

## **SECTION - 1**

### **SCOPE, SPECIFIC TECHNICAL REQUIREMENTS** **SPECIAL CONDITIONS FOR CIVIL WORKS & QUANTITIES**

#### **1.1.0 SCOPE**

1.1.1 The scope of work under this specification is Civil Works of 400/220/132 kV GIS Sub Station at Rasra distt, Ballia, U.P by Bharat Heavy Electricals Ltd. The Customer is U.P. Power Transmission Corporation Limited.

1.1.2 The Civil Works shall generally include, *but not limited to*, following:

- (i) Fire Fighting Pump House Building & Water tank.
- (ii) RCC Cable trenches including precast covers & cable trench crossings.
- (iii) Any other work required for the project.

1.1.3 The works to be performed in the above construction includes preparation of bar bending schedules, based on the drawings released for construction and getting the same approved by the Engineer-in-charge plus the execution of the work including providing of all labour, supervision, materials, scaffolding, power, fuel, construction equipments, tools and plants, supplies, transportation, all incidental items necessary for successful completion of the work including contractor's supervision and in strict accordance with the drawings and specifications and with inspection and testing standards. The nature of work shall generally involve excavation in all type of soil and rock including dewatering, shoring, strutting, and filling under and around structures, backfilling with available excavated earth around completed structures, cable trenches with covers, disposal of surplus soil, formwork, providing necessary steel embedments and other inserts, drainage work, stone spreading (including antiweed treatment), Surface dressing, concreting, brickwork, plastering as per technical specifications and other works in switchyard all complete as per detailed specification, drawings and directions of Engineer-in-charge.

#### **1.2.0 SPECIFIC TECHNICAL REQUIREMENT**

1.2.1 The specific technical requirements for the execution of civil works shall be as per Customer Technical Specification/IS code. In case of any conflict between Indian Standard Code and Technical Specifications, the provisions of Technical Specification shall prevail.

### **1.3.0 SPECIAL CONDITIONS FOR CIVIL WORKS**

- i. All civil work shall be executed as per approved / released for construction drawings.
- ii. Mode of measurement for civil works shall be as per customer technical specifications.
- iii. All centering, shuttering and scaffolding shall be arranged by the contractor. Form work used should be of good quality and no honeycombing in concrete will be allowed.
- iv. The materials such as brick, sand, coarse sand, stone aggregate etc. shall be as per relevant IS code and regular testing of materials shall be done by the contractor from approved laboratory at his own cost.
- v. Centre-line pillars, benchmarks pillars and level pillars in brick work shall be constructed by the contractor at various places as per direction of Engineer-in-Charge, at his own cost.
- vi. Portland cement of approved make conforming to IS: 1489 (Part-1)1991 shall be used by the contractor in construction of substation. The cement procured by contractor shall be of standard brand like ACC, BIRLA, JP or equivalent. Test certificates shall be submitted before use.
- vii. Reinforcement steel bars conforming to IS: 1786-1979 of approved manufacturers such as TATA, SAIL, RATHI or equivalent shall be used in construction works. Test certificates shall be submitted before use.
- viii. Structural steel section conforming to IS: 226-1975 shall be used. Test certificates shall be submitted before use.
- ix. Contractor shall arrange Concrete mixture for mixing of all grades of cement concrete at his own cost. For compaction of concrete suitable vibrators shall be arranged and used by the contractor at his own cost.
- x. The contractor will make his own arrangements for electricity / water required for construction of substation. Nothing shall be paid on this account.
- xi. The contractor will arrange for temporary stores and site office at the site of work at his own cost.
- xii. The water fit for drinking shall be used in construction works.
- xiii. Suitable templates made of MS angles and MS channels for grouting of bolts shall be arranged by the contractor at his own cost. Drawings for templates shall be prepared by contractor and submitted to Engineer in charge for approval before use. No tolerance is allowed in grouting of bolts.
- xiv. Regular Testing of construction work/material as per approved FQP or direction of Engineer-in-Charge shall be carried by contractor at his own cost from approved laboratory and results shall be submitted to Engineer incharge.
- xv. All civil work shall be carried out as per UPPWD/UPPTCL specification/Relevant IS codes.
- xvi. No extra item shall be executed / started by the Contractor without written permission, failing which the Contractor shall be responsible for any expenditure incurred or risk involved as such. Contractor is strictly prohibited to start extra items without written permission by Engineer Incharge. Any violation of this clause will mean breach of the contract.

- xvii. Concrete of RCC slab shall be smooth finished & no extra payment shall be made on this account.
- xviii. RCC water tanks shall be tested for water tightness at full supply level as per IS 3370.

### **1.3.0 BILL OF QUANTITIES**

- 1.4.1 The Bill of Quantity shall be as per pages from 1.4 to 1.10
- 1.4.2 The quantities indicated in the 'Bill of Quantity' are indicative and can vary to any extent. Contractor shall not be entitled for any claim for any such variation in the quantities.
- 1.4.3 The provision of Bill of Quantity, specifications and drawings shall be read in conjunction with each other and in case of conflict amongst them, the clarification shall be obtained from the Engineer-in-charge whose decision shall be final and binding.

# **U.P. POWER TRANSMISSION CORPORATION LIMITED**

**SECTION-VIII**

**TECHNICAL SPECIFICATIONS  
FOR CIVIL WORKS  
FOR  
CONSTRUCTION**

**OF**

**400 KV GIS SUBSTATION  
AT  
RASRA, BALLIA**

# TECHNICAL SPECIFICATIONS FOR CIVIL WORKS

## 1.0 INTENT OF SPECIFICATION

The owner desired to have the contract for complete civil works for construction of 400 KV GIS S/S, Jehta, Hardoi Road, Lucknow. The work shall have to be carried out both below and above ground level involving construction of GIS cum control room buildings, various RCC foundations, transformer-plinth foundation, main gantries foundations, auxiliary structure foundations, cable trenches inside GIS cum control room buildings as well as well outdoor switchyard & covers, cement concrete roads, drains, culverts, tube well boring, O.H. Tank, Erector Hostel, residences and other associated civil works like earth filling & cutting, development works, park and plantation, required for proper energization of the substation and its operation complete in all respect as per approved drawings.

The work shall be executed on Turn-key basis. The item wise cost has been calculated based traditional drawings & on the basis of Schedule of rates effective from 01.11.2014 issued by Electricity Civil Transmission Circle, Lucknow. The tentative quantum of work has been estimated as per available standard drawings issued by ECDC, Lucknow and shall vary as per site condition. All the civil works shall be executed as per UPPWD/ UPPTCL specification.

## 1.1 SCOPE OF THE WORK

The scope of the work to be performed under the part of contract consists of labor, material, plants and equipments including all incidental items not shown or specified but reasonably implied or necessary for the proper completion of all civil works in all respects, in accordance with the approved

design and drawings for construction of all civil works at 400 KV GIS S/S, Jehta, Hardoi Road, Lucknow. The work also includes **contractor's** supervision in strict accordance with the drawings and specification or direction of Engineer-in-Charge. The main civil works are as below.

## 1.2 LAND DEVELOPMENT & PARK PLANTATION

Park and plantation as per approved layout which includes preparation of hedge and shrubs and planting various shadow & flower plants and grass decided by the Engineer-in-Charge in park and empty land out side the switch yard including arrangement of plants of specific height, shrubs, manure etc. and preparation of pits as per specification and direction of Engineer-in-Charge.

## 1.3 GIS CUM CONTROL ROOM BUILDING

The construction of control room building shall be carried out as per approved drawing. Lean concrete shall be consisting of 1:6:12 mix with 40 mm stone ballast. All brick work consisting of 230

mm and above thickness shall be in 1:6 while below 230 mm shall be in 1:4 cement mortar. Kota stone flooring/ Mosaic flooring/Industrial Tiles flooring shall be done in Control Room Building as per direction of E/I. In battery room, wherein acid proof tiles/industrial tiles shall be provided on floors and walls. Anti termite treatment shall be carried out in control room and other buildings as per relevant I.S. specifications. Aluminum frames and panel shall be kept in door and windows as per direction of Engineer-in-Charge. Construction of cable trenches including trench covers as shown in drawing and as per site requirements shall be part and partial of the contract. In bath rooms and toilets glazed tiles on walls and anti-skid tile on floors and ISI approved CP heavy quality fixtures as per sample approved by Engineer-in-Charge, shall be provided. All electrical fittings shall be carried concealed with copper wire of gauge approved by Engineer-in-Charge as per specifications. Walls shall be plastered with 1:4 mix. The internal & external surface shall be make smooth with Birla putty. Internal surface shall be painted with Oil bound distemper/ acrylic distemper, while outer surface with water proof cement paint/APEX paint as directed by Engineer-in-Charge.

Septic tank of suitable size shall be constructed as per approved drawing and drainage system of the entire area shall be developed and constructed as per direction of Engineer-in-Charge.

#### **1.4 OUT DOOR SWITCH YARD AND OTHER CIVIL WORKS**

1. Construction of store.
2. Various RCC foundation, transformer plinth, main gantry, auxiliary structure foundation and under ream piles, C.C. road etc.
3. Construction of cable trenches and trench covers.
4. Construction of Partition Wall, gate and sump house.
5. Land development and other associated civil works like earth filling & cutting, leveling and dressing, park and plantation.
6. Construction of drains and culverts and 50KL O.H Tank as per approved drawing.

Other civil works not covered above but necessary for successful completion and proper energization and its operation in all respect etc. shall be executed by contractor.

#### **1.5 MAIN GANTRY FOUNDATION**

Construction of main gantry foundation for 400/220/132/33 KV yard shall be as per approved layout drawing. The gantries shall be constructed on pile having dia between 300 mm to 400 mm with under reams, or as approved by department in CC 1:1.5:3 cement concrete mix with 20 mm graded stone ballast with reinforcement as per approved drawing. The template for grouting of bolts shall be arranged by the contractor at his own cost. The foundations will also include the anchor bolts of specified length of 28 mm dia or



above. The bolts shall be grouted in such a way that min. 100 mm clear threaded height of bolts above the foundation top shall remain visible. Champhering of edge of foundation shall be 35 mm wide. The foundation shall be finished as per E/I.

#### **1.6 TRANSFORMER PLINTH**

Construction of transformer plinth for 500/315/240/200/160/100/60/40/20 MVA Transformer as the case may be & chilling tank shall be carried out as per approved drawing. The alignment and location of rails will be exactly as per electrical requirements. Champhering of edge of plinth shall be 35 mm wide. The plinth shall be finished as per E/I.

#### **1.7 AUXILIARY STRUCTURE FOUNDATIONS**

The auxiliary foundations in 400/220/132/33 KV yard shall consist of CT, CVT, LA, PI, Tandem isolator, Line/Bus isolator, Circuit breaker and Station transformer etc. shall be constructed as per approved drawing. Construction of auxiliary foundations shall be in RCC with 1:1.5:3 mix (1 cement : 1.5 coarse sand and 3 - 20 mm graded stone ballast) on pile foundation or on open foundation as per approved drawings. The lean concrete 1:6:12 (1 cement: 6 coarse sand and 12- 40 mm gauge stone ballast) will be provided. The foundations will also include the anchor bolts of specified length of 25

mm dia or below. The template for grouting of bolts shall be arranged by the contractor at his own cost. The bolts shall be grouted in such a way that min. 80 mm clear threaded height of bolts above the foundation top shall remain visible. Champhering of edge of foundation shall be 25 mm wide. The foundation shall be finished as per E/I.

#### **1.8 CABLE TRENCH**

The civil works of cable trench & 40mm thick covers in 1:1.5:3 mix shall be carried out as per approved drawing. Racking arrangement mentioned in the drawing shall be strictly adhered. The alignment of trench, trench edge and racks shall be strictly in straight line. The gradient of cable trench floor shall be kept as per direction of Engineer-in-Charge & keeping in view the site conditions and drainage to the surrounding area. The brick work shall be in 1:4 cement mortar and plaster in 1:4 cement mortar. Floor shall be 25 mm thick C.C. floor as per approved drawing. The grouting of racks in trench walls shall be carried out by leaving pockets of 150 x 115 x 75 mm size in trench walls and shall be grouted with C.C. mix of 1:1.5:3. MS racks, edging and frame of RCC trench covers shall be applied with primer and approved enamel paint. It also covers to provide numbers on trench covers as per specifications and direction of Engineer-in-Charge. Off size trench covers shall be fabricated as per site requirement.

#### **1.9 PARTITION WALL**

Construction of Partition Wall shall be constructed as per approved drawing and direction of Engineer-in-Charge.

### **1.10 ROAD**

Cement concrete road 6/4 meter width shall be constructed in switchyard and in front of CRB as per approved drawing. The earth sub grade shall be well compacted with mechanical means to achieve 96% compaction before laying of BOE. The top layer of road shall be of cement concrete with 1:1.5:3 mix with nominal temperature reinforcement provided at the center of cement concrete layer. The road sections shall be constructed in given specified camber with templates, which shall be arranged by the contractor. The construction joint shall be filled and finished with expanded material as per direction of Engineer-in-Charge. The scope of supply / laying CI / Concrete pipes / PVC pipes of different dia as per requirement to cross fire-fighting pipes, street lightening cables, telephone wire etc. as per location indicated or specified or as per direction of Engineer-in-Charge, is also included in this work.

### **1.11 DRAINAGE SYSTEM (DRAIN AND CULVERT)**

All internal site drainage shall be discharged at one or two points near the boundary wall or locations as directed by Engineer-in-Charge. Drain shall be in brick masonry with 1:4 mix, 12mm plaster in 1:4 mix & 40 mm thick cc floor with gradient as per approved lay out drawing.

### **1.12 STORE SHED**

A permanent store shade of 15x6M shall be constructed as per approved drawing. Lean concrete shall be consisting of 1:6:12 mix with 40 mm stone ballast. All brick work consisting of 230

mm and above thickness shall be in 1:6 while below 230 mm shall be in 1:4 cement mortar. Floor shall be 40 mm thick C.C floor over 50mm thick C.C. 1:2:4 and 100 mm thick base concrete. Walls shall be plastered with 1:4 mix. The internal & external surface shall be made smooth with Birla putty. Internal surface shall be painted with Oil bound distemper/ acrylic distemper, while outer surface with water proof cement paint/APEX paint as directed by Engineer-in-Charge.

### **1.13 SUMP HOUSE**

A permanent sump house shall be constructed as per approved drawing. Lean concrete shall be consisting of 1:6:12 mix with 40 mm stone ballast. All brick work consisting of 230/345 mm thickness shall be in 1:6. Floor shall be R.C.C. to bear the load & thrust of sludge pump. Discharge of pump shall be in pit which shall be connected to drain. Suitable capacity sludge pump shall be installed to pump out rain water collected in sump well from trenches. Walls shall be plastered with 1:4 mix. External surface shall be painted with water proof cement paint while internal shall be white wash as per directed by Engineer-in-Charge. A de-watering pump of 5HP shall be installed in sump house.



#### **1.14 MEASUREMENTS:**

Details measurements of the works executed by the firm/contractor shall be recorded by UPPTCL. The contractor will execute the work as per UPPTCL / UPPWD specification strictly as per approved drawings. The detail measurement sheet & bill of work shall be submitted by firm/contractor which shall be verified & recorded by UPPTCL representative. No work shall be measured if it is not executed as per specifications or below specifications or without proper clearances from UPPTCL. The contractor will do such activities only at his own cost and responsibility. Any sub-standard work shall be demolished by the contractor at his own cost.

#### **1.15 RCC O.H.TANK**

O.H. Tank of 50 KL shall be constructed as per approved drawing. Lean concrete shall be consisting of 1:6:12 mix with 40 mm stone ballast. All columns, dome, beams & wall shall be constructed with RCC in 1:1.5:3 mix with 20 mm stone ballast. The tank shall be leak proof. Proper stair & ladder shall be provided for regular inspection of tank. Proper ventilation, earthing & water level indicator system shall be developed.

#### **1.16 LAYOUT AND LEVELS**

The layout and levels of land shall be made by the contractor at his own cost for which nothing shall be paid extra, from the general grid of the plot and bench mark level decided by the UPPTCL. The contractor shall give all help in providing instruments, materials and man to the UPPTCL representative for checking the detailed layout and levels but the contractor shall be solely responsible for correctness of layout and levels.

#### **1.17 DESIGN AND DRAWINGS:**

All civil work shall be executed according to the approved drawings which shall be provided by the department i.e. UPPTCL.

#### **1.18 SUBMISSION OF PROGRAMME OF CONSTRUCTION**

Contractor shall prepare the programme for all construction activity (Bar-Chart) and submit within period not exceeding 2 weeks from date of award of contract.

