the bay) at
 - i. Supports of gantry girders 15 mm
 - ii. Mid span of gantry girders 20 mm
- e. Relative shift of crane rail surfaces (at joint) in plan and elevation 2 mm

4.3 Hanger Scaffolding for Pipe Rack

Hanger scaffolding (fixed/ movable) shall be provided in the pipe rack to facilitate mechanical works over the first tier & above. The same shall provide protection from falling material as well as act as a safe working platform. This shall be provided about one meter below the entire pipe rack first tier elevation.

The scaffolding shall be light weight, easy to remove when the work is complete. The deck planks may be perforated sheets suitably folded at the ends and open web ladder type of beams may be used to support them. These beams shall be supported on the hangers provided from the beams of the pipe rack.

The design load under the working condition shall be 120 kg/m^2 and that for the limit state of collapse shall be twice the same. However individual panel shall be designed for the concentrated loads of 120 kg at spacing of 1 m and double that load for the limit state of collapse.

Deflection of individual planks shall be maximum span/100. For the beam, the deflection shall be controlled as per IS 800:2007.

The design shall be supported by the properly testing of the checking for the specified loads.

After completion of work over the pipe rack, the contractor shall remove the hanging scaffolding from the pipe rack and take back the scaffolding material.

मानक विनिर्देशन सिविल एवं संरचनात्मक कार्य

STANDARD SPECIFICATION CIVIL & STRUCTURAL WORKS

इपोकसी रेजिन प्रणाली द्वारा नई कंक्रीट को
पुरानी कंक्रीट से जोड़ना

BONDING FRESH CONCRETE TO OLD CONCRETE BY EPOXY RESIN BONDING SYSTEM

5	28.02.25	REVISED & REISSUED	RICA	VIKRAM	AS	MN
4	28.01.20	REAFFIRMED & REISSUED	IQBAL	ALPANA	RS	RKT
3	21.08.14	REAFFIRMED & REISSUED	AJS	AS	PKM	SC
2	30.06.09	REAFFIRMED & REISSUED	AS	SCH	VINAY KUMAR	N.DUARI
1	16.06.99	REISSUED AS STANDARD SPECIFICATION	RPM	RS	SCJ	A. SONI
Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
Approved by						

Abbreviations:

ASTM : American Society for Testing & Materials

Structural Standards Committee

Convenor: Mr. Anurag Sinha

Members: Mr. Virender Goel
Mr. Deepak Agrawal
Ms. Alpana Srivastava
Dr. Sudip Paul
Mr. Charanjit Singh (Projects)
Mr. Indrajit Neog (Construction)
Ms. Papia Mandal
Mr. Vikram Kumar Gupta

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1.0 SCOPE

1.1 This specification defines the material, constructional and other performance requirements for proper bonding of fresh concrete to old, hardened concrete by epoxy resin bonding system which is able to cure under humid conditions and bond to damp surfaces. Any special requirement as shown or noted on the drawings and directed by the Engineer-in-Charge shall govern over the provisions of this specification.

1.2 Actual working shall be carried out in accordance with this specification and recommendation of the manufacturer of the resin system to suit specific requirements for the particular site and other climatic conditions existing there. In case of any conflict, this specification shall govern.

2.0 MATERIALS

2.1 Epoxy resin system used for bonding fresh concrete to old hardened concrete shall consist of two components, viz. epoxy resin and hardener for combining immediately prior to use as per manufacturer's recommendations. Filler material shall be added, if required, as per manufacturer's specification. However, this shall be incorporated in any of the two components. The system shall cure under humid conditions and bond to damp surfaces.

2.2 The bonding material shall be compatible with the concrete to which it is to be applied and shall have the following minimum properties:

Compressive Yield Strength	55 N/mm ² (7 days)
Tensile Strength	40 N/mm ² (7 days)
Bond Strength	10 N/mm ² (14 days)
Flexure Strength	35 N/mm ² (7 days)
Shear Strength	10 N/mm ² (7 days)
Pot Life	45 minutes
Full Cure	7 days at 20°C to 35°C
Overlaying Time (open time)	1 hour at 20°C to 35°C

2.3 The resin and hardener shall be mixed in the proportion as specified by the manufacturer. The preparation, mixing and application of the resin system shall strictly be in accordance with the manufacturer's recommendations.

2.4 Certificate of test results of all the materials from BIS/NABL recognised laboratories duly authenticated by the approved manufacturer(s) shall be submitted to Engineer-in-Charge and got approved by him in writing prior to commencement of work. In the event of failure to submit such test results from the manufacturer for any material, the contractor shall carry the tests from an approved laboratory and submit the test results including the name(s) of manufacturer(s) to the Engineer-in-Charge and get approved by him in writing prior to commencement of work. All tests shall be in accordance with ASTM C881M (Type V) in case of non-availability of any specific Indian Standard.

2.5 Pot life and open time

Pot life is the period during which the resin system after mixing retains sufficient workability for proper use and the resin system must be applied to the prepared concrete surface within this period.

The 'open time' is the maximum period of time allowable between application of resin system and pouring of fresh concrete. Exceeding the 'open time' shall result in considerably reduced adhesion. The adhesive shall be applied to the prepared substrata as soon as the components have been mixed and fresh concrete shall be poured immediately before adhesive begins to gel. The bonding of fresh concrete to old concrete shall not to be done if the temperature is below 10°C.

3.0 SPECIAL REQUIREMENT

- 3.1 All works covered by this specification shall be carried out by experienced and approved agency having sufficient knowledge in epoxy resin treatment works. Only skilled and experienced operators shall be employed for the purpose.

4.0 APPLICATION

4.1 Preparation of Concrete Surface

- 4.1.1 Grease, oil, algae and other foreign substances likely to impair good bonding shall be thoroughly removed from the surface by scrubbing or using detergent and washing with clean water. All loose and spalling concrete pieces shall be removed. The surface to be bonded shall be made thoroughly rough by chiselling, taking off the skin of concrete and sharp edges of aggregate shall be exposed. The surface shall be washed, wetted cleaned and dried with dry compressed air. Exposed reinforcement shall be thoroughly cleaned with sand paper and wire brushes to remove all dust and sticking mortar.

4.2 Mixing

- 4.2.1 The resin and hardener shall be thoroughly mixed in a mixer. The approved resin system shall be prepared strictly as per manufacturer's recommendations. It shall not contain lumps and shall have uniform colour. Filler material shall be added if so specified by the manufacturer. Hand mixing shall be allowed for small quantity with prior permission of the Engineer-in-Charge.

4.3 Method of Application

- 4.3.1 The resin system shall be applied by spraying to the prepared surface. Manual application by using stiff nylon bristle brush may also be allowed with prior permission of the Engineer-in-Charge. The manufacturer shall specify the method of application suitable for the specified work.

4.4 Coverage

- 4.4.1 A minimum of half kilogram per square metre ($\frac{1}{2}$ kg/m²) or resin system shall be applied to prepared concrete surface. However, the covering capacity depends on the nature of surface over which the system is being applied and the contractor shall use additional quantity of the resin system as per the recommendation of the manufacturer.

4.5 Handling Precaution

- 4.5.1 Only skilled and experienced workers shall be entrusted with the application of epoxy system. The resin and hardener shall not be allowed to come into direct contact with the skin. Rubber or polythene gloves with cotton gloves underneath must be worn by the workers handling resin products. Parts of skin which have accidentally come into contact with resin or hardener shall immediately be washed with lukewarm water and a mild soap. Special cleaning creams or chemical shall be kept readily available and used as recommended by the manufacturer.

4.6 Cleaning and Maintenance of Equipment

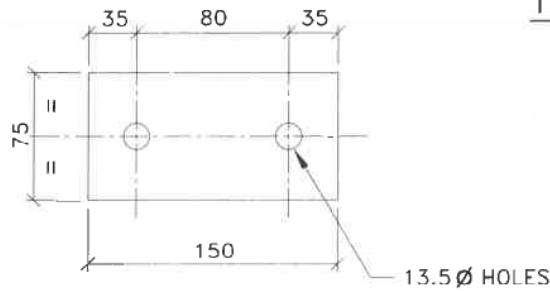
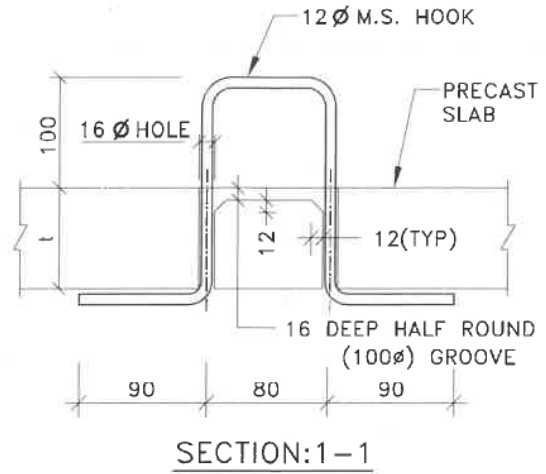
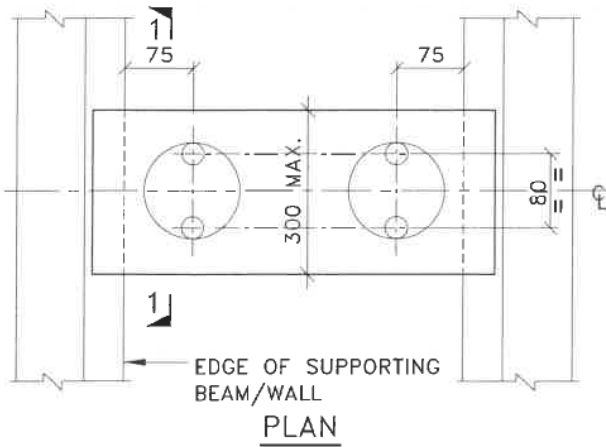
- 4.6.1 Tools and mixing equipment shall be cleaned immediately after use by using scrapers and other solvents (e.g. toluene, xylene or acetone) as recommended by the manufacturer.

5.0 APPROACH, WORKING PLATFORM & SCAFFOLDING

- 5.1 The contractor shall arrange all approaches, stairways, ladders, working platform etc. for carrying out the entire operation safely. The working area shall be neatly maintained and all facilities required by the Engineer-in-Charge for proper supervision of the work shall be provided by the contractor.
- 5.2 All precautionary measures required for the safety of the structure during the progress of operation and till the successful completion and handing over shall be the responsibility of contractor. He shall carry out all such measures as directed by Engineer-in-Charge.

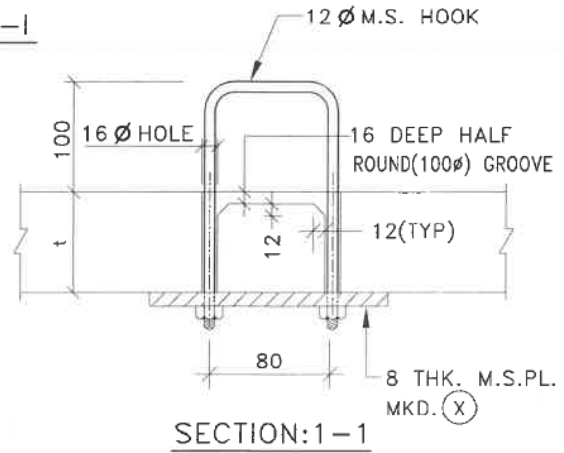
6.0 PAYMENT (applicable to item rate tenders only)

- 6.1 Payment shall be made by weight of resin system actually used in the work.
- 6.2 The rate quoted shall be inclusive of all labour and materials required for the successful completion of the work including all cleaning operation before and after the work, preparation of the old, hardened concrete surface as specified, mixing, application of epoxy resin and other safety measures including their removal after completion, all plants and tools etc. complete. Rate shall also be inclusive of all tests required to check the specific properties of materials.
- 6.3 Any test specified and directed to establish the soundness and monolithicity of bonding of fresh concrete to old concrete actually executed shall be paid separately unless such tests fail to meet the requirements of this specification. In case of failure, no such payment shall be made and the contractor shall repair/ rectify or re-do the work as directed by Engineer-in-Charge at no extra cost to the owner.
- 6.4 Underground work like excavation, backfilling, removal of surplus earth, keeping the pit dry by pumping/ bailing out subsoil water shall be paid separately as per relevant item in the contract.

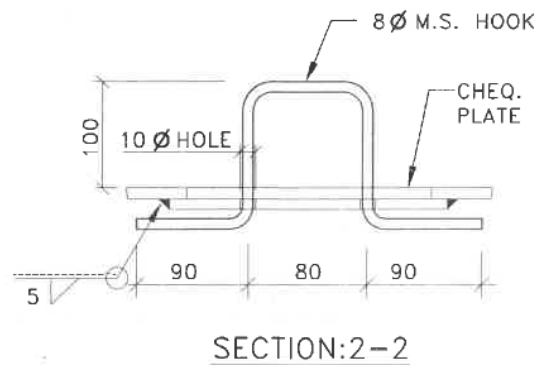
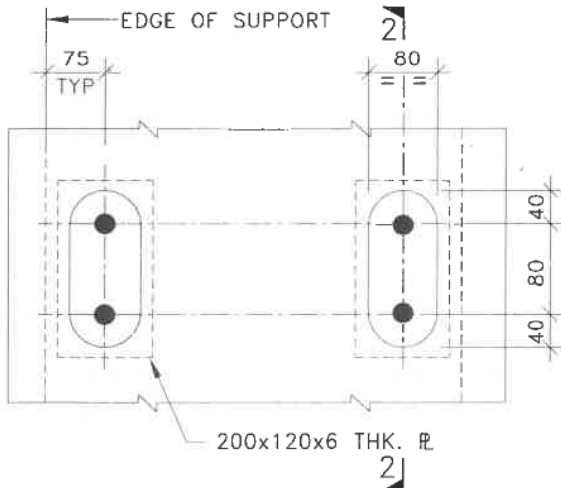


DETAIL OF M.S. PLATE MKD. (X)

TYPE-I



TYPE-II



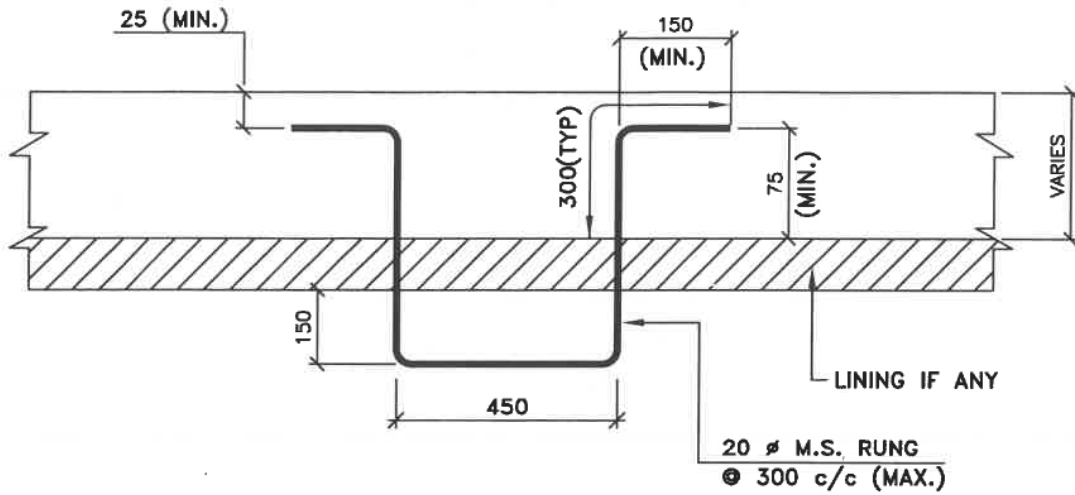
TYPE-III

(FOR CHEQ. PLATE ONLY)