#### **1.19 MATERIALS**

1. The brick shall be of 1st class quality.
2. Pozzolono Portland cement confirming to IS: 1489 (PART-1) 1991 of standard make shall be used.
3. Water to be used shall be clean, potable and free of salts, iron and injurious organic matters.
4. Coarse sand shall be of fineness modulus 1.8 to 2.25.

5. The cold twisted deformed bars (Fe 415 N/sqmm) confirming to IS: 1786 or approved TMT bars shall be used as reinforcement.
6. All aggregates shall confirm to all provisions and test methods of IS: 383 or IS:515.

## **TECHNICAL SPECIFICATION FOR EARTH WORK**

### **Scope :**

This shall include all work involved in excavation, dressing of soil, shoring, filling around foundations and trenches, carting of sand or good quality earth if required for filling, disposal of residual earth at a place as directed by the Engineer-in-charge. Boring and sub surface data regarding nature of soil, sub-soil water etc. shown on drawings or otherwise furnished to the contractor shall be taken as guidance only and variation, therefore, shall not affect the terms of the contract. The Contractor must satisfy himself of the character and volume of all work under this item and expected surface sub-surface, and/or Sub-soil water to be encountered. He must also satisfy himself about general conditions of site and ascertain the existing and future obstructions likely to come up during the execution of the Contract.

### **Excavation :**

Excavation shall include the removal of all materials required to execute the work properly and shall be made with sufficient clearance to permit the placing, inspection, setting of forms and completion of all works for which the excavation was made.

Earth sides of excavation shall not be used in lieu of form work for placement of concrete unless authorized in special cases by the Engineer-in-charge, where limitation of space for large excavation necessitate such a decision.

When machines are used for excavation, the last 300 mm before reaching the required level shall be excavated by hand or by such equipment that will leave the soil at the required final level in its natural condition.

Suitability for bearing of the bottoms of excavations shall be determined by the Engineer-in-charge.

The bottom of excavation shall be trimmed to the required levels and when carried below such level due to contractor's fault, the excess depth shall filled upto the required level at the contractor's cost with cement concrete 1:6:12 or as directed by the Engineer-in-charge in each individual case.

Excavated material shall be placed beyond 1.5 meter away from the edge of the pit or half the depth of the pit whichever is more or farther away, if directed by the Engineer-in-charge.

The contractor shall be responsible for assumptions and conclusions regarding the nature of materials to be excavated and the difficulty of making and maintaining the required excavations and performing the work required as shown on the drawing and in accordance with these specifications, Cofferdams, sheeting, shorting, bracing, drawing, de-watering etc. shall be furnished and installed by the contractor as required / directed by the Engineer-in-charge and the cost thereof shall be included in the unit rate quoted for the items of excavation. The contractor shall be held responsible for any damage to any part of the work and property caused by collapse of sides of excavations. Material

may be salvaged if it structures, as approved by the Engineer-in-charge. However, no extra claim shall be other damage to **contractor's** property as a result of collapses. He shall not be entitled to any claim for re-doing the excavation as a result of the same.

All excavation for installation of under ground facilities such as piping, sewer lines, tunnels, ducts, drain, lines etc. shall be open cuts.

Excavation for foundations where specified shall be carried at least 100 mm below of bottom of structural concrete and then be brought to the required level by placing lean concrete 1:6:12 with aggregate of 40 mm maximum nominal size stone ballast.

Where excavations requires bracing, sheeting or shoring etc. the Contractor shall submit to the Engineer-in-charge drawings showing arrangement and details of the proposed installation, and shall not proceed until he has received approval from the Engineer-in-charge.

For purposes of excavation of earth work, the term soil shall apply to all kinds of soil containing any percentage of Kankar, moorum or shingle etc.

#### **Disposal Of Surplus Earth:**

The contractor shall arrange to transport the surplus excavated soil to in/out side the project area as direction of E/I.

#### **Measurement For Excavation:**

The unit of measurement shall be  $m^3$ . Nothing extra would be payable for slope, shoring, strutting etc. irrespective of whatever is provided. The overlapped portion in the case of adjacent foundation shall be paid only once.

#### **Excavation below Water Table**

Wherever water table is met with during the excavation the contractor shall immediately report the fact to the E/I who shall arrange to record the exact level of the water table. The decision of the E/I in the matter shall be final.

The contractor shall de-water and maintain the water table below the bottom of the excavated level during excavation, concreting and back-filling. Nothing extra shall be paid to the contractor for excavation below water table.

#### **Backfill**

The Contractor shall furnish all labors, equipment and materials required for complete performance of the work in accordance with the drawings and as described herein.

After completion of foundation footings, and walls and other construction below the elevation of each the final grades and prior to back-filling, all forms, temporary shoring, timber etc. shall be removed and the excavation cleaned of all trash, debris and perishable materials, back-filling shall begin only with the approval of the Engineer-in-charge.

Back-filling shall be done with inorganic materials obtained from the excavation or borrow pits, if suitable and subject to the approval of the Engineer-in-charge.

Backfill shall not be dropped directly upon or against any structure or facility where there is danger of displacement or damage.

Backfill shall be placed in horizontal layers not to exceed 20 cm in thickness. Each layer shall be compacted with proper moisture content and with such equipment as may be required to obtain a density not less than 96% of maximum dry density as determined by the relevant Indian Standards, Trucks or heavy equipment for depositing or compacting backfill

shall not be used within 1.5 m of building walls, pipes, or other facilities which may be damaged by their weight or operation. The methods of compaction shall be subject to the approval of the Engineer-in-charge. Pushing of earth for back-filling shall not be adopted under any circumstances.

Backfill adjacent to pipes shall be hand placed free of stones, concrete etc. compacted uniform on both sides of the pipe and where practicable to a depth of 300 mm over the top of pipes. while tamping around pipes, care shall be taken to avoid unequal pressures.

On completion of structures the earth surrounding them shall be accurately finished to line and grade as shown on the drawings. Finished surface shall be free of irregularities and depressions and shall be within 50 mm on the specified level. No extra shall be paid for backfilling.

## **TECHNICAL SPECIFICATION FOR MASONRY WORKS**

### **Scope:**

This section covers the furnishing of all labors materials and equipment and the performing of all operation required for the supply of masonry, materials and erection work and incidental items pertinent thereto, all in accordance with the drawings and these specifications.

### **General Requirements:**

Masonry products such as face bricks, common bricks concrete blocks and tile shall be products of producers or suppliers approved by the Engineer-in-charge.

Delivery, Storage & Handling of materials shall be done as follows:-

- i) All materials shall be delivered to the site, stored & handled so as to prevent intrusion of foreign substances, damage by breakage, exposure to the weather and contact with the soil.
- ii) Cementation materials shall be delivered in unbroken containers or packages or stored in weather-proof enclosures.

**Materials** Common bricks and face bricks shall conform to the requirement of IS : 1077 and shall be of uniform colors, strength and size. Bricks shall not absorb more than 20% of their own dry weight when soaked in water. The bricks shall be 1st class quality. Crushing strength of first class bricks and brick tiles shall not be less than as specified in relevant specification.

Reinforcement for masonry walls wherever required shall be of mild steel 6 /8 mm dia tor bar if the Engineer-in-charge approves it in a particular situation.

Samples of all materials shall be submitted for the approval of the Engineer-in-charge.

Mortar of specified proportions as shown on the drawings shall be mixed by volume with just enough water and produce a workable mix. Only freshly prepared mortar shall be used. Mortar shall conform the requirements IS: 1925

### **Bond of Coursing**

All masonry walls shall be laid with horizontal courses level & true in English Bond. All masonry units shall be laid up in full beds of mortar with all units butter solidly against adjacent units with mortar in between.

All masonry units having appreciable water absorption potential shall be soaked as per relevant IS code.

Vertical surfaces of all masonry walls and partitions shall be plumb and true to line on uneven surface with a maximum total variation of 25 mm in any plane or 12.5 mm in 5 m.

Where two walls meet or intersect, the masonry course shall be carried up together bonding at least fifty percent of the units at the intersection.

Horizontal surfaces of masonry not being worked on shall be protected from the natural elements by the use of non-staining water proof coverings properly secured in places.

Brick tiles where shown on drawings shall be laid staggered vertical joints and shall be bonded with bricks walls.

Masonry in contact with structural steel including beams and columns, shall be anchored to the steel work as indicated on the drawings.

Concrete for precast copings, Sills and lintels shall be of grade M 15 with maximum aggregate size of 10-12 mm.

Surfaces of precast concrete to be exposed to view after erection shall have a smooth finish. **Built In-Works**

Built-in-works shall be carried out as per instruction communicated by the Engineer-in-charge during or before the work is taken up.

Door frames shall be set plumb and accurately aligned and checked for proper position.

Anchors for door frames, copings partitions bonding walls to concrete and structural steel and other anchors shall be securely and accurately located and installed.

Water proofing membrane, within masonry walls, where required, shall be carefully installed in accordance with "water-proofing and Damp-proofing" specifications mentioned in this volume.

Steel lintels and base plates shall be set over doors or other openings where required. The lintel or plates shall be set in cement mortar grout.

All structural steel members enclosed or in contact with masonry work shall be waterproofed with a heavy coating of asphalt mastic of approved quality.

#### **Masonry Joints:**

All joints in masonry wall surfaces to receive cement plaster shall be raked out to a depth of 12 mm to create mechanical bond for the plaster finish.

Joints in exterior walls to be left exposed shall be neatly tooled with a weathered joint.

Where masonry shuts, penetrating built-in-items such as door frames etc. the joints shall be 6 mm wide and raked to a depth of 20 mm for subsequent caulking.

Where openings are left in masonry for fixing doors windows etc. or where masonry is discontinued for extending at a later date, the masonry work should be left at an angle not steeper than 60 degrees.

#### **Cleaning**

All exposed brick work shall be scrubbed down and rinsed with clean water thoroughly.

All work stained or discoloured during the process of cleaning shall be replaced by the contractor at his own expenses.

Green work shall be protected from the effects of sun rain etc. by suitable covering. All the masonry work shall be kept constantly moist on the faces for a period of seven days.

**Measurements:**

The unit of measurement for this item shall be cubic meter and shall be based on the volume of masonry actually constructed or the volume of masonry as worked out from the dimensions indicated in the drawings and the lower of the two values shall be adopted for payment. No deductions shall be made for drain holes etc.

Mild steel for walls and anchors for columns shall be paid for by weight separately on the basis of the quantity calculated.

## **TECHNICAL SPECIFICATION FOR DAMP PROOF COURSE**

**Scope :**

This sections covers the furnishing of all labor, materials and equipment and performing of all operations for laying DPC consisting of cement concrete layer including application of bitumen.

**Cement Concrete layer**

It shall be C.C. of proportion 1:2:4, of 50 mm thickness unless otherwise specified in the item of the bill of quantity / approved drawings, including shuttering, curing etc. complete including application of hot bitumen at the rate of  $1.7 \text{ Kgs/m}^2$  on the surface of dried concrete.

The surface of the brick work shall be leveled and prepared before laying the cement concrete. Edges of DPC shall be straight and even. The side shuttering shall consist of wooden forms and shall be strongly and properly fixed so that it does not get disturbed during compaction and mortar disturbed during compaction and mortar does not leak through. The concrete mix shall be of workable consistency and dense. When the side shuttering are removed, the surface should come smooth without any honey combing.

**Curing:**

The DPC shall be cured for at least 7 days after which it shall be allowed to dry.

**Application of Hot Bitumen:**

Cement concrete shall be allowed to dry for 24 hours after curing and hot bitumen at the rate of 1.7 Kg./Sq. metre shall be applied over the dried surface of cement concrete properly cleaned with brushes and finally with a cloth soaked in kerosene oil. The bitumen shall be applied uniformly so that no blank spaces are left any where.

**Measurement:**

Measurement shall be made for its surface area in sq. meter correct to two places of decimal. The length as well as breadth shall be measured correct to the cm.

# TECHNICAL SPECIFICATION FOR CEMENT CONCRETE

## SCOPE

This specification deals with Cement concrete plain or reinforced for general use, and covers the requirements for concrete materials, their storage, grading, mix design, strength and quality requirements, pouring at all levels, reinforcement protection, curing, form work, finishing, painting, admixtures, inserts and other miscellaneous works.

The provisions of the of IS: 456-1978, shall be complied with unless permitted otherwise and any other Indian Standard Code shall form a part of this specification to the extent it has been referred to for application within this specification.

## GENERAL REQUIREMENTS

The Contractor shall furnish all labour, material and equipment to form, place and finish all cement concrete items complete as indicated in the approved drawing and as described therein.

All materials, tests, mixing, placing, form work reinforcing and workmanship shall conform to code of practice for plain and reinforced concrete for general building construction IS : 456-1978 and other relevant IS Codes.

## MATERIALS

### Aggregates:

All aggregates shall conform to provisions of IS: 383. Samples of aggregates proposed to be used shall be submitted free of charge in three bags, each containing 2 cu.ft. of the aggregates, to the Engineer-in-charge for his future reference.

### Coarse Aggregates:

The maximum size of coarse aggregates aggregate shall be as follows:

- |  |            |
|--|------------|
| 1. For Lean concrete of grades M-5, M-7.5 and M-10     | 40 mm size |
| 2. For Concrete of grades M-15, M-20 and higher grades | 20 mm size |

*(PLAIN CEMENT CONCRETE AND REINFORCED CEMENT CONCRETE)*

**The coarse aggregates to be used shall be graded.** The grading of coarse aggregates for a particular size shall generally conform to relevant IS codes and shall also be such as to produce a dense concrete of the specified proportions and/or strength and consistency that will work readily into position without segregation.

### Fine Aggregates:

Coarse and fine sand shall be well-graded within the limits by weight as specified in IS 383. Fineness modulus shall not vary by more than plus or minus 0.20 from that of the approved sample. Fineness modulus for coarse sand should be between 1.8 to 2.5. Washing of aggregates by approved means shall be carried out, if desired by the Engineer-in-charge at no extra cost to the employer. Fine aggregates of zone 1st grading shall not be used for concreting.

### Water :

Water shall be clean, fresh and free from organic or other deleterious matters in solution or in suspension in such amounts that may impair the strength or durability of the concrete. Potable water is generally satisfactory. IS : 3025 and 3550 may be followed for testing, if required.



**Storage of materials :** Materials shall be as so stored as to prevent deterioration or intrusion of foreign matter, and to ensure the preservation of their quality and fitness for the work. Any materials, which has deteriorated or has been damaged or as otherwise considered defective by the Engineer-in-charge, shall not be used and shall be removed from site immediately, failing which the Engineer-in-charge shall be at liberty to get the materials removed and the cost thereof shall be realized from **the contractor's dues. The contractor shall maintain upto date accounts of receipts, issue and balance (stock wise) of all materials.**

**Grades of Concrete :**

Concrete shall be of grade M-5, M-7.5, M-10, M-15, M-20 or as indicated in the approved drawings / items of the bill of quantity. M-5, M-7.5 grades of concrete shall be used for lean concrete basis / simple foundations for masonry works.

M-15 and M-20 grade concrete shall be used in C.C. / R.C.C. structures as indicated in approved drawings.

**Workability of Concrete :**

Ranges of values of workability for different placing condition is suggested as below :

<i>Placing Conditions</i>	<i>Degree of Workability</i>	<i>Values of Workability</i>
(1)	(2)	(3)
Concreting of shallow sections with vibration	Very low	20-10 seconds, vee-bee time or 0.75-0.80, compacting factor
Concreting of lightly reinforced section with vibration	Low	10-5 seconds, vee-bee time or 0.80-0.85, compacting factor
Concreting of lightly reinforced sections without vibration or heavily reinforced section with vibration	Medium	5-2 seconds, vee-bee time or 0.85-0.92, compacting factor or 25-75 mm, slump for 20 mm aggregate
Concreting of heavily reinforced section without vibration	High	Above 0.92, compacting factor or 75-125 mm, slump for 20 mm aggregate

**SAMPLING AND TEST OF STRENGTH OF CONCRETE :**

Samples from fresh concrete shall be taken as per I.S. : 1199-1959 and the specimen cubes shall be made and tested as per I.S. : 516-1959. The preliminary test (compressive strength test at 7 days) are carried out in addition to 28 days compressive strength test only to get a quicker idea of the quality of the concrete which may be expected to give the required strength. But in all cases, 28 days compressive strength specified in I.S. : 456-1978 shall alone be the criterion for acceptance or rejection of the concrete. **At least one sample shall be taken from each shift.** Three test specimen shall be made from each sample for testing at 28 days. Additional cubes may be required to test the concrete at 7 days. The test strength of the sample shall be the average of the strength of the three specimens. The individual variation should not be more than  $\pm 15\%$  of the average. The cost of all sampling and testing of concrete shall be borne by the contractor.