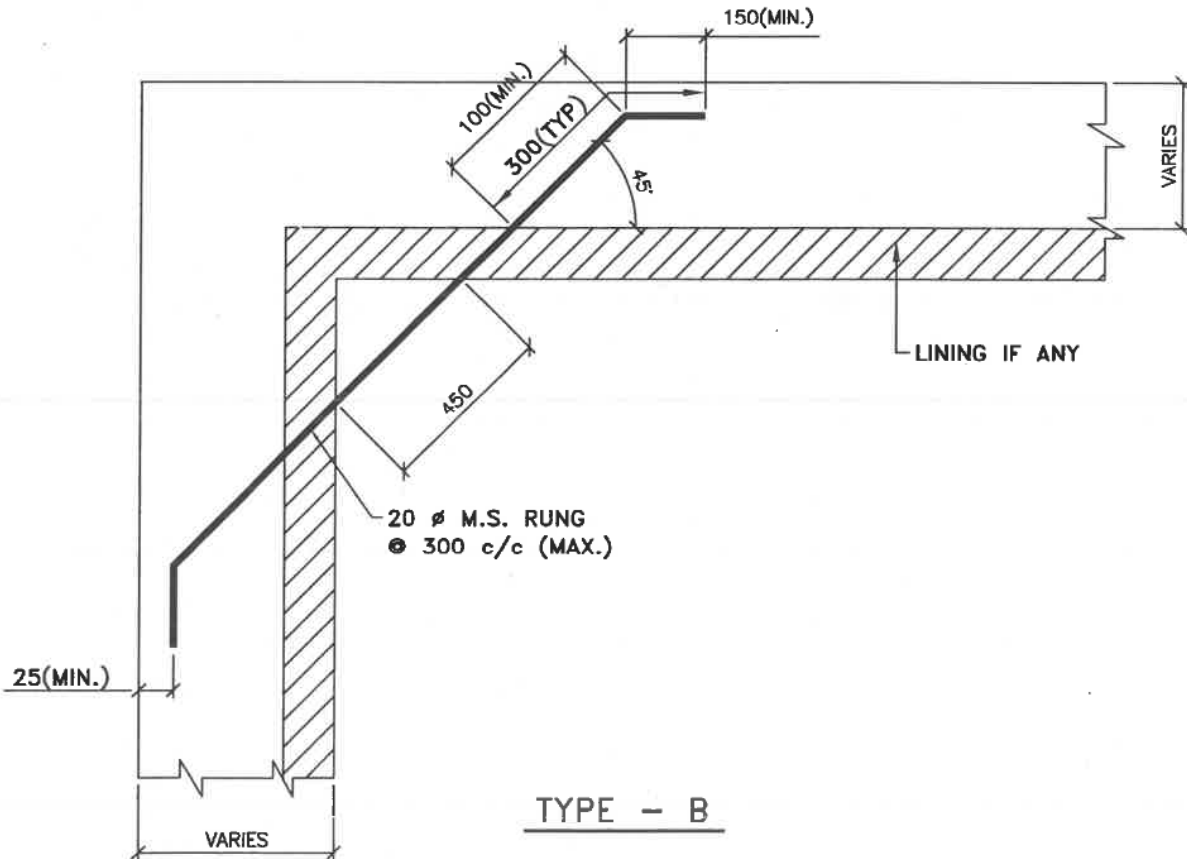
NOTES:

1. ALL DIMENSIONS ARE IN mm
2. FOR PRECAST SLABS GENERALLY LIFTING HOOK TYPE-I SHALL BE USED UNLESS TYPE-II IS SPECIFIED IN THE DRAWING.

7	28.03.24	REVISED AND ISSUED AS STANDARD	SN	AD/MM	ANURAG SINHA	MAINAK NANDI
6	27.08.18	REAFFIRMED AND ISSUED AS STANDARD	KKS	A. SINHA	R. SRIVASTAVA	R. K. TRIVEDI
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	



TYPE - A



TYPE - B

NOTES :-

1. ALL DIMENSIONS ARE IN mm.
2. FIRST RUNG SHALL BE AT 300 mm FROM TOP.

8	28.03.24	REAFFIRMED AND ISSUED AS STANDARD	SN	AD/MM	ANURAG SINHA	MAINAK NANDI
7	18.06.18	REAFFIRMED AND ISSUED AS STANDARD	ANNU	VIKRAM GUPTA	RAJANJI SRIVASTAVA	R. K. TRIVEDI
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
Approved by						

STANDARD LAP LENGTH FOR REBARS

TYPE OF REBARS	TYPE OF STRUCTURE	LAP LENGTH						TENSILE STRESS (σ_s) FOR Fe500 (N / mm ²)	DESIGN METHOD
		GRADE OF CONCRETE							
		M20	M25	M30	M35	M40	M45		
HIGH STRENGTH DEFORMED BARS CONFORMING TO IS 1786 AS PER GENERAL NOTES OF THE PROJECT	GENERAL R.C.C STRUCTURES / LIQUID RETAINING STRUCTURES / CHIMNEY	57 D	49 D	46 D	40 D	36 D	36 D	435	LIMIT STATE
	STORAGE BINS	54 D	48 D	43 D	40 D	36 D	34 D	275	WORKING STRESS

REMARKS: 'D' DENOTES DIAMETER OF REBARS.

NOTES :-

- LAP LENGTHS FOR REBARS, FULLY STRESSED TO TENSILE STRESS AT DESIGN LOAD / WORKING LOAD, HAS BEEN DERIVED FROM THE BASIC FORMULA GIVEN BELOW (REFER CLAUSE 26.2.1, IS 456)

$$L_d = \frac{D\sigma_s}{4\tau_{bd}}$$

WHERE D = NOMINAL DIAMETER OF THE BARS ; L_d = LAP LENGTH

σ_s = TENSILE STRESS AT DESIGN LOAD / WORKING LOAD IN REBARS HAS BEEN ADOPTED AS 0.87 f_y FOR LIMIT STATE AND 0.55 f_y FOR WORKING STRESS

τ_{bd} = DESIGN BOND STRESS AS PER CLAUSE 26.2.1.1 OF IS 456 FOR LIMIT STATE AND TABLE 21 OF IS 456 FOR WORKING STRESS DESIGN.

2. IS CODE REFERENCES :

LIQUID RETAINING STRUCTURE	IS 3370
R.C.C CHIMNEYS	IS 4998
STORAGE BINS	IS 4995
GENERAL R.C.C STRUCTURES	IS 456

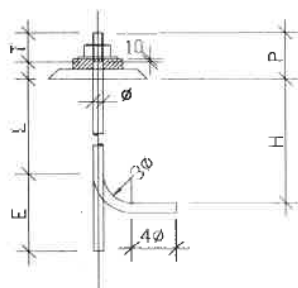
- LAP LENGTH SHALL BE ROUNDED UP TO THE NEXT HIGHER WHOLE NUMBER.
- THE LONGITUDINAL DISTANCE BETWEEN TWO ADJACENT LAPS SHOULD NOT BE LESS THAN 1.3 TIMES THE LAP LENGTH L_d .
- LAP SPLICES SHALL NOT BE USED FOR BARS LARGER THAN 32mm.