## **DURABILITY OF CONCRETE:**

Besides ensuring the required strength of the design mix concrete, the concrete must also have an adequate cement content and a low water cement ratio. The minimum cement content and the maximum water cement ratio shall conform to the provisions of clause 7 of I.S. : 456-1978.

## **WORKMANSHIP**

**General :** Concrete shall not be placed in any unit of the work until after the forms / centering and shuttering, bracing reinforcing steel and other properties for casting and approval given to proceed with casting.

**Mixing Concrete :** Mixing concrete shall conform to IS: 456-1978. Mixing shall be continued till materials are distributed and uniform color of the entire mass obtained and each individual particle of the coarse aggregate shows complete coating of mortar containing its proportionate amount of cement. In no case, shall the mixing be done for less than 2 minutes after all ingredients have been put into the mixer. Mixer which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to by the Engineer-in-charge, the first batch of concrete from the mixer shall contain only two thirds of the normal quantity of coarse aggregate. When hand mixing is permitted by the Engineer-in-charge for concrete to be used in unimportant structures it shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency. In case of hand mixing, extra cement 10% shall be added to each batch at no extra cost to the employer.

The workability of the concrete shall be checked at frequent intervals by slump test as required by the Engineer-in-charge. Alternatively the compacting factor test in accordance with IS : 1199 shall be carried out.

### **Transporting, placing compacting & curing :**

The method of transporting and placing concrete shall be approved by Engineer-in-charge. Concrete shall be so transported and placed that there is no contamination and segregation or loss of its constituent materials takes place.

All formwork and reinforcement contained in it shall be cleaned and made free from standing water, dust, immediately before placing of concrete.

No concrete shall be placed in any part of the structure until the approval of the Engineer-in-charge has been obtained.

If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer-in-charge, concreting then shall proceed continuously over area between construction joints, Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete when deposited shall have a temperature of not less than 45<sup>0</sup>C and not more than 38<sup>0</sup>C. It shall be compacted in its final position within 30 minutes of its discharge from mixers unless stirred on properly designed agitators, operating continuously, when this time shall be within 2 hours of the addition of the cement to the mix and within 30 minutes of its discharge from agitator. Except where otherwise agreed to by the Engineer-in-charge, shall be deposited in horizontal layers to a compacted depth of not more than 0.30 meter when internal vibrators are used and not exceeding 0.20 meters in all other cases.

Unless otherwise agreed to by the Engineer-in-charge, concrete shall not be dropped into place from a height exceeding 2 meters. When chutes are used, they shall be kept clean and used in a such a way as to avoid segregation. When concreting has to be resumed on a surface which has hardened, it shall be roughened, swept clean, thoroughly wetted, and covered with a 20 mm thick layer of mortar composed of cement and sand in the same ratio as in the concrete mix itself This 20 mm layer of mortar shall be freshly mixed and placed before placing of new concrete.

Where concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgment of any particles of coarse aggregate. The surface shall then be thoroughly wetted, all free water removed and then coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 150 mm in thickness, and shall be well rammed against old work. Particular attention being given to corners and close spots.

All concrete shall be compacted to produce a dense homogenous mass with assistance of vibrators, unless otherwise permitted by the Engineer-in-charge for exceptional cases, such as concreting under water, where vibrators cannot be used. Sufficient vibrators in serviceable condition shall be kept at site so that spare equipment is always available in the event of break downs.

Internal vibrators shall be capable of producing not less than 10,000 cycles per minute, and external or form vibrators not less than 1,000 cycles per minute. Vibration shall not be applied through reinforcement, and where vibrators of the immersion type are used, contact with reinforcement and all inserts shall be avoided, as far as practicable.

#### **Concreting Under Water :**

When it is necessary to deposit concrete under water, the methods, equipment materials and proportions of the mix to be used shall be got approved from the Engineer-in-charge before any work is started. Concrete shall not be placed in water having temperature below 45<sup>0</sup>C the temperature of the concrete, when deposited, shall be not less than 16<sup>0</sup>C, not more than 38<sup>0</sup>C.

Concrete shall contain 10% more cement than that required for the same mix placed in the dry conditions. The material shall be so proportioned as to produce a concrete having a slump of not less than 100 mm and not more than 150 mm. The slump shall be tested as per IS : 516. ,Coffer dams or forms shall be sufficiently to ensure still water conditions if practicable and to reduce the flow of the water to less 3m / minute through the space into which concrete is to be deposited , coffer dams or forms in still water shall be sufficiently tight to prevent loss of mortar through the joints in the walls, Pumping shall not be done while concrete is being placed, or until 24 hours thereafter. Concrete shall be deposited continuously until it has been brought to the required height. While depositing the top surface shall always be kept as nearly leveled as possible and formation of seams avoided. Depositing of concrete may be done by **“Tremei Pipe”** or **“Drop Bottom Bucket”**.

#### **Curing of Concrete :**

Immediately after completion concrete shall be protected against harmful effects of weather, including rain, running water, shocks, vibrations, traffic, rapid temperature changes, frost and drying out process. It shall be covered with wet sacking, jute or other similar absorbent material approved by the Engineer-in-Charge soon after initial set, and shall be kept continuously wet for a period not less than 14 days from the date of placement.

**Finishing:**

Immediately after removal of forms, all exposed bars or bolts passing through the reinforced cement concrete member and used for shuttering or any other purpose shall be cut inside the reinforced cement concrete members to a depth of at least 25 mm below the surface of concrete and the resulting holes to be closed by cement mortar. All fills caused forms joints, all cavities produced by the removal of form tiles and all other holes and depressions, honey comb spots, broken edges or corners and other defects shall be thoroughly cleaned saturated with water are carefully pointed and rendered to true with mortar of cement and fine aggregates mixed in the proportions used in the grade of concrete that is being finished and to as dry a consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which have been pointed shall be kept moist for a period of 24 hours.

If rock pockets/honey combs, in the opinion of the Engineer-in-Charge are of such an extent or character as to affect strength of the structure materially to endanger the life of the steel reinforcement, he may declare the concrete defective and required the removal and replacement of the portions of the structure affected.

**Construction Joints**

When the work is to be interrupted, the concrete shall be related at the joint to such shape and size as may be required by the Engineer-in-charge or as shown on the drawing. All vertical construction joints shall be made with stop boards, which are rigidly fixed and slotted to allow for the passage of the reinforcing steel. If desired by the Engineer-in-charge, keys and dowel bars shall be provided at the construction joints. In the case of water retaining structures and basements and under ground passages etc., water stop of approved material shall be provided if so specified on the approved drawing or desired by the Engineer-in-charge. Construction joints shall be provided in positions as shown on the drawings. Where it is not shown in the drawings, the joints shall be in accordance with the following. In a column, the joint shall be formed about 75 mm below the lowest soffit of the beams framing into it. Concrete in a beam shall be placed throughout without a joint but if the provision of a joint is unavoidable the joint shall be vertical and at the middle of the span. A joint in a suspended floor slab shall be vertical at the middle of the span and at right angle to the principal reinforcement.

In forming a joint concrete shall not be allowed to slop way to thin edge. The locations of construction joints shall be planned by the contractor well in advance of pouring and have to be approved by the E/I.

Construction joints in foundations of equipment shall not be provided without specific concurrence of the Engineer-in-charge.

Before fresh concrete is placed, the cement skin of the partially hardened concrete shall be thoroughly removed and surface made rough by backing water jetting, air jetting or any other method as directed by the Engineer-in-charge. The rough surface shall be thoroughly wetted for about two hours and shall be dried and coated with freshly mixed cement sand slurry immediately before placing the new concrete. The new concrete shall be worked against the prepared surface before the slurry sets. Special cares shall be taken to see that the first layer of concrete placed after a construction joint is thoroughly rammed against the existing layer.

At the construction joints a key along with extra reinforcement shall be provided. In addition to this 12

mm M.S. pipe at regular intervals will be inserted in the concrete at the construction joint. A part of the pipe will have threads and will be covered by a M.S. plug. The complete arrangement of the pipe will be as shown in the drawings. After pouring of concrete, the plug of the M.S. pipe will be removed and pressure grouting with cement and with suitable admixture of proper consistency will be done to fill the gap in concrete at construction joint. This grouting shall be got executed by specialist in this field. The injection grouting will be required only for water retaining structure. For all other construction joints in under ground facilities like cable trenches etc. 30 mm wide PVC water stops may be provided.

The unit rate of concrete work shall include the cost of preparation of construction joints as mentioned above (including pressure grouting at construction joints) and no extra payment shall be admissible on this account.

**Measurement of Concrete** Measurement of concrete shall be in cubic meters correct upto second place of decimal. Deductions shall be made for all block cuts and openings but not embedment and reinforcement.

## **REINFORCEMENT**

Reinforcing steel shall be clean and free from loose mill scales, dust loose rust and coats of paints, oil, grease or other coatings, which may impair or reduce bond. It shall conform to the IS specifications.

- i) Mild steel & Medium Tensile Steel Bars and Hard drawn steel wire conforming to IS-280-1978.
- ii) Cold Twisted Bars conforming to IS : 1786-1979. or TMT bars.
- iii) Structural steel sections conforming to IS-226-1975. All steel reinforcement, including and above 6 mm diameter shall necessarily be of tested quality.

The work of providing reinforcement include cutting of reinforcement bars their bending and placing them in position as per approved drawing including welding wherever necessary and binding. Binding wire shall be annealed iron wire quality not less than No. 16 SWG. (1.65 mm dia). Bar support, chairs and bolsters (as approved by Engineer-in-charge) shall be sufficiently strong to support the steel properly.

- iv) Reinforcement shall be bent and fixed in accordance with procedure specified in IS:2502 and shall not be straightened in a manner that will injure the material. Bar bending schedule as shown in the approved drawing shall be followed for construction purpose.
- v) Procedure as specified in IS-456-1978 shall be followed in general unless and otherwise permitted by Engineer-in-charge.
- vi) As far as possible, bars of full lengths shall be used. In case it is not possible, overlapping of bars shall be done as directed by the Engineer-in-charge. When practicable, overlapping bars shall not touch each other and be kept apart by 25 mm of the dia of the bigger bar or 1.25 times the maximum size of the coarse aggregate whichever is greater for easy concreting between them. The overlaps shall be staggered for different bars and located at points along the span where neither shear nor bending moments is maximum.
- vii) Welding of mild steel reinforcing bars conforming to IS: 432 shall be permitted. Welding of

Cold Twisted Deformed Bars conforming to IS: 1786 shall in general be prohibited except in special cases mentioned in I.R.C. 21-1987. Test shall be made, if directed by the Engineer-in-charge, to ensure that the joints are of full strength.

- viii) Measurement : Steel work in reinforcement shall be measured in running metres and converted to weight in accordance with the standard sectional unit weight for different diameter bars provided in IS: 1786-1979 or IS: 432(Part I – 1966) as the case may be or actual weight( only if variation in weight is within permissible limit ) which ever is lesser & shall be paid. Other provisions shall be as per IS: 1200 (Part 8 - 1971). No allowance shall be made for wastage.

**Form Work :**

**General :** Form work shall be as per IS: 456-1978. The Form-work shall conform to the shape lines and dimensions as shown on the drawings. It shall be composed of steel and/or best quality shuttering wood on non-absorbent timber and shall be free from knots. Hard woods shall be used as caps and wedges under or over posts.

Plywood or equivalent shall be used where specified to obtain smooth surfaces for exposed concrete work. Struts shall generally be mild tubes, and strong sal ballies 150 mm in dia, or above. Bamboos, small diameter ballies etc. shall not be used unless approved by the Engineer-in-charge in specified cases.

Where metal forms are used, all bolts and rivets shall be counter-sunk and well grounded to provide smooth and plain finish. The forms shall be mortar-tight and shall be made sufficiently rigid by the use of ties and bracings to prevent any displacement or sagging. The forms shall be strong enough to withstand all pressures, ramming and vibration without deflection from the prescribed lines. Screw-jacks or hard wood wedges shall be provided where required to make up any settlement in the form work before or during the placing of concrete.

Suitable cambers shall be provided in horizontal members of structures especially in long spans to counteract the effect of any deflection. Unless otherwise specified, fillets of size 25 mm x 25 mm shall be provided in all edges of form work to avoid sharp corners. Release agents wherever required, shall be applied on the inside surface of the form work except in case of permanent form work strictly in accordance with the manufacturers instructions.

Procedure laid down in IS: 456-1978 latest edition) shall be followed for removal of forms.

**Tolerance :** It shall conform to IS: 456-1978.

**Mode of measurement :**

The rate of R.C.C. / C.C. includes the cost of form work and not additional payment shall be made for form work.

**ANCHOR BOLTS, ANCHORS, OPENINGS, SLEEVES, INSERTS AND OTHER BUILT-IN-FIXTURES :**

The contractor shall provide openings, grooves, chases, etc. in concrete work as required for section of equipment and structures. He shall embed into concrete work the materials noted below as shown on the approved drawings or as required by the Engineer-in-charge. The material shall be of approved manufacture to the satisfaction of the Engineer-in-charge.

The contractor shall erect all embedded parts in accordance with the drawings and specifications including setting materials in concrete on grouting pieces in place, furnishing

all labor, scaffolding tools, services necessary incidental to its transporting, unloading, storing, handling and erection.

Materials to be embedded:

- a) Inserts, hangers, anchors, opening frames manhole cover frames, floors chips, & conduits etc.
- b) Anchor bolts & plates for machinery, equipment & for structural steel work.
- c) Lugs or plus for door and window frames occurring in concrete work.
- d) Flushing and jointing in concrete work.
- e) Any other built-in-fixtures as may be required.

### **TECHNICAL SPECIFICATION FOR SAND FILLING**

The contractor shall furnish all labor, equipment and materials required for complete performance of work in accordance with the drawings and as described herein. Sand filling will be done below flooring in residences, control room building, store sheds, compressor house etc. before laying the floor.

#### **General requirements:**

Sand shall be clean and free from dust organic and foreign matters subject to approval of Engineer-in-charge.

The spaces for filling shall be cleaned of all debris bricks bats etc. The filling shall be done in not exceeding 20 cm each layer. Consolidation of each layer shall be done by flooding with water. Surface of the consolidated sand shall be dressed to required level or slope. Concreting of floor and sand filling shall not be started till the Engineer-in-charge has inspected and approved of the sand filling.

#### **Measurements:**

Volume of only consolidated filling shall be measured. The dimensions shall be measured correct to the nearest and cubical contents worked out in cubic meter correct to two places of decimal.

### **TECHNICAL SPECIFICATIONS FOR STEEL DOORS AND PANEL DOORS, WINDOWS, VENTILATORS AND ROLLING SHUTTERS**

#### **STEEL DOORS:**

##### **Scope:**

This section covers the furnishing of all materials, labor and equipment and performing all operations to complete all work involving the installation of all angle steel door/window frames, hollow metal doors, panel doors for bath rooms and W.C. and fittings in accordance with the drawings and specifications or as directed by E/I.

##### **Materials:**

Single sheet metal door shall be accordance with requirement of I.S. specifications no. 1038 sheet steel for hollow metal frames and for door plates shall be of flat rolled, stretcher leveled, annealed and picked steel free from visible waves on other surface defects.



Sheet steel for concealed members, reinforcement for fittings and similar items shall be 5 mm thick for all other items, adequately sized to receive each item.

**PANEL DOORS:**

The panel inserts shall be 12 mm thick commercial veneered teak wood particle board, three layers, flat pressed, bonded with phenol formaldehyde synthetic resin conforming to IS specification 3097 (latest edition).

The stiles and rails of panel doors shall be made out of best locally available kiln seasoned and chemically treated hard wood. The stiles and rails, lock rails and bottom rails shall be 100 mm x 35

mm. There should be two panels and the centre lock rails should be 890 mm from bottom of the shutter.

Paint for priming shall be formulated from basic lead sulphate paste in oil.

**GLAZING:**

Glazing shall be of 'A' quality glass conforming to IS: 1761 (latest edition)

The glass panes on all windows and ventilators shall be fixed with bred and putty of approved quality

**TECHNICAL SPECIFICATION FOR DOOR, WINDOW FRAME AND DOOR WINDOW  
SHUTTERS GENERAL:**

The work shall be carried out as per detailed drawings or as directed by E/I. Angle iron shall be used in doors, windows, shutters frames as per relevant PWD specifications.

**CUTTING AND PANALNING:**

All pieces shall be accurately cut and planed smooth to be full dimensions and rebates, rounding and molding as shown in the drawing without any pitching or plugging of any kind. The thickness of style and frames shall be specified for the shutters. Styles, rails and sockets panels in door and window shutters shall be of the same specifications of timer unless otherwise specified.

**PANNELING AND GLUING OF JOINTS:**

All panels upto a width of 30 cms shall made out of one piece. When made from more than one piece, the pieces shall be jointed, glued together and reinforced with metal dowels. The glue shall be from skin or bone material and shall be of such nature that it may be used without harm.

**GLAZING:**

Unless otherwise specified the glass used for panels shall of good and durable quality, weighing not less than 7.2 Kg/SqM.

**SPECIMEN DOORS AND WINDOWS :**

The contractor shall submit a complete specimen of door window and cupboard door for the E/I approval before commencing the work.

## TECHNICAL SPECIFICATIONS FOR PLASTERING AND POINTING

### **Scope :**

The section covers the furnishing of all materials and equipment and performing of all operation necessary to complete all interior and exterior plaster work.

**Mortar:** Specified mortar shall be used.

**Preparation of surface:** Dust and mortar power shall be brushed out of the joints. The surface shall be thoroughly washed with water cleaned kept wet, before plastering is commenced.

### **Plastering:**

Plastering shall be started from the top and proceed towards the ground. The mortar shall be applied in uniform layers through the surface and spread over by wooden trimmers finishing complete.

All corners, angles and junctions, vertical or horizontal as the case may be shall be neatly finished. Rounding off corners and junctions where required shall be done without any extra payment to the contractor.

No portion of surface shall be left out initially to be patched later on. Any crack which may appear on the surface and all portions which sound hollow where as tapped or are found to be soft or otherwise yielding/defective, shall be cut out and redone as directed by the Engineer.

**Curing:** Curing shall be started as soon as the plaster has hardened sufficiently not to be injured. The plaster shall be kept wet for a period of at least 7 days. During this period it shall be adequately protected from the sun, rain and other damages.

### **POINTING:**

#### **Scope:**

Pointing, shall be of the type specified such as 'flush' 'ruled' or 'cut' and weather - struck' etc.

The following general specifications shall apply to the types of pointing. All joints shall be raked to such depth that the minimum depth of the new mortar measure from either the sunk surface of the finished pointing or from the edge of the brick shall not be less than 12 mm mortar or specified mix only shall be used.

The mortar shall be pressed into the raked out joint with a pointing trowel either flush, sunk or raised according to the type of pointing required. The mortar shall not be spread over the corner, edges, surfaces of the masonry. The pointing shall then be finished with the proper tool as required for the particular kind of pointing specified. The superfluous mortar shall then be cut off from the edges of the lines and the surface of the masonry shall also be cleaned of all mortar. The finish shall be such that the pointing is to the exact size and shape stipulated and the edges are straight, neat and clean.

#### **Curing:**

The pointing shall be kept wet for 7 days. During the period, it shall be suitably protected from all damages. The pointing lines shall be truly horizontal and vertical except where the joints are slanting as in Random Rubbles Masonry. Lines of joints from different directions shall meet neatly at the junctions instead of crossing beyond.

The rate shall include the cost of all materials & labor involved in all the operations required for pointing.

**Measurement:**

The measurements shall be in sq.m. of the finished work. This shall be measured correct to second place of decimal. Deduction for openings etc. shall be made as under :

- a) No deductions will be made for opening at the end of the joints, beams, posts, girders steps etc. upto 0.5 sq. m. each in area. An addition shall be made either for the jambs, soffits or sills of such opening. The above procedure will apply to both faces of the wall.
- b) For openings exceeding 0.5 sq. m. and upto 3 sq.m. each when only one face of the wall is plastered and the other face is not plastered neither deduction shall be made from the opening nor shall any addition be made for reveals, soffits and sills etc.
- c) For openings exceeding 0.5 sq.m. and upto 3 sq.m. each when both faces of the walls are plastered deductions shall be made as detailed below but no addition shall be made or reveals, soffits, jambs, sills etc. for the openings.
  - i) When both the faces of the walls are plastered with same thickness of plaster deduction shall be made for one side plaster only.
  - ii) When the two faces of the walls are plastered with different proportions of plaster or if one is pointed and the other face plastered deductions shall be from the plaster or pointing on the side of the frames of doors, windows etc. on which the width of reveals is less and no deduction shall be made for other side.
- d) For opening with areas exceeding 3 sq.m. deduction shall be made for the full openings on both the faces of the walls, while as the same the jambs, sills and soffits shall be measured for payment. In measuring the jambs soffits and sills, deductions shall be made for the area in contact with the frames of doors/windows.
- e) The method of measurement for pointing shall be similar to that for plastering.

**TECHNICAL SPECIFICATION FOR PVC WATER-STOPS AND JOINT-FILLERS**

**SCOPE :**

This section covers technical requirements for furnishing and installation of PVC water stops and joint filter across joints in the concrete, including supply of material labour etc. complete.

**General Requirements :**

The contractor shall furnish and install PVC water stops in the joints at the locations shown on the drawings or wherever directed by the E/I. The space in the joint above and below the water-stops shall be filled with bitumen impregnated fiber-board.

**Material :**

Water stops shall be molded from PVC and shall have the following physical properties :

- a) Shore 'A' Durometer hardness 65A
- b) Minimum elongation 250-275%
- c) Ultimate minimum tensile strength  $120\text{kg/Cm}^2$
- d) The PVC compounds shall not absorb more than 5% by the weight of water in 7 days test and shall conform to the following requirements for effect of alkali :

- i) 7 days : Weight increase  
0.25% max. Weight increase  
0.10% max. Hardness  
change 5
- ii) 28 days : Weight  
increase 0.4% Weight  
decrease 0.3%

The size of water stop shall be 225 mm and shape shall be of ribbed type.

Bitumen impregnated fiber board shall be used as joint filter and this shall conform to IS : 1838-1961 (latest edition).

The thickness of Bitumen Impregnated Fiber Board shall be 12 mm.

**Installation:**

Care shall be taken for the correct positioning of the water stops to prevent any faulty installation which may result in joint leakage.

The water stop shall be installed at mid depth of concrete as indicated in drawings with approximately one half of the width of the material embedded in the concrete on each side of the joint.

Care shall be exercised in placing and vibrating the concrete around the water stop and from under and above it so as to obtain a continuous bond between the concrete and water stop at all points around the periphery of the water stop. Care shall also be exercised in use of vibrators in the proximity of joints to avoid dislodging of the water stops while concreting.

In the event the water stop is installed in the concrete on one side of a joint more than one month prior to the schedule date of placing the concrete on the other side of the joint, the exposed water stop shall be covered or shaded to protect it from the direct rays of the sun during the exposures.

The Bitumen impregnated fiber board shall be placed in position below and above the rubber/PVC water stops as shown in the drawing. The fiber board shall be glued securely to one side of the joint by using hot bitumen or any other approved glue before placing concrete on the other side of the joint. Care shall be taken to prevent movement of the fiber board while placing and vibrating the concrete in the vicinity of the board.

**Splicing:**

All splicing of PVC water stops shall be done by adopting suitable process subject to the approval of Engineer-in-charge.

**Storage:**

The PVC water stops and the bitumen impregnated fiber board shall be stored in a cool place as practicable (85<sup>0</sup> F or less). These materials shall not be stoned in the open or where they will be exposed to the direct rays of the sun.

All water stops and impregnated fiber board shall be protected from oil and grease.

**Inspection:**

All water stops installations shall be subjected to inspection and approval by the Engineer-in-charge before concreting operation for fixing water stops are performed. The fiber board

installation shall also be subjected to similar inspection for approval before placing concrete.

**Method of measurements:**

Measurement for payment of PVC water stops shall be based on the length of water stops actually placed in position, measured, nearest to a centimeter, along the centre line of the water stop. The unit rate quoted shall include the cost of all material and labor for making the splices and cost of PVC water stops and their installation but exclude the cost of joint filler which shall be separately paid for.

**Filler materials:**

The bitumen impregnated fiber board shall be used as joint filler which shall fill space between the concrete surfaces above and below the water stops at the joints as indicated in the drawing. The thickness of bitumen impregnated fiber board shall be 12 mm and shall conform to IS: 1838 (latest edition). The fiber boards shall be glued securely to one side of the joint by using hot bitumen or any other approved glue before placing concrete on the other side of the joint. Care shall be taken to prevent movement of the fiber board while placing and vibrating the concrete in the vicinity of the Board.

**Measurement:**

The measurement for payment of bitumen impregnated fiber board used as a joint filler shall be based on the actual surface area in sq.m. covered by the board correct to the second place of decimal. The unit rate shall be inclusive of the cost of the materials, labour, equipment, etc. Complete and installation. The cost of glue required to attach the fiber board to the joint included in the unit rate noted.

**TECHNICAL SPECIFICATION FOR WATER PROOFING CEMENT ADDITIVE**  
**WATER PROOFING CEMENT ADDITIVE**

**Scope :**

This specification covers the technical requirement for furnishing, placing and mixing water proofing cement additive of Reliance Recorn 2s or equivalent in all kinds of cement concrete plain or reinforced and cement mortar for all kinds of structures at all levels, including encasement of steel sections, as shown in drawing or otherwise specified.

**General requirement:**

The contractor shall furnish all labour and equipment to place and mix water proofing cement additive in concrete of any grade and cement mortar, there after carryout the work as specified for concrete and then complete the work as indicated on the drawing and described herein.

**Material:**

The material shall be water proofing cement additive like Reliance Recorn 3 S or equivalent which conform to IS : 2645 (latest edition) and with ISI certification marks subject to approved by the Engineer-in-Charge.

Water proofing additive shall be as far as possible free from aggressive chemicals like chloride, sulphate etc. which can cause corrosion of steel reinforcement in RCC and pre-stressed concrete work.

**Mixing:**

Water proofing additive shall be used @ 125 Gm/bag or specified by the manufacturer (which ever is maximum) and shall be mixed with water as required by the Engineer-in-charge.

## **TECHNICAL SPECIFICATION FOR WHITE WASHING, DISTEMPER AND SPECIAL FINISHES**

### **WHITE WASHING :**

#### **Scope :**

This section covers the furnishing of all labour, materials and equipment and the performance of all operations required for the completion of the work of white washing all the internal faces of the walls, roof ceiling and other situations as directed by the Engineer-in-charge.

#### **Preparation of Surfaces :**

The surface shall be thoroughly cleaned of mortar drops and foreign matter.

#### **Materials :**

The wash shall be prepared from fresh white lime-stone of approved quality. The lime shall be thoroughly slaked on the spot, mixed and stirred with sufficient water to make a thin cream. The cream shall be screened through a clean coarse cloth and 300 gms. of gum dissolved in hot water added to each 10 cu. dm. of the cream. Water shall be added at the rate of 5 litres/kg. of lime to produce a milky solution.

#### **Application.**

The wash shall be applied with a brush, the coats being laid vertically and horizontally alternately, each coat being allowed to dry before the next coat is applied. The wash should show no sign of cracking.

No portions of the surface shall be left out initially to be patched up later on.

Three or more coats shall be applied till the surface presents a smooth and a uniform finish. The last coat being applied vertically.

Doors, windows, floors and other articles of furniture etc. shall be protected from being splashed upon. Splashing and droppings, if any, shall be removed and the surface be cleaned.

**Measurement :** The method of measurements for white washing shall be the same as indicated under the item of plastering work.

### **OIL BOUND DISTEMPER /ACRYLIC EMULSION PAINT:**

All the interiors of the building shall be painted with oil bound distemper or acrylic emulsion paint as per direction of E/I, as per PWD specification including preparation smooth finished base with Birla putty.

### **WATER PROOF CEMENT PAINT/APEX PAINT:**

#### **Scope :**

This section covers the furnishing of all materials, labour and equipment and performing of all operations for the preparation and finishing of external faces of the walls with water proofing cement paint/apex paint.

#### **Materials :**

Water proofing cement paint/apex paint of approved quality and shade and conforming to relevant IS code only shall be used.

#### **Preparation of surface :**



The surface shall be thoroughly cleaned of all water droppings, dust, foreign material, greases etc by brushing and washing. All patches and cracks in the surface shall be repaired. Wall surface shall be made smooth with Birla putty as per direction of E/I.

To avoid cracking and flaking, working in the sunshine shall be avoided. In dry weather, the surface after application shall be lightly sprayed with water to keep it wet.

**Measurement :**

The measurement for this item shall be in square meters and shall be in accordance with the item under plastering.

**PAINTING SYNTHETIC ENAMEL PAINT**

**Scope :** This section includes the cost of all labour, materials, equipments consisting of all operations as detailed below etc. complete including the cost of primers and paints. The surface to be painted shall be thoroughly brushed to remove accumulated dust and all loose powdered material. If on exterior surfaces, there is an extensive growth of vegetable matters and this cannot be removed by brushing, the growth shall be killed by applying a 2½ percent solution of magnesium silica fluoride. When the growth is dead and dry, the remains of the growth shall be brushed off. Any loose or hollow areas or any major cracks shall be cut out and made good, and the repairs allowed to dry thoroughly before painting. Minor repairs can be made with mastic cement to avoid the delay caused by the use of cement. A coat of ready mixed alkali resistant primer conforming to IS:109 shall then be applied over the prepared surface. The next day, a second but a slightly heavier coat of primer shall be applied thereafter the under coat and finishing coat with synthetic enamel paint conforming to IS:133 will be given to get an even and smooth finish.

In all other respects, the specifications, mentioned under the specifications for painting and finishing shall be applicable.

**Measurement:** The measurement for the work done on the exposed surface of misc. and structural steel shall be on total surface without any deduction for the portion embedded in concrete or masonry in sqm.

Measurement for payment for doors windows shall be as follows :-

- (a) Moulded work of all kinds such as cornices etc. and doors and windows shall be measured flat.
- (b) Both sides area of glazed (ventilators) painted shall be measured as 1½ times the single flat area. Expanded metal or similar work will be measured as ½ the single area measured, M.S. gates, grills, collapsible shutters etc. shall be measured 1.25 times flat for area of painting on both sides.
- (c) Fully glazed shutters (both sides) shall be measured as 1 ½ times the area of the opening while that of wire gauge doors may be one time only.
- (d) Part panelled and glazed shutters (both sides) shall be measured as 1¾ times of the area of the opening.
- (e) Fully panelled / flush shutters both sides may be measured as 2.25 times the area of the opening.
- (f) Rolling shutters may be measured as 2.6 times flat.

**TECHNICAL SPECIFICATION FOR PIPES AND PIPE FITTINGS**

**WATER SUPPLY PIPES AND FITTINGS**

**G.I. Pipes and Sockets**

**Scope:** This section covers the finishing of all materials, labour and equipments and performing of all operations necessary to complete the piping work in accordance with drawings and specifications.

**Materials:** The pipes shall be galvanized mild steel welded pipes and seamless, screwed and socketed tubes conforming to the requirements of IS : 1239-1984 for medium grade. They shall be of diameter (nominal bore) specified in the description of the item. The sockets shall be designated by the respective nominal bores of the pipes for which they exist.

The pipe shall be smooth and of uniform thickness; all galvanized in and out and free from cracks, surface flaws, laminations and other defects, all screw threads shall be clean and well cut. The ends shall be cut clearly, and square with the axis of the tube.

The details of pipes and sockets regarding nominal bore, thickness and weight in kg/m are given in the table below.

**TABLE**  
(Particulars of Medium Grade G.I. Pipes / Sockets)

Nominal Bore	Dimensions of pipes outside diameter		Thickness	Dimensions of Ordinary socket		Weight of pipe
	Max.	Min.		Approximate Out side dia.	Minimum Length	
Mm	mm	mm	Mm	mm	Mm	Kg/metre
15	21.8	21.5	2.65	26.90	34	1.21
20	27.3	26.5	2.65	33.70	36	1.57
25	34.2	33.5	3.25	42.60	43	2.42
32	42.9	42.0	3.25	51.00	48	3.1
40	48.8	47.9	3.25	57.00	48	3.59
50	60.8	59.7	3.25	70.00	56	5.07
65	76.6	75.3	3.65	88.90	65	6.49
80	89.5	8.0	4.05	101.60	71	8.43

#### Pipe Fittings

The fittings shall be malleable cast iron or mild steel tubes complying with all the appropriate requirements given in para 2.1.2 or as specified. The fittings shall be designated by the respective nominal bores of the pipe for which they are intended.

The fittings shall have screw threads at the ends conforming to the requirements of IS : 554-1955. Female threads on fittings shall be parallel and male threads (except on running supplies and collars of unions) shall be tapered.