8	22.12.25	REVISED AND REISSUED AS STANDARD	AK	PM	AS	MN
7	28.09.20	REAFFIRMED AND ISSUED AS STANDARD	JG	AVM	AS	SM
6	21.07.14	REVISED AND ISSUED AS STANDARD	A.K. SHARMA	AMARJEET	P.K.MITTAL	S.CHANDA
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman

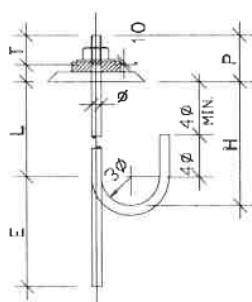
GRADE OF CONC.	BOLT TYPE	DIMENSIONS MM	BOLT DIA (ϕ) IN MM											
			10	12	16	18	20	22	24	27	30	33	36	39
M20	I & III	L	250	300	450	450	550	600	650	750	850	950	1000	1100
		E	95	115	155	170	190	210	230	255	285	315	345	370
		H	TYPE-I	280	336	498	504	610	666	722	831	940	1049	1108
			TYPE-III	430	486	648	654	910	966	1022	1281	1390	1499	1558
	II & IV	L	200	200	300	350	400	450	450	550	600	700	700	800
		E	150	180	240	270	300	330	380	405	450	495	540	585
		H	TYPE-II	230	236	348	404	460	516	522	631	690	799	808
			TYPE-IV	380	386	498	554	760	816	822	1081	1140	1249	1367
M25	I & III	L	200	250	400	400	450	550	550	650	700	800	850	950
		E	95	115	155	170	190	210	230	255	285	315	345	370
		H	TYPE-I	230	286	448	454	510	616	622	731	790	899	958
			TYPE-III	380	436	598	604	810	916	922	1181	1240	1349	1408
	II & IV	L	150	150	250	250	300	350	350	450	500	550	600	650
		E	150	180	240	270	300	330	360	405	450	495	540	585
		H	TYPE II	180	186	298	304	360	416	422	531	590	649	708
			TYPE-IV	330	336	440	454	660	716	722	981	1040	1099	1158
M30	I & III	L	180	220	315	335	390	445	470	550	600	680	735	815
		E	95	115	155	170	190	210	230	255	285	315	345	370
		H	TYPE-I	210	260	365	390	450	515	545	635	690	780	845
			TYPE-III	360	410	515	540	750	815	845	1085	1140	1230	1295
	II & IV	L	150	150	200	200	250	275	300	350	375	425	450	500
		E	150	180	240	270	300	330	360	405	450	495	540	585
		H	TYPE-II	180	190	250	255	310	345	375	435	465	525	560
			TYPE-IV	330	340	400	405	610	645	675	885	915	975	1010

9	06.06.24	REVISED AND ISSUED AS STANDARD	ANNU AHUJA	VIKRAM GUPTA	ANURAG SINHA	MAINAK NANDI
8	27.03.19	REVISED AND ISSUED AS STANDARD	JITENDER GUPTA	AMARJEET	RAJANJJI SRIVASTAVA	R.K.TRIVEDI
7	26.11.13	REVISED AND ISSUED AS STANDARD	A.K. SHARMA	AMARJEET	P.K.MITTAL	S.CHANDA
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman

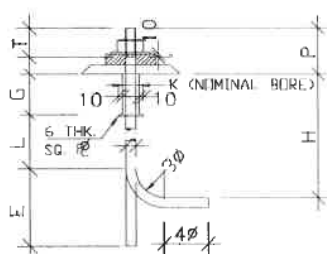
GRADE OF CONC.	BOLT TYPE	DIMENSIONS MM		BOLT DIA (ϕ) IN MM											
				10	12	16	18	20	22	24	27	30	33	36	39
M35	I & III	L		160	190	275	295	340	390	410	480	525	595	640	710
		E		95	115	155	170	190	210	230	255	285	315	345	370
		H	TYPE-I	190	230	325	350	400	460	485	565	615	695	750	830
			TYPE-III	340	380	475	500	700	760	785	1015	1065	1145	1200	1280
	II & IV	L		150	150	150	150	180	225	225	275	300	350	350	400
		E		150	180	240	270	300	330	360	405	450	495	540	585
		H	TYPE-II	180	190	200	205	240	290	300	360	390	450	460	520
			TYPE-IV	330	340	350	355	540	590	600	810	840	900	910	970
M40	I & III	L		150	170	240	255	300	340	360	425	460	525	565	625
		E		95	115	155	170	190	210	230	255	285	315	345	370
		H	TYPE-I	180	210	290	310	360	410	435	510	550	625	675	745
			TYPE-III	330	360	440	460	660	710	735	960	1000	1075	1125	1195
	II & IV	L		150	150	150	150	175	200	200	225	250	275	300	325
		E		150	180	240	270	300	330	360	405	450	495	540	585
		H	TYPE-II	180	190	200	205	235	270	275	310	340	375	410	445
			TYPE-IV	330	340	350	355	535	570	575	760	790	825	860	895



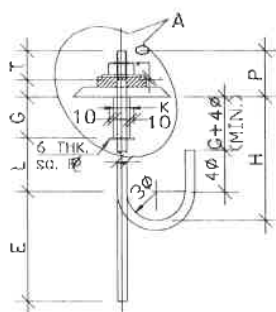
TYPE - I



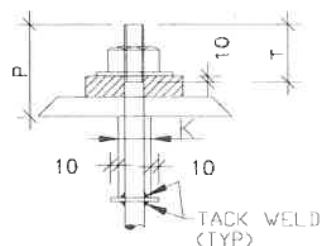
TYPE - II



TYPE - III



TYPE - IV



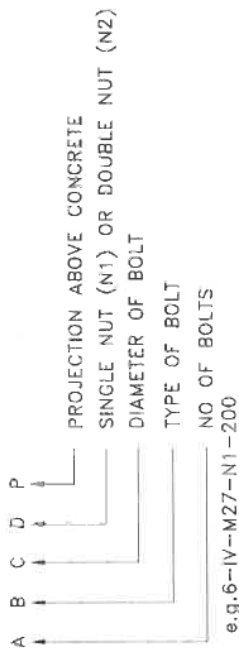
DETAIL-A
(TYP)

GRADE OF CONC.	BOLT TYPE	DIMENSIONS MM		BOLT DIA (ϕ) IN MM																			
				10	12	16	18	20	22	24	27	30	33	36	39	42	45	48	52	56	60	64	
M20,M25, M30,M35 & M40	III & IV	SLEEVE	G	150	150	150	150	300	300	300	300	450	450	450	450	450							
			K	50	50	50	50	50	80	80	80	80	80	80	100								
	I TO IV IX & XII	THREADED (T) LENGTH	SINGLE NUT	40	45	55	60	60	65	70	75	80	90	95	100								
			DOUBLE NUT	50	60	70	75	80	90	95	105	110	120	130	140								
M20 & M25	V		G	150	150	150	200	300	300	300	300	450	450	450	450	550	600	650	700	750	800	900	900
			H	210	222	234	291	398	410	417	580	585	598	608	722	786	841	905	975	1035	1150	1171	
	V & VI		W	80	80	90	100	100	130	130	140	150	170	180	200	210	220	230	260	270	290	320	
			t3	10	12	16	16	20	20	25	25	25	28	32	36	36	36	40	45	45	50	56	
M30	VII		L					350	400	400	500	550	600	750	950	1050	1100	1200	1350	1500	1750	1900	
			L											350	400	450	500	550	600	650	700	750	
	VIII		C											160	200	200	200	240	240	240	260	280	
			G	150	150	150	200	300	300	300	450	450	450	450	500	500	550	600	650	750	800	800	
	V		H	210	225	235	290	400	410	415	580	585	600	610	675	690	745	805	875	985	1050	1075	
			W	80	80	90	100	100	100	100	110	110	140	160	200	210	220	230	260	270	290	320	
	V & VI		t3	10	12	16	16	20	20	20	25	25	28	32	36	36	36	40	45	45	50	56	
			L				275	325	325	375	425	500	600	750	850	975	1000	1075	1225	1375	1525		
VIII		L											300	350	400	450	500	550	600	650	700		
		C											125	160	160	185	185	200	240	240	240		