#### Cutting, laying and jointing

The pipes and fittings shall be inspected at site before to ascertain that they conform to the ISI specification. The defective pipes shall be rejected. Where the pipes have to be cut or re-threaded, the ends shall be carefully filed out so that no obstruction to bore is offered. The ends of the pipes shall then be threaded conforming to the requirements of IS : 554-1955 with pipe dies and taps carefully in such a manner as will not result in slackness of joints when the two pieces are screwed together.

The pipes shall be cleaned and cleared of all foreign matter before being laid. In jointing the pipes, the inside of the sockets and the screwed end of the pipes shall be oiled and rubbed

over with white lead and a few turns of spun yarn wrapped round the screwed end of the pipe. The end shall then be screwed in the socket, Tee etc. with a pipe wrench.

Any threads exposed after jointing shall be painted or in case of underground piping thickly coated with approved anti-corrosive paint to prevent corrosion.

#### **Internal work**

For internal work the galvanized iron pipes and fittings shall be done by means of standard pattern holder bat clamps, keeping the pipes about 1.5 cm clear of the wall. When it is found necessary to conceal the pipes casing may be adopted or pipes fixed in the ducts or necessary etc. provided there is sufficient space to work on the pipes with the usual tools. The pipes shall not ordinarily be buried in walls or solid floors. Where unavoidable, pipes may be buried for short distances provided adequate protection is given against damages and where so required joints are not buried. Under the floors, the pipes shall be laid in the layer of sand filling done under concrete floors.

All pipes and fittings shall be fixed truly vertical and horizontal unless unavoidable. The pipes shall be fixed to walls with standard pattern holder bat clamps of required shapes and sizes so as to fit tightly on the pipes when tightened with screw bolts.

For G.I. pipes 15 mm to 25 mm dia. the holes in the walls and floors shall be made by drilling with chisel or jumper and not by dismantling the brick work or concrete. However, for larger pipes the holes shall be carefully made of the smallest size as directed by Engineer-in-charge. After fixing the pipes the holes shall be made good with cement mortar 1:3 (1 cement and 3 coarse sand) and properly finishing to match the adjacent surface.

#### **Testing of Joints**

After laying and jointing the pipes and fittings shall be inspected under working conditions of pressure and flow. Any joint found leaking shall be redone and all leaking pipes removed and replaced at the contractors cost. The pipes and fittings after they are laid shall be tested to hydraulic pressure of  $6 \text{ kg/cm}^2$  (60 metre). The pipes and fittings shall be test in sections as the work of laying proceeds, keeping the joints exposed for inspection.

#### **Method of measurement :**

The pipes shall be measured along its central line in running meter correct to a cm. for the finished work which shall include G.I. pipe and G.I. fittings such as bends, tees, elbows, reducers, crosses, plugs, sockets, nipples and nuts, but exclude brass or gun metal taps (cocks), valves, lead connection pipes and shower rose. The pipe shall be described as including all cuttings and waste. In case of fittings of unequal bore, the largest bore shall be measured. The rate for internal work shall include the cost of labor and material involved in all the operations described above. The rate also includes the cost of cutting holes in walls and floors and making good the same. It includes painting of pipes and providing sleeves wherever necessary.

#### **Brass Water fittings:**

**Scope :** This section covers the furnishing of all materials, labor and equipment and performing all operations necessary to complete the installation work in accordance with drawings and specifications.

#### **Material:**

The brass fitting shall be of approved quality manufacture and pattern with screwed or flanged ends as specified. The fittings shall in all respects conform to the requirements of IS:781-1959. All supplies shall be made according to the approved samples.

All cast fittings shall be sound and free from laps below holes and fittings both internal and external shall be clean, smooth and free from sand etc. Burning plugs, stopping or patching of the casting shall not be permissible. The bodies bonnets, spindles and other parts shall be axial, parallel and cylindrical with surface smoothly finished. The area of the water way of the fittings shall not be less than the area of the nominal bore.

**Brass Bib Cock and Stop Cock:**

They shall be of specified size and shall be of screw down type. The minimum finished weights of the bib tap (cock) and stop tap (cock) shall be as follows:

Size	Minimum Finished Weight	
	Bib Tap	Stop Tap
mm	Kg.	Kg.
8	0.25	0.25
10	0.30	0.35
15	0.40	0.40
20	0.75	0.75

When the bib cock or stop cock are required to be chromium plated, the same shall be grade B type conforming to IS:1069-1958 (latest edition). The chromium shall never be deposited on brass unless a heavy casting of nickel is interposed in case these are required to be nickel plated, the plating shall be of the first quality with a good thick deposit of silvery whiteness capable of taking high polish which will not easily tarnish or scale.

**Brass Full Way Valve:**

Full way valve is a valve with suitable means of connection for insertion in a pipe line for controlling or stopping the flow. The valve shall be of brass fitted with a cast iron wheel and shall be of gate valve type opening full way and of the size as specified.

The valve shall be of the quality as approved by the Engineer-in-charge and shall have the following approximate weights with a tolerance of 5 percent

Size	Weight	
	Flanged ends	Screwed ends
mm	kg.	kg.
15	1.02	0.567
20	1.503	0.680
25	2.495	1.077
32	3.232	1.539
40	4.082	2.268
50	6.691	3.232
65	10.149	6.804
80	13.381	8.845

### Lead connection pipe:

The lead connection pipes shall be of 15 mm nominal bore and 450 mm in length with wiped soldered joints including brass unions each of 65 mm length at the ends. It shall have an approximate weight of 1.85 kg/m with tolerance of 5%.

### Method of Measurement:

The water cocks valves and similar type of fittings shall be counted in numbers for each item separately.

The rate shall include the cost of materials and labor involved in all the operation described above and shall paid for under the respective items.

## CAST IRON PIPES AND FITTINGS

### Scope:

The work shall comprise of providing all material and labor and doing all the operations viz. excavating, laying, jointing, testing etc. complete in accordance with the operations detailed below.

### Materials :

#### C.I Pipes:

The cast iron pipes shall be either centrifugally cast (spun) iron pipes conforming to IS 1536-1967 or vertically cast iron pipes conforming to IS 1537-1967 as given in the tables below :

### HYDRAULIC TEST PRESSURE FOR CENTRIFUGALLY CAST (SPUN) IRON PIPES

<i>S. No.</i>	<i>Category of pipes in the order of increasing thickness for the same diameter</i>	<i>Test pressure in kg/cm<sup>2</sup></i>	<i>Working Pressure in kg/cm<sup>2</sup></i>
1.	Class LA	35	12
2.	Class A	35	18
3.	Class B	35	20

### HYDRAULIC TEST PRESSURE FOR VERTICALLY CAST IRON PIPES

Nominal diameter	Socket & spigot pipes "Class A"		Flanged pipes "Class A"	
	Test pressure kg/cm <sup>2</sup>	Metre-head	Test pressure kg/cm <sup>2</sup>	metre-head
Upto and including 300 mm	20	200	20	200
Over 300 mm to 600 mm	20	200	15	150
Over 600 mm to 1000 mm	15	150	10	100

It may be noted that unless specified otherwise in the respective item, the C.I. Pipe shall be centrifugally cast (spun) iron pipe of Class B.

**C.I. Specials :** The specials shall conform to IS 1538-1960 and shall be of medium class depending

on their thickness. The hydraulic test pressure shall be follows :-

Nominal diameter	Test pressure in Kg/cm <sup>2</sup> (metre-head)	
	Special without branches or with branches. Less than half the principal diameter	Special with branches greater than half the principal diameter
	Medium	Medium
Upto and including 300 mm	20(200)	20(200)
Over 300 mm to 600 mm	15(150)	15(150)
Over 600 mm to 1500 mm	10(100)	8(80)

All the cast iron pipes shall be capable of being easily worked with a drill or file. Pipes and special should be sound with smooth inner and other surfaces, neatly dressed and carefully fitted free from laps, pin holes and other imperfections and shall ring end of the pipes, and specials shall be reasonably square to their axis.

**The trenching for C.I. Pipes and specials:**

The trenching for the pipes shall be excavated to lines and levels as directed. The bed of trench shall have to be truly and evenly dressed throughout from one end to the next.

The gradient is to be set out by means of "boning rods" and the required depth excavated at any point of the trench shall be graded as directed by the Engineer-in-charge. The depth of the trench shall not be less than 1 metre measured from the top of the pipe to the surface of the ground under roads and not less than 0.75 m elsewhere.

The width of the trench shall be the nominal diameter of the pipe plus 40 cm but it shall not be less than 55 cm in case of all kinds of soils excluding rock and not less than 1 metre in case of rock.

The bed of the trench, if in soft or made up earth, shall be well watered and rammed before laying the pipes and the depression if any shall be properly filled with earth and consolidated in 20 cm. layers.

Where the pipe line or drain crosses an existing road the road crossing shall be excavated half at a time, the 2nd half being commenced after the pipes have been laid in the first half and the trench refilled. Necessary safety measures for traffic as directed shall be adopted. All types of pipes, water mains, cables etc. met within the course of excavation shall be carefully protected and supported. Care shall be taken not to disturb the electrical and communication cable, removal of which if necessary, shall be arranged by the Engineer-in-charge. Nothing extra shall be payable to the contractor on this account.

**Laying of pipes and specials:**

Before being laid the pipes shall be examined to see that there are no cracks or defects described in para above. Subject to the approval of the Engineer the damaged portion of the cracked pipe may be cut at a point not less than 15 cm. beyond the visible extremity in water and sewer lines wherever it is practicable to use cast lead caulking but no in case of wet conditions.

The pipes shall be thoroughly cleaned of all dust and dirt and special care shall be taken to clean the inside of the socket and outside of the spigots.

After lowering in the trenches, the pipes shall be arranged so that the spigot of one pipe shall be carefully centered into the socket of the next pipe and pushed to full distance that it can go. The pipe line shall be laid to the levels required.

Where so directed, the pipes and specials may be laid on masonry or concrete pillars. The pipes laid on the level ground, shall be laid with socket facing the direction of flow of water. In all other cases the sockets shall be laid facing uphill.

Cement concrete thrust blocks of suitable design as approved by the Engineer-in-charge shall be provided at  $45^{\circ}$  and  $90^{\circ}$  bends of the pipes and also at places where there is likelihood of thrust so as to withstand the dynamic and static forces developed due to water in the pipe line. The thrust

block shall be made after the joints have been caulked with lead. No extra payment shall be made for such blocks.

Lead caulked joints with Molten lead: This type of lead caulking is generally done in providing joints in gas.

**Materials : Pig lead and spun yarn.**

Pig lead shall be of uniform quality, clean and free from foreign materials. It shall be of uniform softness and capable of being easily caulked or driven. It shall conform to IS 782-1962 for caulking lead.

Spun yarn shall be of clean hemp and of good quality. It shall be soaked in hot coal-tar or bitumen and cooled before use.

The approximate depth of pig lead for various diameters of C.I. pipes and specials shall be given below with a tolerance of +5 percent.

Diameter of pipe	Depth of lead
80 mm to 250 mm	45 mm
300 mm to 1000 mm	50 mm
1100 mm to 1500 mm	60 mm

Just sufficient quantity of spun yarn shall be put so as to give the specified depth of lead.

**Jointing**

**Preparing the joint:** The interior of the socket and exterior of the spigots shall be thoroughly cleaned and dried. The spigot shall be inserted into the socket right up to the back of the socket and carefully centered by two or three laps of treated spun yarn, twisted into ropes of uniform thickness, well caulked into the back of the socket. No piece of yarn shall be shorter than the circumference of the pipe. The jointed pipe line shall be at required levels and directions.

**Leading:** The leading of pipes shall be made by means of ropes or covered with clay or by using special leading rings. The lead shall be melted so as to be thoroughly fluid and each joint shall be filled in one pouring. Lead shall not be overheated as it is not desirable to overheat it.

**Caulking:** After the lead has been run into the joint, the lead shall be thoroughly caulked. Caulking of joints shall be done after convenient length of pipes has been laid and leaded.

The leading ring shall first be removed and any lead outside the socket shall be removed with a flat chisel and then the joint caulked round three times. The joints shall not be covered till the pipe lines has been tested under pressure though the rest of the pipe line should be covered to prevent expansion and contraction due to variation in temperature.

**Testing of Joints:**

After laying and jointing, the pipes and fittings shall be inspected under working conditions of pressure and flow. Any joint found leaking shall be redone and all leaking pipes removed and replaced at contractor's cost.

The pipes and fittings after they are laid shall be tested to hydraulic pressure of 10 kg/cm<sup>2</sup> (100 metre).

**Refilling the excavated earth in the trench:**

As per specification under sub-head Backfill;

**Measurement :** This shall be measured as the net length of the pipe and shall not include the portion of spigots within the sockets of specials and pipes. The unit rate is inclusive of excavation, back filling, de-watering etc. however, the concrete thrust blocks as well as masonry or concrete pillars shall be measured and paid for separately.

## **TECHNICAL SPECIFICATION FOR SANITARY FITTINGS**

**Scope:**

This section covers the furnishing of all materials, labor and equipment and performing of all operations, necessary fittings in accordance with drawings and to complete the sanitary specifications.

**General requirements:**

All the materials and fittings used shall be of the best quality.

Any damage caused to the building or to electric, sanitary, water supply or other installations etc., either due to negligence on the part of the contractor or due to actual requirement of the work, shall be made good and the building or the installation shall be restored to its original condition by the contractor. Nothing extra shall be paid for this, except as otherwise specified.

All masonry work shall be made good at contractor's cost using the same class of work as used in the original construction work and to the satisfaction of the Engineer-in-charge. Cement concrete shall be made good at the contractor's cost with a mix of same proportion as previously used. On completion of the work the site shall be cleaned and all rubbish disposed off as directed by the Engineer-in-charge.

**Materials and Installations:**

All sanitary appliances shall be of the size and design as specified in relevant I.S. Codes or as directed by the Engineer-in-charge.

Orissa type W.C. pan shall be either of vitreous china or white glazed fine clay or white glazed earthenware complete with foot rests, low level flushing cistern of 10 liter capacity of DIPLAST / AGRAWAL / UNIQUE make fixed with necessary brackets and fittings for symphonic arrangement with PVC ball valve and float including PVC long bend / flush pipe and coupling etc. complete. In all cases a pan shall be provided with 100 mm S.C.I. trap 'P'



or 'S' type with approximately 50 mm water seal and 50 mm dia vent horn where required by the Engineer-in-charge. The inside of the bottom of the pan shall have sufficient slope from the front towards the outlet to enable quick disposal. The European type W.C. pan shall be of white glazed fine clay and type I with S or P trap complete with cover seat, low level flushing cistern complete as described above if required.

**Wash basin:**

Wash basin shall be of white glazed earthen ware, white vitreous china or white glazed fine clay as specified. It shall be of one piece construction and shall be complete in all respects including waste, pipes, fittings taps, rubber plug with C.P. brass chain etc.

**Towel rail** shall be C.P. brass with two C.P. brass brackets. The size of the rail shall be 75 cm x 20

mm dia. 1.25 mm thick or as specified. Chromium plating shall be of grade B-type conforming to IS : 1968 (latest edition) The brackets shall be fixed by means of C.P. brass screws to wooden plugs firmly embedded in the wall.

**The mirror** shall be superior glass with edges rounded off or beveled as specified. It shall be free from flaws, specks or bubbles. The size of the mirror shall be 600 x 450 mm and unless specified otherwise its thickness shall be not less than 6 mm. The glass for the mirror shall be free from silvering defects. Silvering shall have a protective uniform covering of red lead paint. The mirror shall be mounted on 6 mm thick plain asbestos sheet ground and shall be fixed in position by means of C.P. brass screws and C.P. brass washers, over rubber washers and wooden plugs firmly embedded in the wall. C.P. brass clamps with C.P. brass screws may be an alternative method of fixing when so directed. Chromium plating shall be of grade B-type conforming to IS : 1968 (latest edition). Unless specified, otherwise the longer sides shall be fixed horizontally.

**Water storage tanks.** The water storage tanks shall be of best quality, **SINTEX** or equivalent make of capacity as specified in the item. The type of tank to be placed shall be approved by the Engineer-in-charge.

**The liquid soap container** shall be of glass or plastic as specified in the drawing complete with C.P.

brass lid and brackets etc.

All soil vent and anti-syphonage pipes and fittings shall conform to IS-1729 (latest edition). The soil cast iron pipe shall be of dia as specified in the drawings. They shall be sound and nicely cast and shall be free from cracks, laps, pin holes and other defects.

**Testing of pipe lines for Drainage & Sanitation**

Comprehensive tests of all pipe lines shall be made by simulating conditions of use. The method of actual tests shall be decided by the E/I. All tests recorded and submitted to the E/I for review and instruction. The Engineer-in-charge discretion regarding tolerance shall be final.

General guidance for the test given below :

**a) Smoke Test**

All soil pipes, waste pipes and vent pipes and all other pipes when above ground shall be approved gas tight by a smoke test conducted under a pressure of 2.5 M of water and maintained for 15 minutes after all trap seals have been filled with water. The smoke is produced by burning only wastes or tar paper or similar material in the combustion chamber of a smoke machine. Chemical smoke are not satisfactory.

#### **b) Water test**

Cast iron pipes shall be subjected to a test pressure of at least 1.5 M head of water at the highest point of the section under test. The tolerance figure of two liters per centimeter of diameter per kilometer may be allowed during a period of 10 minutes. The test shall be carried out by suitably plugging the low end of the drain and the ends of connections, if any, and filling the system with water. A knuckle bend shall be temporarily jointed in at the low end and a sufficient length of the vertical pipe jointed to it so as to provide the required test head or the top end may be plugged with a connection to a hose ending in a funnel which could be raised or lowered till the required head is obtained and fixed suitably for observation.

#### **Measurements:**

The measurements of sanitary fittings for the purpose of payment shall be on the basis of numbers of individual items. The payment for pipes shall be made on the basis of the lengths of pipes actually installed including head, bend, shoes, tees and specials. Over-laps shall not be measured. No separate measurements for payment shall be made for fixing devices and testing. The pipes shall be measured in running meters. Pipes of different dia, shall be measured separately and paid for accordingly.

### **TECHNICAL SPECIFICATION FOR MANHOLES**

#### **SCOPE**

The work shall comprise of constructing manholes complete with all operations as detailed below inclusive of providing all labors, materials and T&P etc. Manholes of different types and sizes as specified shall be constructed in the sewer line at such places and to such levels and dimensions as shown in the drawings or as directed by the Engineer-in-charge. The size specified shall indicate the inside dimensions of the manholes.

Sewers of unequal sectional area shall not be joined at the same invert level in a manhole. The invert of the smaller sewer at its junction with main shall be at least 2/3 the diameter of the main above the invert of the main. The branch sewer should deliver sewage in the manhole in the direction of main flow and the junction must be made with care so that flow in main is not impeded.

The various sizes of manholes to be adopted under different conditions are indicated below :-

<b>Size of manhole</b>	<b>Remarks</b>
i) 90 x 80 cm	For House drainage
ii) 120 x 90 cm	For depth less than 2.45 meter for main drainage work.
iii) 140 x 90 cm or 140 cm circular junctions or	For depths of 2.45m. or more for main drainage work. The width or diameter of manhole shall be increased on bends, pipes with diameter more than 45 cm. so as to have a minimum benching width of 22.5 cm. on either side of the channel.

Manhole on foot paths and within the width of roads are provided with covers of medium duty casting and heavy casting respectively.

**Excavation:** The manhole shall be excavated true to the dimensions and levels shown on the plans or as directed by the Engineer-in-charge.

**Back-filling:** As per specification under sub-head "Backfill".

**Bed Concrete:**

The manhole shall be built on a bed of cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 grades stone aggregate 40 mm brick ballast nominal size). The thickness of the bed concrete shall be 20 cm. for manholes upto 4.25 m. depth and 40 cm. for depths beyond 4.25 m. unless otherwise specified or directed by the Engineer-in-charge. The bed concreting shall be done as explained under sub-head "concrete".

**Brick work:** The brick work shall be with first class bricks in cement mortar 1:6 (1 cement : 6 fine sand). The external joints of the brick masonry shall be finished smooth and the joints of the pipes with masonry shall be made perfectly leak proof. For arched tube and circular manholes arch ring over the brick masonry in arches and the pipes shall be with 1st class bricks in cement mortar 1:3 (1 cement : 3 fine sand). In the case of manholes of circular type the access shaft shall be corbelled inwardly on three sides at the top to reduce its size to that of the cover frame to be fitted. For brick work refer specification under subhead 'Brick work' in 'Masonry Chamber'.

The walls shall be built of 20 cm. brick work for depth upto 4.25 m. Below a depth of 4.25 m in ordinary subsoil the wall thickness shall be increased to 30 cm and at 9.75 m. below ground, the wall thickness shall be 40 cm.

**Plaster and pointing:** The walls of the manholes shall be plastered inside with 12 mm thick cement plaster 1:3 (1 cement 3 coarse sand) finished smooth. In the case of arched type manholes, the walls of the manhole shall be plastered only inside all-round upto the crown level, and flush pointed for the shaft with cement mortar 1:2 (1 cement 2 fine sand). Where the saturated soil is met with, the external surface of the walls of the manholes shall also be plastered with 12 mm cement plaster 1:3 (1 cement 3 coarse sand) finished smooth upto 3 cm above the highest sub-soil water level, with the approval of the Engineer-in-charge. The plaster shall further be water proofed with addition of approved water-proofing compound in a quantity as per manufacturer's specification. For plastering refer to specification under sub-head 'Plastering'.

**Benching:**

The channels and benching shall be done in cement concrete of Grade M-15 and rendered smooth with neat cement as per specification under sub-head 'concrete'.

The depth of channels and benching shall be as indicated in table given below :-

Size of drain	Top of channel at the centre above bed concrete	Depth of benching at walls above bed concrete
mm	Cm	Cm
100	15	20
150	20	30
200	25	35
250	30	40
300	35	45
350	40	50
400	45	55

**R.C.C. WORK:**

R.C.C. work for slabs and lintels shall be in cement concrete, M-20 with steel reinforcement.

Plain concrete where used for fixing the frames of manholes covers, shall be of grade M-15. This concrete shall be laid in one operation integral with R.C.C. slab underneath. For specifications refer to sub-head 'Concrete & Reinforcement'.

**Foot Rests:**

All manholes deeper than 1.20 M shall be provided with M.S. foot rests. Foot rests shall be of 20 mm M.S. square or of M.S. round bars as specified. These shall be embedded 20 cm. deep with 250 x 250 x 150 mm blocks of cement concrete 1:2:4 (1 cement, 2 coarse sand, 4 graded stone aggregate 20 mm nominal size). The block with M.S. foot rest placed in its centre shall be cast-in-situ along with the masonry and surface finished with 12 mm thick cement plaster 1:3 (1 cement : 3 coarse sand) finished smooth. Foot rests shall be fixed 30 cm apart vertically and staggered laterally and shall project 10 cm. beyond the surface of the wall. The top foot rest shall be 45 cm. below the manhole cover. Foot rests shall be painted with coal tar, the portion embedded in the masonry or cement concrete block being painted with thick cement slurry before fixing.

**Manhole covers and Frames:** The covers and frames shall conform to IS : 1726-1960. Only heavy duty manhole covers shall be used at all places.

**TECHNICAL SPECIFICATION OF UNDER REAMED PILES****Scope:**

The scope of work covers designing and providing under reamed piles and piles caps for the foundation of control room and steel towers and columns of switchyard area. The dia of piles may vary from 250-400 mm & length upto 3.5-10 M. However, exact dia & length shall be obtained at the time of designing, depending upon safe load i.e. ultimate load & factor of safety.

**Design and Drawings / Construction:**

The work is to be executed as per approved drawings. The construction of under reamed piles shall be carried out as per IS code 2911 (Part III) and other relevant standards. The piles shall also meet the requirements of the HANDBOOK ON UNDERREAMED BORED COMPACTION PILE FOUNDATIONS of C.B.R.I (Roorkee).

**Layout:**

The complete setting out work required for piling shall be done by the contractor at his own cost. The layout of the general grid of the plot shall be approved by the Engineer-in-charge. The Contractor at his own cost shall build and preserve bench marks constructed with reference to the permanent bench marks indicated by the Engineer-in-charge. He shall give all help with instruments, materials and men to the Engineer for checking the detailed layout and levels.

**Materials:****Concrete :**

The Concrete mix for piles, piles cap and grade beams shall be of grade M-15 (1:2:4 mix) or M-20 (1:1.5:3 mix) as per approved drawings. "Technical Specification of Cement Concrete" described earlier shall apply here also.

**Reinforcement**

The longitudinal reinforcement shall not be less than 0.4% of the cross sectional area of the pile and diameter of longitudinal bars shall not be less than 12 mm. The lateral reinforcement may be of the type or of spiral type, and dia of reinforcement shall not be less than 6 mm. The technical specification of "Reinforcement" described earlier shall apply here also.

**Sequence of piling:**

Individual piles and pile groups shall be cast-in-situ in such a sequence that the adjacent piles already installed are not disturbed, nor their carrying capacity reduced by subsequent boring operation. In a group, the piling operation shall proceed from the centre of the group towards the periphery.

**Boring / Drilling:**

Bore holes shall be made by earth augers. In case of manual boring, and auger boring guide shall be used to keep the bores vertical or to the desired inclination and in position. After the bore is made to the required depth enlarging of the base shall be carried out by means of an under-reaming tool.

The diameter of the under reamed bulb shall be 2.5 times the diameter of the pile stem / shaft. The centre to centre spacing for under-reamed piles shall be as shown on the approved drawing but in no case shall it be less than  $2 D_u$  (where  $D_u$  is the under reamed diameter) for under - grade beams, the maximum spacing of pile shall not exceed 3 metre.

In ground with high water table having unstable pile bores, boring and under reaming may be carried out using a suitable drilling mud (Bentonite drilling mud of 7% or upto 8% consistency by weight i.e. 7 kg. or upto 8 kg. per 100 liter of water). In normally mud soil strata, drilling mud can be poured from top while boring and under reaming can be done by normal spiral earth auger and under reamer. The level of drilling mud should always be about 1 metre above the water table or the level at which caving - in occurs. In case of very unstable strata with excessive caving - in, continuous circulation of drilling mud using suitable pumping equipment and tripod etc. along with modified auger and under - reamer to avoid back action shall be used. At least 2 m long temporary M.S. casing be provide of required size be provided at the top of every bore hole to guide the cutting tools and also to avoid the bore hole from being damaged due to continuous flow of slurry and movement of cutting tools etc. This M.S. casing should be taken out when the concrete would reach at that level. The contractor shall arrange this casing at his own cost. Nothing extra shall be paid to him for the same.

**Control of alignment:**

For vertical piles a deviation of 1.5% and for batter piles a deviation of 4% should not be exceeded to. Piles should not deviate more than 75 mm or  $1/10$ th of dia of pile whichever is more (in case of piles having diameter more than 600 mm ) from their designed position at the working level. In the case of single pile under each leg of column the positional clearance shall not be more than 50 mm. In case of piles deviating beyond limits, to such an extent that the resulting eccentricity can not be taken care of by redesigning of pile cap or pile ties, the pile should be replaced ( )r supplemented by one or more additional piles at contractors own cost.

**Placing reinforcement :**

Reinforcement as required shall be made into staff cages sufficiently wired with IS/20 gauge annealed soft iron binding wire or welded to withstand handling without any damage or

distortion. Reinforcement shall be placed immediately after cleaning and inspection of bottom of bore holes.

The projecting lengths of longitudinal bars beyond the pile cut-off level shall be equal to a minimum of 50 times the bar diameter. Concrete cover over all reinforcement shall be 50 mm. The inside dimension of reinforcing cage shall be adequate for operating the tremie pipe when used.

#### **Concreting:**

Before start of concreting for the cast in-situ under reamed pile, the contractor shall get checked the bore hole / under reamed bulb of each and every pile by the Engineer-in-charge or his authorized representative / subordinate looking after the work and obtain an O.K. card / slip from him for proceeding with the operation of concreting. A register / cut file shall be maintained at the site by the contractor to record necessary information about boring and concreting of piles e.g. date, the pile number, dimension of pile and any other detail as required by the Engineer-in-charge. The contractor shall put up the same before the Engineer-in-charge regularly during the period of construction of piles.

The bottom of the bore hole shall be cleaned of all the loose materials, debris and all the water shall be removed by pumping and bailing just before the concreting starts.

In case of bore holes established by 'Bentonite' slurry and of bore holes which are not dry, concrete shall be placed by means of tremie pipe which will be suitably closed at bottom at the start of concreting. The tremie pipe must extend upto the bottom of the bore-hole at the start, and may be withdrawn in sections as the level of concrete rises in the bore-hole and shall at all times be embedded in the concrete to a minimum depth of one metre. Placing of concrete should be continuous and the tremie pipe shall be held concentric in the hole. The borehole shall be maintained full with the drilling fluid where used throughout the concreting operation.

Since supervision at night becomes difficult, concreting shall be carried out only from morning to evening. The procedure of concreting shall be got approved by the E/I.

#### **Finishing pile heads:**

The top of the pile shall be brought up above the cut off level to permit all laitance and weak concrete to be removed and to ensure that it can be properly keyed into the pile cap. the minimum distance of keying of pile into pile cap shall be 5 cm. Any defective concrete in head of the completed pile shall be cut away and made good with new concrete. The clear cover between the reinforcement in pile cap from the top of the pile shall not be less than 10 mm. The reinforcement in the pile should be exposed for a sufficient distance to permit it to be adequately bonded in the pile-cap.

#### **Replacement of rejected pile:**

Piles that are defective or exceed the tolerance specified, shall be left in place or pulled out, as directed by the Engineer-in-charge, without adversely affecting the performance of adjacent piles.

Contractor shall install replacement pile/piles in lieu of rejected piles as directed by Engineer-in-charge.

Contractor shall not be paid any additional amount for expenses incurred for extraction of rejected piles, provision of extra piles, enlargement of pile cap necessitated due to faulty work of the contractor.

**Measurement for Payment of Under Reamed Piles:**

The bore hole of piles (stem / shaft only i.e. excluding under reamed bulbs) upto 3.5 m depth below ground level shall be measured and paid for in "each" unit for all such numbers of piles. The under reamed bulbs (2.5 times of the stem dia) shall also be measured and paid for in "each" unit for all such numbers of the under reams (bulbs) separately against another item. However additional depth of stems of piles beyond 3.5 m depth shall be measured and paid for separately in "meter" unit.

The measurement for payment of cement concrete 1:2:4 or 1:1.5:3 for stems / shafts of cast in-situ R.C.C. piles (excluding under reamed bulbs) shall be in "cum meter" unit, measured from cut-off level to founding level. The extra concrete required for concreting of the under reamed bulbs shall be measured and paid for in "cum meter" unit for such numbers of under reamed bulb.

If due to any reason the size of under reamed pile (i.e. the depth and dia of the bore-hole or the dia of the under reamed bulbs which has to be 2.5 times the dia of the respective stem) becomes more than that specified on the approved drawing, the whole pile shall be cast with same mix. with the reinforcement having been placed only in the designed depth as per approved drawing. Nothing shall be paid extra to the contractor for the increased size of the bore-hole / under reamed bulb and the concrete for the same.

Reinforcement used for construction of the cast in-situ R.C.C. under reamed pile shall be measured as per slanted weight and paid for separately.

**Pile caps:**

The cap shall be cast over a 7.5 cm thick leveling course of concrete of mix 1:6:12 or as specified in the approved drawings. The clear overhang of the pile cap beyond the outer most pile in the group shall normally be 10 - 15 cm depending upon the pile size.

The clear cover for the main reinforcement from the bottom of cap shall not be less than 6 cm.

The reinforcement from the pile should be properly tied to the pile cap.

The pedestals of foundations shall be 15 cm. above the formation level.

The pile should project 40 mm into the cap concrete.

Each leg of towers/columns shall be welded with the base plate with proper anchorage to be provided in the pile cap, with required nos. of foundation bolts to be fixed in the left out block cuts in the pile cap. This job will be done in the presence of Electrical Engineer of employer.

**Measurement of Pile Cap for Payment :**

The C.C. for the R.C.C. work in pile caps shall be measured in cubic metre and paid against the item of providing / laying C.C. for R.C.C. work in plinth. Nothing extra shall be paid to the contractor for any enlargement of pile cap necessitated due to faulty work of the contractor.

Note : In order to assess and have an idea of the volume of the cement concrete in under reamed pile foundation, the following formula as suggested by the C.B.R.I. (Roorkee) may be used.

$$V = \frac{\pi}{4} \times d^2 \times (L + K.n.d.)$$

where :

V = Total volume of the concrete

L = Depth of pile from  
cut-off level d =  
Diameter of stem of pile

n = Nos. of Under  
Reamed Bulbs k =  
Constant

For under reamed dia = 2.5 d,      K = 4

For under reamed dia = 2.0 d,      K = about 3

## TECHNICAL SPECIFICATION FOR ROADS

This shall consist of the following :

1. Sub grade
2. Sub-base : It shall consists of soling with over-burnt clay bricks laid on edge in one layer.
3. Water bound macadam: It shall consist of crushed or broken stone aggregate as per specification.
4. 100mm/150mm C.C. with nominal reinforcement as per drawing.