GRADE OF CONC.	BOLT TYPE	DIMENSIONS MM	BOLT DIA (ϕ) IN MM															
			10	12	16	18	20	22	24	27	30	33	36	39	42	45	48	52
M35 & M40	V	G	150	150	150	200	300	300	300	450	450	450	450	450	500	550	600	600
		H	210	225	235	290	400	410	415	580	585	600	610	625	690	745	805	825
	V & VI	W	80	80	90	100	100	100	100	110	110	140	160	200	210	220	230	260
		+3	10	12	16	16	20	20	20	25	25	28	32	36	36	36	40	45
M20, M25, M30, M35, & M40	VII	L					250	275	300	350	400	450	550	675	775	875	900	975
		L											300	350	400	450	500	550
	VIII	C											125	160	160	160	185	200
	V & VI	E	50	60	70	75	80	90	95	105	110	120	130	140	150	155	165	180
M20, M25, M30, M35, & M40	V & VI	K	50	50	50	50	50	80	80	80	80	80	80	100	100	100	100	125
		THREADED (T) LENGTH	40	45	55	60	60	65	70	75	80	90	95	100	105	110	120	125
	VII & VIII	DOUBLE NUT	50	60	70	75	80	90	95	105	110	120	130	140	150	155	165	180
	VII	+3					16	16	16	16	16	16	16	16	16	16	20	20
M20&25 M30 M35&M40	VIII	+3											16	20	20	20	25	25
	VII & VIII	G	150	150	150	150	300	300	300	450	450	450	450	450	450	450	450	450
	IX	L	80	100	150	170	200											
	XII	L	185	220	310	335	385	435	460	535	590	660	720					
M35&M40		L	150	150	200	225	250	275	300	350	375	425	450					
		L	150	150	175	200	225	250	275	300	350	375	400					

NOTES :-

1. BOLTS SHALL BE MARKED ON THE DRAWING AS UNDER :



2. BOLTS SHALL BE TURNED FROM M.S. ROUNDS CONFORMING TO IS:2062 GRADE-E250 QUALITY A/BR/BO.

3. NUTS AND WASHERS SHALL CONFORM TO IS:1363.

4. THREADING SHALL BE COARSE CONFORMING TO IS:1367 AND IS:4218.

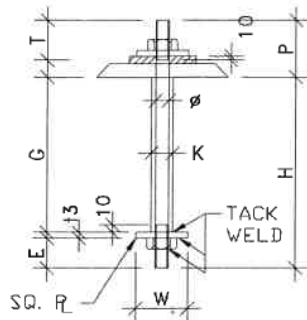
5. ANCHOR BOLTS SHALL BE SET ACCURATELY AND HELD IN POSITION BY TEMPLATE BEFORE CONCRETING.

6. 6 THK. SQ. PLATE AT THE BOTTOM OF SLEEVE SHALL BE TACK WELDED WITH BOLT AND SLEEVE FOR BOLT TYPE III, IV, VII AND VIII.

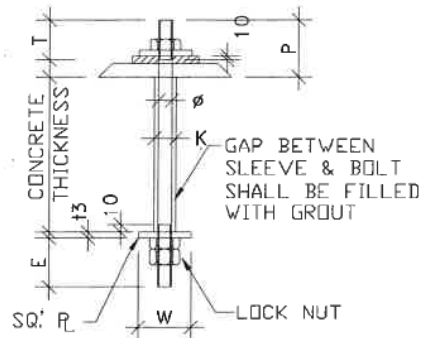
7. SLEEVE SHALL BE M.S. TUBES (MEDIUM) AS PER IS:1239.

8. REFER DESIGN DRAWINGS FOR PROJECTION (P) OF BOLT ABOVE TOP OF ROUGH CONCRETE AND NUMBER (A) OF BOLTS.

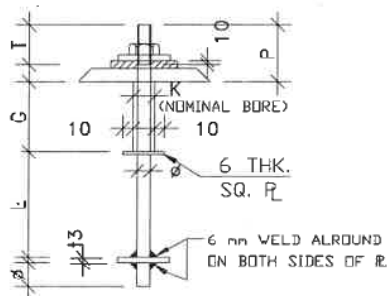
9. ANCHOR BOLTS SHALL BE TEMPERED BEFORE MACHINING IF MADE BY FORGING. THE FORGING TEMPERATURE SHALL BE ABOVE 900° C BUT LOWER THAN SUPER HEATING TEMPERATURE.



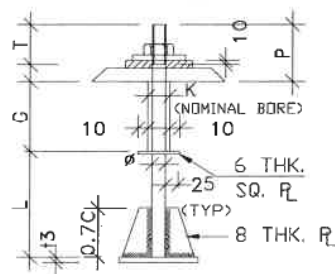
TYPE - V



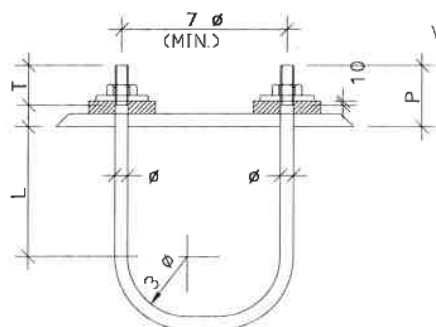
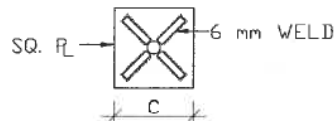
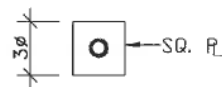
TYPE - VI



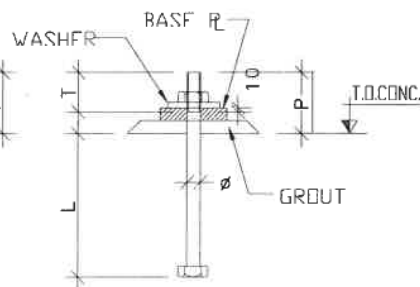
TYPE - VII



TYPE - VIII

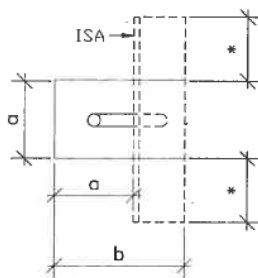
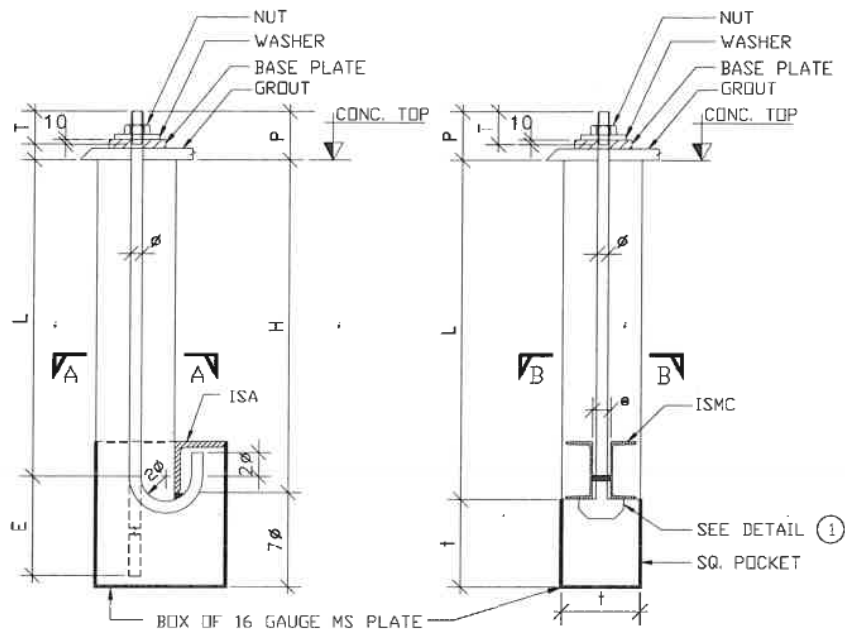