The CC road shall be constructed as per drawing approved by UPPTCL.

**Sub Grade :** This shall consists of construction of sub-grade with approved material obtained from excavation for road construction, borrow pits or other sources, in lines grades and cross section as shown in the approved drawing or as directed by the Engineer-in-charge.

### **Materials :**

The materials used in sub-grades shall be earth, moorum, gravel, a mixture of these or any other material proved by the Engineer. The size of coarse material in the mixture of earth shall not exceed

60 mm when placed in the sub-grade. Clays shall not be used in the sub-grade.

### **Construction of Sub-grade :**

Consolidating / compacting ground supporting sub-grade: In all cases the original ground shall be consolidated by rolling with six passes of 8 – 10 ton roller.

The ground shall be excavated to an average depth of 15 cm and the surface below this level shall be suitably consolidated with six passes of 8-10 ton roller including making good the undulations.

In sub-grade composed of clay, fine sand or other soils that may be forced up into the coarse aggregate during rolling operation, an insulation layer of granular material of suitable thickness shall be provided for blanketing the sub grade. Payment to be made for this separately.

### **Materials :**

The material to be used for the work shall be over burnt clay bricks, natural moorum, or crushed stone.



## ANTI-TERMITE TREATMENT

### SCOPE:

The scope of work is to set up a chemical barrier against attack by subterranean termites in the areas like cable trenches, control room etc.

### General:

All work shall in general be executed as specified in IS: 6316 (Part-II) 1971. All necessary work to ensure uniform distribution and proper penetration of treating solution shall be done according to the instruction of the Engineer-in-charge. Soil treatment shall not be done when it is raining or when the soil is wet with rain or subsoil water. Once formed, the treated soil barrier shall not be disturbed.

### Chemicals and Rate of Application:

Any of the following chemicals (conforming to relevant Indian Standards) in water emulsion shall be supplied by pressure pumps uniformly over the area treated :-

Chemical	Concentration by weight percent.
Deildrin (IS:1052-1962)	0.5
Aldrin (IS:1306-1958)	0.5
Chlordane (IS:2863-1964)	1.0
Heptachlor	0.5

In case the chemical specified above / in the respective item of the bill of quantity is not available then any equivalent make of the chemical may be used after getting the same approved by the Engineer-in-charge.

### Measurement for Payment:

It shall be measured for the area treated in sq.m. In case of building, the plinth area at ground floor shall be measured .

## TECHNICAL SPECIFICATIONS FOR FLOORS

### General:

The flooring provided in the control room hall, carrier room, officers / staff room, battery room and else where in the sub station shall be Terrazzo/Mosaic Flooring, C.C. flooring, Acid resistance tile flooring, Kota stone flooring, Industrial tiling, Vitrified tiling etc. as specified in the approved drawing.

### Terrazzo/Mosaic Floor

#### Scope:

This section covers the furnishing of all labour, materials and equipment and performing all operations, necessary to complete the terrazzo work.

Terrazzo flooring shall be placed in areas indicated on the drawings and finish schedule.

All terrazzo floors shall be finished with a non-slip surface.

Laying of terrazzo shall not commence in any area until the base surface is inspected by the E/I and found by him to be in satisfactory condition to receive the topping.

**Materials:**

Cement shall be Portland cement in accordance with 1489(Part-1)1991 Sand shall be coarse screened, washed sand, free of organic materials in accordance with IS:650.

Marble shall be of standard quarry product or machine crushed of sizes 4 mm or below and of specified colour and uniform grade as directed by Engineer-in-charge.

**Installation / laying**

All phases of workmanship including preparation of structural slabs, under-bed, terrazzo mix installation, curing, grinding, grouting, finishing, sealing and treating etc. shall be in accordance with the following specifications.

Terrazzo/mosaic floors shall be 35 mm thick consisting of 25 mm thick cement concrete (1:2:4) under layer and 10 mm terrazzo topping or other wise as specified in the drawing.

The surface over which the under layer is to be laid shall be leveled by chipping if necessary, thoroughly cleaned of dust etc. wetted and cement slurry applied before placing the cement concrete.

The terrazzo floor shall be laid in panels of 1m x 1m or less with 4 mm glass strip dividers as per directed by Engineer-in-charge.

Terrazzo topping shall be 10 mm thick and shall consist of white cement, marble powder, marble chips and water. The white cement and marble powder shall be mixed in the ratio of 1:3 (1 marble powder and 3 cement) by weight. Colouring matter shall be mixed dry thoroughly with the marble powder mixture and the marble chips added in the ratio of 1:1 and 1/2 (1 cement marble powder mixture and 1 and 1/2 marble chips) by volume and mixed thoroughly to get a uniform mix of all the materials. The full quantity of dry mixture of mortar required for it shall be prepared in a lot in order to ensure a uniform colour. This mixture shall be stored in a dry place and well covered and protected from moisture. The dry mortar shall be mixed with water as and when required. The mixed mortar shall be homogeneous stiff and contain just sufficient water to make it workable.

The terrazzo topping shall be laid in alternate panels. It shall be laid when the under layer is still plastic, but has hardened sufficiently to prevent cement from rising to the surface, this is normally achieved between 18 to 24 hours after the under layer has been laid. Cement slurry preferably of the same colour as that of the terrazzo topping shall be brushed on the surface immediately before laying is commenced. It shall be to a uniform thickness slightly more than that specified in order to get the specified finished thickness after rubbing. The surface of the top layer shall be trowelled over, pressed and brought true to required level by a straight edge and steel floats in such a manner that the maximum amount of marble chips comes up and are spread uniformly over the surface and no part of the surface is left without chips.

**Curing, Grinding/Rubbing, Polishing & Finishing :** After 36 hours after laying the top layer, the surface shall be watered and ground evenly with machine fitted with special rapid cutting grit blocks of coarse grade (No. 60) till the marble chips are evenly exposed and the floor is smooth. After the first grinding, the surface shall be thoroughly washed to remove all grinding and covered with a grout of cement or/and colouring matter in same mix and proportion as the topping in order to fill any pin holes that appear. The surface shall be allowed to cure for 5 to 7 days and then ground with machine fitted with fine grit blocks (No. 120). The surface is cleaned and repaired as before and allowed to cure again for 3 to 5 days. Finally the third grinding shall be done with machine fitted with fine grade grit blocks (No. 320) to get even and smooth surface without pin holes. The finished; surface should

show the marble chips evenly exposed. Polishing shall be done by machine. Where use of machine for polishing is not feasible or possible, rubbing and polishing shall be done by hand, in the same manner as specified for machine polishing except that carborundum stone of coarse grade (No. 60) shall be used for the 1st rubbing; stone medium grade (No. 80) for second rubbing and stone of fine grade (No. 120) for final rubbing and polishing. After the final polish either by machine or by hand, oxalic acid shall be dusted over the surface @ 33 gm. per square metre sprinkled with water and rubbed hard with a namadah block (Pad of woolen rags). The following day, the floor shall be finished clean. Curing shall be done by suitable means such as laying moist saw dust or by ponding water.

**Method of Measurement:**

The measurement shall be in square metres. The length and width being measured from the finished faces of skirting or dado as the case may be correct to a cm. for floor and for dado or skirting from finish floor to the top of skirting or dado. No deductions shall be made for any openings upto  $0.1 \text{ m}^2$ . The glass strip dividers shall be measured and paid for separately in running metres.

**Concrete Floors**

**Scope:**

This section covers the furnishing of all materials, labour and equipment and performing all operations necessary to complete the concrete floor.

**Materials:**

Concrete for floor topping shall be in proportion 1:2:4 (1 cement, 2 coarse aggregate : 4 stone aggregate 20 mm and below) consistent with requirements of this section of the specification. The thickness shall be kept as 25/40 mm unless other wise specified in the drawing.

**Installation:**

The concrete floor shall be laid in panels 1m x 1m or less separated by glass strip. Alternate panels shall be laid in one followed by the other group of alternate panels the next day.

The concrete shall be laid in the panels and tamped with wooden mallets till a cream of mortar covers the structures.

The junction of floor and walls, floors, and dado or skirting shall be rounded off as directed without any extra payment.

**Method of Measurement:**

Measurement of flooring shall be in square meters. The length and width shall be measured from the finished faces, correct to a cm. No deductions shall be made for any openings upto  $0.1 \text{ m}^2$ . The glass strip shall be paid for separately in running meter.

**TECHNICAL SPECIFICATION FOR CERAMIC TILES**

The section covers the furnishing of all labor materials and equipment and performing all operations necessary to complete al interior and exterior tile work in accordance with the drawing and specifications.

**Material:**

Glazed and unglazed tiles shall be of dense and fine grained hard-burnt clay suitable for use on wall faces. Tiles shall not be less than 6 mm in thickness. Water absorption shall not

exceed 0.005%. Caps, bases, inside and outside corners trimmed all required. Special shapes shall be provided for a complete installation Colour and pattern shall be as selected by the Engineer.

**Preparation Of Surface:**

Before fixing tiles the vertical surfaces of the walls shall be cleaned and thoroughly wetted. In case of masonry walls the joints shall be raked out and in the case of concrete, the surface shall be hacked and wire brushed.

**Installation:** Tiles shall be installed using the conventional method as described ahead. A bed of 10

mm thick mortar consisting of Portland cement and sand in the proportion of 1:3 mix shall be laid. Before the plaster has hardened; the back of each tile shall be covered with a thin layer of neat Portland cement slurry and tile shall then be gently tapped against the wall with wooden mallet. The sides of the tiles shall be coated with white cement slurry and butt jointed. The joints shall be as thin as possible.

Ceramic wall tile shall be accurately laid out with horizontal joints level and vertical joints plumb.

Finished surface shall be flat and free from perceptible imperfections.

In completion of tile work all surface shall be flat and free of mortar spots, laitance and loose particles. All finished surfaces shall be finally cleaned after at least 7 days of curing with a mild solution of soap and water and thoroughly rinsed. No acid shall be used to clean tile work.

**Measurements:**

The measurements of this item shall be based on the area (sq. metres) actually covered by the tiles. **Kota Stone flooring / Industrial tiling / Vetrified tiling**

The work includes providing and fixing of Kota stone slab floor 25 mm thick/ Industrial tiling / Vetrified tiling floor over 20 mm thick base of 1:6 mortar laid over joint filled with gray cement slurry mixed with pigment to match shade of slab/tile including grinding, rubbing and polishing by hand or machine as required and finally finished with french mansion polish or equivalent as per direction of Engineer-in-Charge.

**TECHNICAL SPECIFICATION FOR ACID RESISTANT TILE FLOORING**

**Scope:**

This specification covers furnishing of all materials, labour and equipment, and performing all operations necessary to complete the laying of acid resistant tile work wherever indicated in the drawings.

**Materials :**

**Acid Resistant Tiles:**

The tiles shall be of ceramics unglazed vitreous material conforming to IS : 4457 and of approved colour and make. The tiles shall be sound, true to shape, flat and free from flaws and other manufacturing defects. They should be guaranteed to resist sulphuric acid in battery room. Manufacturer's certificate in this regard shall be submitted before the work is undertaken in addition to the tests required to be conducted for acid resistant tiles as given in IS : 4457. Size of the tiles shall be 198.5 mm x 198.5 mm x 20 mm. The tolerance in length, breadth and thickness of tiles shall be  $\pm 2\%$ . The depth of groove on the underside

shall not be more than 3 mm. When soaked in water, they shall not absorb more than 2 percent of their own dry weight of water. The compressive strength of the tiles shall be not less than  $700 \text{ kg/cm}^2$ . When soaked in acid, the loss in their weight shall not be more than 1.5% of their own dry weight.

**Acid/Chemical Resistant Cement:**

The acid/chemical resistant cement shall be supplied in powder or in syrup form to meet the requirements of acid and chemical resistance. The cement shall be resistant to sulphuric, hydrochloric acid, sodium hydroxide, calcium hydroxide and other chemicals.

The cement used for the acid resistance work shall be in accordance with the recommendations of the manufacturers of the tiles/ bricks. The tensile strength of the tile shall not be less than 35 kg/sq. cm. Its adhesion to tiles shall not be less than 8 kg/sq. cm. Its compressive strength at 7 days and 28 days respectively shall not be less than 140 kg/sq. cm. and 350 kg/sq. cm. The cement shall conform to IS: 269.

**Painting of acid/chemical resistant paint:**

Acid/chemical resistant paint shall be of approved quality and painting shall be done as per specifications given for painting and finishing. At least three coats of paint shall be given and the drying time between consecutive coats shall be not less than 5 hours.

**Acid / chemical resistant mastic :**

The pieces of the acid/chemical resistant mastic shall be put into a tar or asphalt boiler and heated. The boiler shall be kept in motion so that the mastic does not get burnt. The mastic shall be heated to a temperature of  $150^{\circ}\text{C}$  to  $300^{\circ}\text{C}$  and is applied in 6 mm layers to the cleaned and dried surface. Hot molten mastic only is applied and proper joint shall be made by keeping correct temperature. The specified thickness of acid / chemical resistant lining shall be made by painting in the above manner in layers of 6 mm thickness.

**Acid proof / chemical resistant lining:**

It is required to be done at a vertical surface. The following procedure shall be adopted. After cleaning and draining the surface, it shall be covered with three coats of bituminous corrosion resistant paint. Holes shall be drilled to a depth of 40 mm at 275 mm centre to centre. Fibrous plugs of 30 mm shall be inserted into these holes 18 gauge expanded metal shall be fixed in position on the wall by using 40 mm and 25 mm washers and screws fitted into the plugs already inserted. After fixing the expanded metal, it shall be painted with 25 mm thick chemical resistant bitumen which is applied in layers of 6 mm thickness.

**Safety:**

The contractor shall be responsible for the safety, suitability and efficient functioning of the acid/chemical resistant lining. He shall have to give a guarantee for efficient performance of the lining for a period of five years from the date of the commissioning of the unit. During this period of five years if at any stage, it is found that; the lining has given away or has not been functioning satisfactorily, the same shall be made good by the contractor at his own cost.

**Measurement:**

Measurement shall be based on the area covered with acid proof / chemical resistant lining and unit of measurement shall be sq. m.

## **MISCELLANEOUS STEEL ERECTION**

### **Scope:**

This section covers the technical requirements for the erection of all miscellaneous steel parts by the contractor. The extent and type of miscellaneous steel to be erected shall be as per the detailed drawings.

### **Materials:**

The miscellaneous steel shall be furnished to the Engineer-in-charge, detailed and fabricated in accordance with the requirements as indicated in the detailed drawings. The miscellaneous steel shall be furnished within the project area and the contractor shall make his own arrangements at his cost to transport the same to the work site.

Miscellaneous steel parts shall include items such as Anchor bolts, pipe sleeves, puddle, flange through floors and walls, equipment mounting plates, steel pieces for setting in or attachments to turbine generator foundation, steel pieces for setting in or attachment to pump house and discharge structures, hoist structures, ladders, roof ventilator support frames, steel pieces set in concrete for trench digging, frames and floor plate covers, concrete inserts, expansion bolts, auxiliary framing for equipment supports, miscellaneous frames, loose lintels etc. Erection of material shall include setting in forms for connecting in place and grouting as required. The grouting operations shall be performed as per the direction of the Engineer.

The above list provides only as an illustration of the type of steel items to be considered as miscellaneous steel and some items listed may not appear in the actual miscellaneous steel to be erected. It shall not also be construed as limiting the materials to be erected specifically to such items only.

The contractor shall erect all miscellaneous steel in accordance with the drawings and these specifications including setting materials in concrete or grouting pieces in place furnishing all labour, materials scaffolding and services necessary for an incidental to its transporting unloading, storing, handling and erection. The contractor shall furnish welding rods and arrange for field welding as required in accordance with IS:816.

### **Installation:**

During erection, the contractor shall provide necessary temporary bracing or supports to ensure proper installation of the materials. All materials shall be erected in true location as shown in the drawings, plumb and level.

The Engineer-in-charge will furnish copies of the shop and assembly drawings prepared by the fabricator of the miscellaneous steel showing the necessary information for erection.

### **Measurements:**

The measurements for this item shall be based on the calculated weight of steel installed in kg. correct to the second place of decimal.