TYPE - IX



TYPE - XII

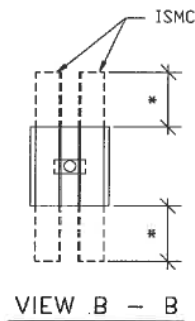
GRADE OF CONC.	BOLT TYPE	DIMENSIONS MM	BOLT DIA (ϕ) IN MM														
			20	22	24	27	30	33	36	39	42	45	48	52	56	60	64
			150	160	180	200	220	240	260	280	300						
M20, M25, M30, M35 & M40	X	a	250	290	310	330	370	390	460	480	500						
		b	600	700	800	900	1000	1100	1200	1300	1400						
		L	220	220	240	270	300	330	360	390	420						
		E	640	744	848	954	1060	1166	1272	1378	1484						
		H	100x100 X10	130X130X10	150X150X12	200X200X16											
		THREADED LENGTH (T)	SINGLE NUT	60	65	70	75	80	90	95	100	105					
				80	90	95	105	110	120	130	140	150					
		DOUBLE NUT	h			18		20		25		30	30		30		30
						18		22		25		30	35		40		50
		c	q			24		30		36		42	48		56		64
						65		75		85		95	110		125		140
	XI	r			1.6			1.6		2.0		2.0	2.0		3.0		3.0
		f			140			150		170		190	210		220		240
		e			30			35		42		50	58		65		75
		L			800			1000		1200		1400	1600		1800		2000
		ISMC				75x40		75x40		100x50		125x65	150x75		150x75		175x75
						70		80		95		105	120		135		150
		THREADED LENGTH (T)	SINGLE NUT														
		DOUBLE NUT															



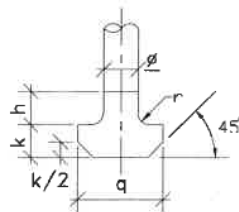
VIEW A - A

TYPE - X

(* AS PER DESIGN REQUIREMENT)



VIEW B - B



DETAIL - ①

(FOR FORGED BOLT HEAD)

TYPE - XI

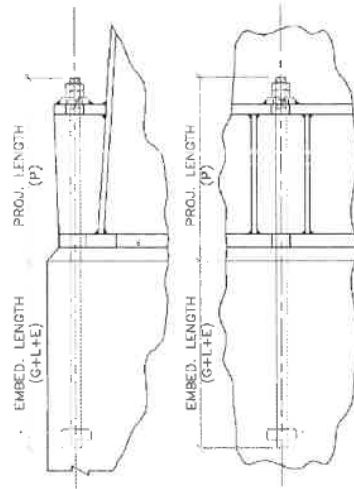


FIGURE 1: ANCHOR BOLT WITH ANCHOR CHAIR
(VERTICAL VESSELS ON SKIRT, STORAGE TANKS, ETC.)

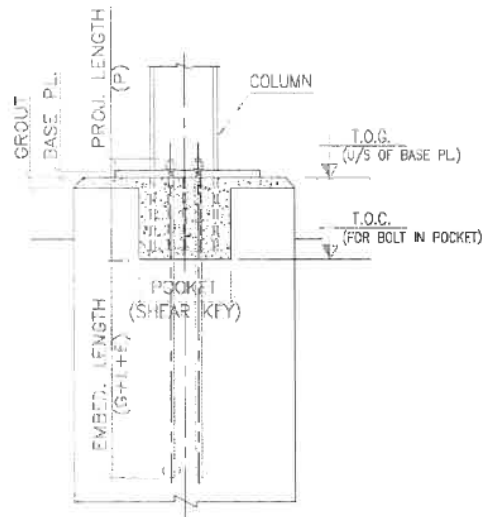


FIGURE 2: ANCHOR BOLT WITH POCKET IN PEDESTAL

Sr No	Supplier Name	City	Phone	E-Mail	Remarks
Department : STRUCTURE					
General Notes/ Instructions:- 1. SPECIFICATION OF THE PRODUCT SHALL BE CHECKED AGAINST TENDER SPECIFICATIONS BEFORE SELECTING ANY PRODUCT/ BRAND. IN CASE OF ANY DISCREPANCY, TENDER ITEM/ SPECIFICATIONS SHALL PREVAIL, AND ANY SUCH PRODUCT/ BRAND SHALL NOT BE USED WHICH IS NOT CONFORMING TO TENDER SPECIFICATIONS EVEN IF IT IS APPEARING IN THIS LIST. 2. DOSAGE OF ADMIXTURES, WHEREVER NOT MENTIONED IN THIS LIST, SHALL BE AS PER MANUFACTURER'S SPECIFICATIONS. 3. IN CASE OF NON-AVAILABILITY OF ANY PRODUCT AMONG APPROVED PRODUCTS/ BRANDS AT A PARTICULAR SITE/ REGION, ALTERNATE PRODUCT/ BRAND NAME SHALL BE PROPOSED BY RCM TO EIL-HO FOR APPROVAL, ALONG WITH THE CREDENTIALS OF THE MANUFACTURER AND DETAILS OF THE PROPOSED PRODUCT/ BRAND. 4. UNDER THE LISTED CATEGORIES, ALL PRODUCTS CARRYING "ISI" CERTIFICATION MARK OF BIS ALONG WITH RELEVANT STANDARD NUMBER "IS:*****" AND THE RELEVANT LICENSE NUMBER "CM/L *****" AND LISTED AT BIS WEBSITE " http://www.manakonline.in " ON THE DATE OF PLACEMENT OF PURCHASE ORDER ARE DEEMED TO BE CONSIDERED AS APPROVED FOR USAGE. 5. IN ADDITION TO PRODUCTS MENTIONED IN THIS LIST, PRODUCTS APPROVED AFTER ISSUE OF THIS LIST SHALL ALSO BE CONSIDERED FOR USE BASED ON PRODUCTION OF "PRODUCT APPROVAL LETTER" ISSUED TO THE MANUFACTURER BY EIL-HO.					
Area of Experience: Other					
Item : A. INTEGRAL WATER-PROOFING COMPOUNDS FOR CONCRETE (AS PER IS:2645)					
1	Refer Remark	INDIA	,	NA	All Integral Waterproofing Compounds for Concrete which carry "ISI" certification mark of BIS along with standard number "IS 2645" and the license number "CM/L **....*)" and listed at BIS website " https://www.bis.gov.in ".
Item : B. CONCRETE ADMIXTURES -(AS PER IS:9103)					
1	Refer Remark	INDIA	,	NA	All Accelerating, Retarding, Water-reducing, Air-entraining & Super-plastizing Admixtures for Concrete which carry "ISI" certification mark of BIS along with standard number "IS 9103" and the license number "CM/L **....*)" and listed at BIS website " https://www.bis.gov.in ".
Item : C. BI-POLAR CONCRETE PENETRATING CORROSION INHIBITING ADMIXTURE (AS PER EIL STD SPEC NO 6-68-0017)					
1	CHRYSO INDIA PRIVATE LIMITED	NAVI MUMBAI	022 2768 5991, ,	info.india@chryso.com	BRAND NAME-CHRYSO CORROCRETE

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Sr No	Supplier Name	City	Phone	E-Mail	Remarks
2	CLEAN COATS PVT LTD	THANE	, ,		PRODUCT NAME-CONPROOF 1A (DOSAGE 1% W/W OF CEMENT)
3	FOSROC CHEMICALS (INDIA) PVT LTD	BENGALURU	+91 8042521900, ,	enquiry.india@fosroc.com	BRAND NAME-AURAMIX BCI
4	HINDCON CHEMICALS LTD	KOLKATA	, ,	NA	BRAND NAME- HIND CORROGUARD
5	KRISHNA CONCHEM PRODUCTS PVT LTD	NAVI MUMBAI	, ,		PRODUCT NAME-EPCO KP-200 (DOSAGE 1% W/W OF CEMENT)
6	MASTER BUILDERS SOLUTIONS INDIA PVT LTD	NAVI MUMBAI	, ,	NA	PRODUCT NAME- MASTERLIFE CI 220 (DOSAGE 1% W/W OF CEMENT)
7	SP CONCARE PVT. LTD.	SANGLI	, ,	NA	BRAND NAME:ADDMIX 109 PCCI
8	STP LTD.	DELHI	, ,	NA	PRODUCT NAME-SHALIPLAST MCI (DOSAGE 1% W/W OF CEMENT)
9	SUNANDA SPECIALITY COATING PVT LTD	MUMBAI	, ,		PRODUCT NAME-POLYALK CP 293 (DOSAGE 1% W/W OF CEMENT)
Item : D. POLYSULPHIDE SEALANTS (TWO PART, AS PER IS:12118) 067050055056					
1	CHOWKSEY CHEMICALS PVT LTD	MUMBAI	, ,		PRODUCT NAME-TECHSEAL 940/941
2	CICO TECHNOLOGIES LIMITED	DELHI	, ,		PRODUCT NAME-CICO SEAL T680
3	DON CONSTRUCTION CHEMICALS INDIA LTD	CHENNAI	, ,	NA	BRAND NAME- 1. FLEXSEAL PS660 (GUN GRADE) 2. FLEXSEAL PS660 (POUR GRADE)
4	DURA BUILD CARE PVT LTD	DELHI	, ,	NA	PRODUCT NAME- DURASIL PPS (POURING GRADE)
5	FOSROC CHEMICALS (INDIA) PVT LTD	BENGALURU	+91 8042521900, ,	enquiry.india@fosroc.com	PRODUCT NAME-THIOFLEX 600
6	HINDCON CHEMICALS LTD	KOLKATA	, ,	NA	BRAND NAME- 1. HIND SEALANT PS (POUR GRADE). 2. HIND SEALANT PS (GUN GRADE)
7	JAY CHEMICAL INDUSTRIES PVT LTD	AHMEDABAD	, ,	NA	PRODUCT NAME- K2 POLYSEAL 22P (POUR GRADE)
8	PERMA CONSTRUCTION AIDS PVT LTD	MUMBAI	, ,	NA	PRODUCT NAME- 1. PERMA POLYSEAL (GUN GRADE) 2. PERMA POLYSEAL (POUR GRADE)
9	PIDILITE INDUSTRIES LTD (DR. FIXIT)	MUMBAI	, ,	NA	PRODUCT NAME-1. PIDISEAL PS41G, 2. PIDISEAL PS42P

Sr No	Supplier Name	City	Phone	E-Mail	Remarks
10	SIKA INDIA PVT LTD	KOLKATA	, ,		BRAND NAME- 1. SIKA POLYSULPHIDE (SIKALASTIC) 2. SIKAFLEX CONSTRUCTION 3. IGAS Ih
11	STP LIMITED	NEW DELHI	, ,		PRODUCT NAME- SHALISEAL PS
12	ZZ-Refer Remarks (ZZ inserted to maintain the alphabetic chronology)	INDIA	, ,	NA	All other Polysulphide Sealants (Two Parts) which carry "ISI" certification mark of BIS along with standard number "IS 12118" and the license number "CM/L**....*)" and listed at BIS website "https://www.bis.gov.in".
Item : E. ANCHOR FASTENERS - CHEMICAL TYPE (EOTA / DIBt/ FM/ ICBO-ES APPROVED). Note- Design of post-installed Anchors and Rebars shall be provided/ verified by the approved manufacturer with installation instructions and execution shall be done by an applicator trained by the approved manufacturer (preferably in the presence of manufacturer for critical applications/ structures).					
1	FISCHER FIXING SYSTEMS(MICO) LTD	BENGALURU	, ,		BRAND NAME-FISCHER ANCHORS
2	FOSROC CHEMICALS (INDIA) PVT LTD	BENGALURU	+91 8042521900, , 067050055056	enquiry.india@fosroc.com	CHEMICAL ANCHORING OF REBAR, BRANDS NAMES- LOKFIX E55, LOKFIX E77 & LOKFIX E45T
3	HILTI INDIA PVT LTD	DELHI	, ,		BRAND NAME-HILTI ANCHORS
4	INDO SPARK CONSTRUCTION SERVICES	KOLHAPUR	, ,	NA	BRAND NAME-ICFS CM VESF, CM VESF TROPICAL, CM SH, CM SH TROPICAL, CM 585 PE PRO, CM 385 PE PRO, CM 400 PE, CM 650 PE
5	MASTER BUILDERS SOLUTIONS INDIA PVT LTD	NAVI MUMBAI	, ,	NA	BRAND NAMES-MASTERFLOW 916 AN, 918 AN, 920 AN, 932 AN, 936 AN
6	MUNGO FIXINGS INDIA PVT LTD	BENGALURU	, ,	NA	BRAND NAME-MIT 700 RE, MIT SE PLUS, MIT TROPICAL, MIT SP & MVA CAPSULE
7	POWERS FASTENERS(THROUGH M/S KRAFT SALES & SERVICES (I) LTD.)	PUNE	, ,	NA	BRAND NAME-POWERS FASTENERS
8	UIP SYSTEMS (INDIA) PVT LTD	MUMBAI	, ,	NA	UIP FASTENERS
9	WUERTH INDIA PVT LTD	DELHI	, ,	NA	BRAND NAME-WUERTH ANCHORS
Item : F. ANCHOR FASTENERS - MECHANICAL TYPE (EOTA / DIBt/ FM/ ICBO-ES APPROVED). Note- Design of post-installed Anchors and Rebars shall be provided/ verified by the approved manufacturer with installation instructions and execution shall be done by an applicator trained by the approved manufacturer (preferably in the presence of manufacturer for critical applications/ structures).					

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Sr No	Supplier Name	City	Phone	E-Mail	Remarks
1	FISCHER FIXING SYSTEMS(MICO) LTD	BENGALURU	, ,		BRAND NAME-FISCHER ANCHORS
2	HILTI INDIA PVT LTD	DELHI	, ,		BRAND NAME-HILTI ANCHORS
3	INDO SPARK CONSTRUCTION SERVICES	KOLHAPUR	, ,	NA	BRAND NAME: (ICFS) INDO WEDGE ANCHOR IWA, IWA-A2, IWA-A4
4	MUNGO FIXINGS INDIA PVT LTD	BENGALURU	, ,	NA	BRAND NAME-M1 POWER GRIP, M1r POWER GRIP, M1T, M2, M2r, MCS, MEA
5	POWERS FASTENERS(THROUGH M/S KRAFT SALES & SERVICES (I) LTD.)	PUNE	, ,	NA	BRAND NAME-POWERS FASTENERS
6	UIP SYSTEMS (INDIA) PVT LTD	MUMBAI	, ,	NA	UIP FASTENERS
7	WUERTH INDIA PVT LTD	DELHI	, ,	NA	PRODUCT NAME- WUERTH ANCHORS
Item : G. ELECTRO-FORGED GALVANISED GRATINGS (AS PER EIL STD 7-68-0697, BS:4592)					
1	ABHYANT EFG & ENGINEERING PVT. LTD	RAIPUR	, ,	NA	TYPE-I & TYPE-II
2	ANKIT ELECTROGRATING	RAIPUR	, ,	NA	TYPE-I & TYPE-II
3	BHOLA RAM STEEL PVT LTD	PATNA	067050055056		BRAND NAME-BHOLARAM GRATINGS
4	CELL COM TELESERVICES PVT LTD	SIKANDRABAD	, ,	NA	BRAND NAME-CELLCOM GRATINGS
5	FERROTECH STRUCTURALS (INDIA) PVT LTD	KANCHIPURAM	, ,	NA	TYPE-I & TYPE-II
6	GREATWELD ENGINEERING PVT. LTD.	PUNE	+91 7350304304, ,	sumit.rungta@greatweld.com	BRAND NAME-GREATWELD GRATINGS, TYPE-I & TYPE-II
7	INDIANA GRATING PVT.LTD	MUMBAI	, ,		BRAND NAME-INDIANA GRATINGS
8	IRONWELD ENGINEERING PVT LTD	PUNE	, ,	NA	TYPE-I & TYPE-II
9	JACINTH ENGINEERING PVT LTD	MUMBAI	, ,	NA	BRAND NAME-JACINTH GRATINGS
10	KANADE ANAND UDYOG PVT LTD	MUMBAI	, ,		BRAND NAME-KANADE GRATINGS
11	LIONWELD MEISER LLC	DUBAI	, ,	NA	TYPE-I & TYPE-II
12	MEET ENGINEERING	VADODARA	, ,	NA	TYPE-I & TYPE-II
13	OMKAR GRATINGS PVT LTD	MUMBAI	, ,		BRAND NAME-OMKAR GRATINGS (FOR EIL TYPE-II GRATING ONLY)
14	PARCO ENGINEERS (MUMBAI) PVT LTD	Mumbai	9819278530, , 9819278530	info@parcoengineers.com	TYPE-I & TYPE-II

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Sr No	Supplier Name	City	Phone	E-Mail	Remarks
15	PINAX STEEL INDUSTRIES PVT LTD	KOLKATA	, ,		BRAND NAME-PINAX GRATINGS
16	PREMIER POWER PRODUCTS PVT LTD	KOLKATA	, ,		BRAND NAME-PREMIER GRATINGS
17	RATAN PROJECTS & ENGINEERING CO.PVT LTD.	KOLKATTA	, ,	sales@ratans.com	BRAND NAME- RATAN GRATINGS
18	SIGMA GALVANIZING PVT LTD	NAVI MUMBAI	, ,	NA	TYPE-I & TYPE-II
19	VINFAB GRATINGS	MUMBAI	, ,		BRAND NAME-VINFAB GRATINGS
20	WHEELS INDIA LTD	CHENNAI	, ,	NA	PRODUCT NAME-WHEELS GRATINGS
Item : H. INTEGRAL CRYSTALLINE ADMIXTURE FOR WATERPROOFING TREATMENT TO CONCRETE (AS PER CPWD SPECIFICATION 2019, CLAUSE 22.14)					
1	CHRYSO INDIA PRIVATE LIMITED	NAVI MUMBAI	022 2768 5991, ,	info.india@chryso.com	PRODUCT NAME-CHRYSO CWA10
2	KRYTON BUILDMAT CO PVT LTD	GURUGRAM	0124 4381 140, ,	info@kryton.in	PRODUCT NAME-KRYSTOL INTERNAL MEMBRANE "KIM"
3	PENETRON INFRA PRODUCTS PVT LTD	NAVI MUMBAI	+91 7738444041, ,	inquiry@penetron.co.in	PRODUCT NAME-PENETRON ADMIX
4	SHALIMAR SEAL & TAR PRODUCTS PVT LTD	JAIPUR	+91 9829065184, , 067050055056	ocrd@shalimartar.com	PRODUCT NAME-KAVASSU CRYSTALLOMIX-PG
5	XYPEX	GAUTAM BUDH NAGAR	0120-4090900, ,	info@xypex.in	PRODUCT NAME-XYPEX ADMIX C-2000 NF
Department : STRUCTURAL DIAGNOSTICS, REPAIR & REHABILITATION					
Area of Experience: Other					
Item : Structural Diagnostics, Repair & Rehabilitation					
1	A to Z NDT Solutions Pvt. Ltd.	Faridabad	01129410532, 8469769160, 8130286278	infodesk@atozndt.com	
2	Aaryan Structcon Pvt. Ltd.	Mumbai	9167397102, , 9167397102	deven.limayae@aaryans.in	
3	Apex Technical Consultancy Service	New Delhi	099538 50684, 9560 900 684,	customer@apextechnical.in, info.apextechnical@gmail.com	
4	Avantech Engineering Consortium Pvt Ltd	New Delhi	011-4557-9300, 011-2735-7277,	Sales@avantech.in, service@avantech.in, projects@avantech.in, training@avantech.in	
5	B J Mehta Structural Consultants Pvt Ltd	Mumbai	022 2567 1005, 022 2567 7389,	jagdishshah@systemstructural.com	
6	B V Bhedasgaonkar Consulting Engineer	Pune	(020) 2546 1501, ,	enem@bom3.vsnl.net.in	
7	Binyas Contech Pvt Ltd	Bangaluru	80 23431739, 9663307001/03, 9448994200	NA	

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Sr No	Supplier Name	City	Phone	E-Mail	Remarks
8	Bureau Veritas India (former Civil Aid Technoclinic Pvt Ltd)	Mumbai	970 272 1828, +91 22 6274 2000,	bvindia.corporate@bureauveritas.com	
9	CCRT Laboratories	Thane	9869026660, 02225820538,	director@ccrtlab.com	
10	Concrete Structural Forensic Consultants	Bengaluru	096209 18480, 91-80-23563287, 9620918480	csfc@rediffmail.com, csfc@hotmail.com, enquiry@structgeotech.com	
11	Construction Diagnostic Centre	Pune	020-25432643, 01126272275, 9225606148	info@concretepune.com	
12	Cortex Construction Solution Pvt Ltd	New Delhi	022-2649491, ,	info@cortexsolutions.in	
13	Delhi Engineering Services	New Delhi	NA, ,	NA	
14	Dhirendra Group of Company	Mumbai	, , 9769396111	info@dgc24.com	
15	Dr Fixit Institute of Structural Protection & Rehabilitation	Mumbai	022 2835 7683, 022 2835 7822, 9769222667	info@drfixitinstitute.com, csc@pidilite.com	
16	ESI Services India LLP	Vadodara	+912652291701/2/3, ,	esi.india@yahoo.com	
17	Epicons Consultants Pvt Ltd	Mumbai	022-26826225, 022-26826215,	response@epicons.com	
18	Fosroc Engineering Services Pvt. Ltd.	Bengaluru	8042521900, 9003199144,	manivannan.periyasamy@fosroc.com	
19	Geo Designes & Research P Ltd	Vadodara	0265-2290222, 0265-2283081,	info@geogroup.in	
20	Goma Engineering and Consultancy	Ahmedabad	8238468031,, 7600004285,	gomaconsultancy@gomaec.in	
21	IIT Madras (Dr B Nageswara Rao)	Chennai	91-44-22574285, ,	bnrao@iitm.ac.in	
22	INT Electra	Goa	9226269036,, 7020232419,	reagendsouza@yahoo.com	
23	National Council for Cement and Building Materials	Ballabgarh	0129-2242051, 0129-4192222,	nccbm@ncbindia.com	
24	RK Infra Techno-clinic Services Pvt Ltd	Thane	022 2582 0538, ,	nquiry@rkinfraconcreteservices.com	
25	SSA Techno Construction Pvt Ltd		, , 9871855887	ssatechno@gmail.com	
26	Sanrachana Structural Strengthening Pvt Ltd	Thane	993 088 4287, 022-2540 0122,	contact@sanrachana.in	
27	Specialty Treatment Enterprises	Noida	9811815335, ,	ste4techno@gmail.com	
28	Structural Specialty & Projects India Pvt Ltd	Thane	022 2580 1080, ,	info@structural-india.com	
29	Structwel Designers & Consultants Pvt Ltd	Navi Mumbai	91 22 6854 1010, , 9820483618	rubina.basu@structwel.com	
30	Triseal Technologies LLP/ Trifix Infrastructure	Mumbai	98200 44118, 74000 51294, 9820062410	info@triseal.co.in	
31	Ushta Infinity Construction Company Pvt Ltd	Vadodara	91 265 2291701 / 02, , 9374990930	tech@iccplindia.com	

SCOPE OF WORK & SUPPLY (STRUCTURAL)

FOR

CIVIL-STRUCTURAL WORKS FOR WATER PIPELINE FROM RUNDH (PH) TO JHAGADIA PUMP HOUSE

PROJECT : SUPPLY, LAYING, INSTALLATION, TESTING & COMMISSIONING INCLUDING ALL FITTINGS, CROSSINGS FOR 1500MM DIA. PCCP PIPELINE FOR WATER SUPPLY PROJECT AT GIDC JHAGADIA ESTATE

CLIENT : GUJARAT INDUSTRIAL DEVELOPMENT CORPORATION (GIDC)

CONSULTANT: ENGINEERS INDIA LIMITED (EIL)

C	29.04.2026	REVISED AND REISSUED FOR TENDER	RK	MS	AH
B	19.04.2024	REVISED AND REISSUED FOR TENDER	RK	MS	AH
A	16.04.2024	ISSUED FOR TENDER	MS	AH	VG
Rev. No	Date	Purpose	Prepared by	Checked by	Approved by

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