## TECHNICAL SPECIFICATION FOR GROUTING

### Scope:

These specifications cover the furnishing of all labour, materials and equipment and performing of all operations necessary to complete the work of grouting of block cuts, foundation bolt holes and space between bottom of base plate and top of foundation concrete.

### Material

Cement shall conform to the stipulations contained in IS: 8111 (Part-1) 1991. Sand shall conform to the stipulations contained in IS: 383 and shall have fineness modulus not exceeding 3 and not less than 2.5.

Water shall be clean and fresh and shall be of potable quality.

Aluminum powder or anti-shrinkage admixture of standard brand from a reputed manufacturer shall be used. Instead, "shrinkomp" by ACC Ltd. which is a ready mix concrete containing anti-shrinkage admixture can also be used. Materials to be used shall be got approved by the Engineer prior to their use on work.

The block-cuts and bolt holes which have to be grouted shall be cleaned thoroughly by use of compressed air immediately before taking up the grouting operations.

Grouting shall be adopted for filling block-cuts, foundation bolt holes and space between the underside of base plates and top of foundation concrete. Thickness of grouting under the base plate shall not be less than 50 mm. Mortar made up of cement and sand in the proportion of 1:1 by weight and blended with aluminum powder (about 0.005% by weight of cement) of anti-shrinkage admixture in a suitable proportion to the cement mortar in accordance with the recommendations of manufacturer and subject to the approval of the E/I, shall be used.

Cement, sand and aluminum powder or approved anti-shrinkage admixture shall first be blended thoroughly in the required proportion. The mortar shall then be prepared by mixing with a quantity of water which will produce a sufficiently workable mix to enable complete and proper compaction of the mortar.

Alternatively "shrinkomp" by ACC Ltd. a ready mix concrete will be mixed with water to produce a sufficiently workable mix to enable complete and proper compaction of the mortar.

The mortar will then be placed in the block-cuts and bolt holes either from the sides or through holes provided for this purpose in the base plate. It shall be ensured by rodding and by tapping of bolts that the block-cuts are completely filled without leaving any voids. The pouring shall cease as soon as each hole is filled and any excess grout found on the surface of the concrete foundation shall be completely removed and the surface dried. For placing mortar between the bottom of base plate and top of foundation concrete, steps shall be taken to ram the mortar that oozes out through the bolt holes in the base plate. When it is clear that the centre of the base plate has been properly filled, the mortar outside the base plate shall be briefly rammed to ensure compaction below the edges.

Any mortar, which has been mixed for a period longer than half an hour, shall not be used in the work.

**Curing:** The work shall be cured for a period of at least 7 days commencing after 12 hours after the completion of the grouting operations. The curing shall be done by covering the surfaces with wet gunny bags.

**Measurements:** Measurement for grouting shall be in cubic decimetres correct to the second place of decimal. Measurement for grouting shall be calculated by volume of the block-cut or bolt holes including the space between the under side of the base plates and the top surface of foundation concrete as per the dimensions shown in the drawing. No deduction shall be made for bolts, shims, shear keys and such other embedments in the block-cuts or bolt-holes. The unit rate is inclusive of the cost of admixtures etc. and curing.

### **TECHNICAL SPECIFICATION OF BALLAST FOR FILLING THE PITS OF TRANSFORMERS AND REACTORS**

**Scope:**

This section covers technical specification for the supply of stone ballasts for filling the soak pits of transformers and reactors and furnishing of all labour, materials, equipment, transport etc. and performing of all operation necessary to complete the work of ballast filling in soak pits as per approved drawings and instruction of Engineer-in-charge.

**Materials:**

The bolders shall be of nominal size 75 to 100 mm conforming to IS : 383 (latest). The aggregate passing through 60 mm sieve shall not be used. The aggregate shall not be weathered and shall not contain foreign and any deleterious material.

The grading of ballasts shall be such as to achieve 40% voids after filling them in soak pits.

**Filling of Soak pit:**

The required quantity of ballast shall be brought to site and stored in regular stacks. The filling of ballast shall be carried in horizontal layers of about 300 mm taking the material from successive stacks. The filled with ballast shall be properly tamped and leveled by rakes etc.

The final layer shall be laid slightly higher than the finished level and brought to required level by tamping. The finished surface of ballast shall be regular and uniform.

**Measurement:**

The measurement of above work shall be done in cubic meters of ballast filled, correct upto second place of decimal. The unit rate is inclusive by the cost of all materials labour T & P etc. required for completing the job as per approved drawing and instruction of Engineer-in-charge.

### **TECHNICAL SPECIFICATION FOR FENCING, GATES AND SIDE BARRIERS**

**Scope:**

This section covers the supply of all materials furnishing of all labour, equipment etc., and performing of all operations necessary to complete the installation of fencing poles, fixing of woven G.I. plain wire mesh (chain link-mesh) 50 mm x 50 mm of 8 gauge in fencing, providing and fixing barbed wire fencing and supply, fabrication and erection of structural steel gates and side barriers, etc, complete in accordance with these specifications and approved drawings.



**Materials:****Structural Steel:**

The material required for the gates shall consist of steel conforming to IS:226 **Woven Wire mesh ( Chain link mesh):**

It shall be made of G.I. plain wire of 8 gauge and conform to IS : 2721.

**Barbed wire :** Barbed wire shall be of G.I. and it shall conform to IS : 278. The base metal of the line and point wire shall be of good commercial quality mild steel. Wire shall be free from scales and other defects and shall be uniformly galvanized. The wire shall be in continuous lengths and shall be generally free from signs of welds. It shall be able to withstand wrapping and unwrapping eight turns round the diameter.

**Fabrication of Gates and Side Barriers :**

All the gates required for installation in the security fencing shall be fabricated by welding the required sections as indicated in the detailed drawings. The welding & fabrication of the gates shall be done in accordance with IS:823 and IS:800.

All operations like cutting, bending, shaping, formation of ornaments, shapes etc. as required in the drawing shall be carried out in accordance with the drawings.

After the fabrication of the gate, the gate shall be cleaned thoroughly by use of wire brushes or by emery paper and shall be painted with three coats of an approved paint, of approved colour conforming to specifications and approved by the Engineer-in-charge.

For facilitating easy movement of gate wheels of suitable size shall be provided at the bottom of the gates and these shall be provided with metal track consisting of 'T' section of structural steel of adequate flange width to accommodate the wheel. These T-sections shall be provided in curved shape to follow internal end, i.e. inside the switchyard area, a suitable steel catch shall be provided which shall be capable of moving up and down in the process shall be able to hold the gate in position or release the same. The T-section forming the track for the movement of the wheels and catch for holding or releasing the gate shall be embedded in M-15 concrete. The top surface of the track shall be finished flush with the concrete finished ground level of the switchyard areas.

Steel gates, pillars shall be embedded in RCC M-20 for which specification has already been dealt elsewhere and the same shall be referred to.

**Fencing Posts :**

The fencing posts shall consist of structural steel angles of size 65 mm x 65 mm unless otherwise specified on approved drawings. The height of fencing posts shall be about 2.95 metre. and centre to centre spacing 2.5 mts. unless specified otherwise on approved drawings. The fencing posts shall have necessary holes, welded cleats having holes and straining bolts etc. necessary for fixing chain link mesh. The inclined angle portion shall also have provisions (holes etc.) for fixing barbed wire as shown on the drawing.

**Applying Red Oxide Primer / Painting :**

All steel members used in fabrication of mild steel gates and fencing shall be given one coat of red oxide primer in shop after fabrication except the portions which shall get embedded in concrete. The cost of one coat of red oxide painting shall be included in the item rate of the respective M.S. work.

After erection, they shall be finished and painted with two coats of paint of approved shade and quality. For specifications, refer specification under subhead "painting and finishing".

**Installation of Fencing Posts:**

The fencing posts shall be embedded in concrete blocks of mix 1:2:4 of suitable dimensions as shown in approved drawings.

Every 5th post, the last but one end post and the corner post shall be strutted on one side only by the angles of the same section as adopted for the main fencing posts. These struts, shall also be embedded in concrete blocks of M 15 grade concrete and of suitable dimensions as indicated on approved drawings.

The connections of struts with the main fencing posts shall be by means of bolts of 12 mm dia.

The embedded ends of the main posts and the struts shall be split to a length of 150 mm before embedment in concrete. The splitting of angles shall be as shown on approved drawings.

**Fixing of Woven wire mesh (chain link) fencing :**

The woven wire mesh ( chain link) shall be made of G.I. plain wire of 8 gauge with mesh size 50 mm x 50 mm, conforming to IS:2721. The chain link mesh shall be fixed to fencing posts by providing 50

mm x 6 mm flats unless otherwise specified in the approved drawings, running throughout the length of fencing. The chain link mesh along with the flats shall be bolted to fencing posts and intermediary location i.e. between fencing posts. The mesh shall be fixed securely to the flats by providing bolts at the spacing not exceeding 1.0 M. The complete fixing details of chain link mesh shall be as per approved drawings.

**Fixing of barbed wire fencing :**

The barbed wire shall be stretched and fixed in number of rows as specified in the drawings and two diagonals as shown in the drawing. The diagonal shall be stretched between the adjacent posts from top wire of one post to the bottom wire of second post. The barbed wire shall be held to the steel post by means of G.I. staples. Turn buckles and straining bolts shall be used at the end posts if so specified.

**Method of Measurement for Mild Steel Work in Fabrication of Gates :**

The measurements of individual members forming the gate shall be separately taken and the total weight of the gate worked out from the weight of these members. The unit weight of various sections used for fabrication of the gate shall be obtained from the I.S. hand book of steel sections. The anchors provided for supporting the gate shall also be paid on the basis of their weight. The unit of payment shall be quintal (the total weight shall be worked out upto 2<sup>nd</sup> place of decimal) and the same shall be paid against the item of M.S. work in built up section. The unit rate quoted for the item of the gate is inclusive of excavation and refilling, laying of lean concrete, plastering etc. complete, cleaning the surface after fabrication, application of three coats of the approved paint of suitable colour approved by the Engineer-in-charge. The anchors for steel track shall however be paid on the basis of their weight. The cost of one coat of red oxide primer on all members of the gate shall be included in this item and nothing shall be paid extra on that account. However the enamel painting on the same shall be paid for separately.

**Measurement for Payment of Mild Steel angle iron fencing posts :**

The weight of all the structural steel, angles and flats etc., used in the fencing work shall be worked out in the manner described above for the gates i.e. by measuring the lengths each and every member (angles and flats etc.) used in the fencing and converting them into their corresponding weights as per their standard unit weights taken from Indian standard Hand

Book. The above weight shall be calculated in quintals upto 2<sup>nd</sup> place of decimal but the payment for these mild steel work shall be paid against the item of steel work in single section. The payment of welding required for joining the inclined portion with the vertical portion of the fencing posts and cleats / bolts etc. shall be paid for separately. Bolts shall also be paid for separately but M.S. angle cleats shall be included in the structural steel work of fencing. The cost of one coat of red oxide primer on all structural steel members of the fencing shall be included in this item and nothing shall be paid extra on that account. However the enamel painting on the same shall be paid for separately.

**Measurement for Payment of Woven Wire Mesh (Chain Link Mesh):**

It shall be on the basis of the area covered by the woven wire mesh in fencing and shall be measured and paid for in square metre (measured upto 2<sup>nd</sup> place of decimal).

**Measurement for Payment of Barbed Wire :**

It shall be measured per running metre of single barbed wire line & converted in to weight and paid accordingly.

**Measurement for Payment of Concrete used in grouting / embedment of steel gates / fencing posts :**

The measurement of the concrete used for the above job shall be made in cubic metre and paid for separately.

**Excavation and Back filling :**

All excavation required for the foundation work of vertical posts of fencing, gates and size barriers etc. shall be carried out in accordance with stipulation of clause under subhead 'Earthwork'.

**Measurement for Excavation :**

The measurement for excavation of earth shall be done in cubic metre and paid for separately against respective items.

**TECHNICAL SPECIFICATION FOR TRENCH COVER, M.S. FRAME AND REINFORCEMENT OF TRENCH COVER AND M.S. ANGLE IRON NOSING / EDGING OF TRENCH WALLS**

**Scope :**

This covers the design, casting of trench covers with cement concrete 1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size) 40 mm thick or 45 mm thick as may be specified in the items of the bill of quantity in M.S. angle frame with reinforcement bars welded to it as per approved drawings along with necessary bar handles welded / fixed in the concrete covers. This also includes necessary arrangements / preparation of plate form with necessary release agents for casting of the C.C. covers. It also includes providing and fixing of M.S. angle nosing / edging at the top of the trench walls as shown on the approved drawings with necessary lugs grouted in C.C. blocks 1:2:4 of size 10 cm x 10 cm x 10 cm the size of M.S. angle shall be as per approved drawings.

**Design :**

The trench covers shall be designed for a live load of 2 MT. Per sq. m. for working out the reinforcement etc. unless otherwise specified by the E/I.

**Measurement for Payment :**

The trench covers of C.C. 1:1.5:3 mix of specified thickness shall be measured by its area in sq. m. and paid against respective item of bill of quantity. The reinforcement bars and the M.S. frames shall be measured by weight in quintal after noting their lengths and multiplying them by their respective unit weights as per IS Hand Book and these shall be paid against item of mild steel work in built up section. The structural steel of M.S. angle in nosing / edging of top of cable trench walls including lugs for fixing shall be measured and paid by weight against the item of mild steel works in single section. Welding required for fixing of lugs to angle nosing shall be paid for separately. All the above steel members shall be painted with a priming coat of red oxide paint. Besides, nothing extra shall be paid for arrangement / preparation of platform for costing of the C.C. covers as this shall also be included in the item rate.

**TECHNICAL SPECIFICATION FOR PLINTH PROTECTION****PLINTH PROTECTION :****Scope :**

This covers the cost of furnishing all labour, material, equipment and the performing of all operations as detailed below etc. complete.

**General :** This shall be provided as specified or as directed by the Engineer-in-charge. It consists of 25mm thick cc floor laid over 75mm thick lean concrete of 1:6:12 mix. Plinth protection shall be laid down with a minimum outward slope of 1 in 25.

**Materials :**

For cement, concrete, aggregate and masonry work, refer to the specification under the sub-head "Cement", "Concrete", "Aggregate" and "Masonry Work" described elsewhere in this volume.

**Brick Aggregate :** This shall be broken from well burnt or slightly over-brunt and dense brick bats. It shall be homogeneous in texture, roughly cubical in shape, clean and free from dirt or any other foreign matter.

**Preparation of ground :**

The ground shall first be prepared to the required slope around the building. The high portions of the ground should be cut down; hollows and depressions filled up to the required level from the excavated earth and rammed so as to give uniform outward slope. All cuttings and fillings are included in this. Bed shall be watered and rammed with heavy iron square rammers.

**Sub-grade :**

This shall be made up with 75 mm thick bed of brick aggregate of 40 mm nominal size. This shall be spread over the prepared ground to a depth of 75 mm with a minimum outward slope of 1:25. Aggregate shall be carefully laid and packed, bigger size being placed at the bottom. The brick aggregate shall be consolidated dry with heavy iron rammer.

After the brick aggregate has been consolidated to the required slope, the surface shall be evenly grouted with fine sand at the rate of 0.06 cubic metres per square metre and slightly sprinkled with water and again rammed with heavy iron rammers.

**Concrete Topping :**

After the sub-grade has been compacted thoroughly, 25 mm thick plain cement concrete of M-15 grade (1 cement : 2 fine aggregate : 4 coarse aggregate) shall be laid and properly, compacted and finished.

**Measurement :**

This shall be measured in square metres correct to the second place of decimal. No deduction shall be made nor paid for any openings for the pipes etc. Upto 0.1 sq. metres.

**TECHNICAL SPECIFICATION FOR CULVERT / DRAINAGE SYSTEM****Scope :**

This section covers the draining of water (including rain water) from sub-station / switchyard areas. Drainage shall be carried out by

- i) Culvert.
- ii) Drains.

**Culverts :**

Culvert shall be constructed as per approved drawing.

**Drains :**

This work consist of constructing surface or sub-surface drains in accordance with the requirements of these specifications and to the lines, grades, dimensions and other particulars shown in the drawings or as directed by the Engineer-in-charge. Schedule of work shall be so arranged that the drains are completed in proper sequence with roadway and pavement works to ensure that no excavation of the completed works is necessary subsequently or any damage is caused to these works due to lack of drainage.

Surface drains shall be excavated to the specified lines, grades, levels and dimensions. The excavated material shall be removed from the area adjoining the drains and, if found suitable, utilized in embankment construction. All unsuitable material shall be disposed off as directed.

The excavated bed and sides of the drains shall be dressed to bring these in close conformity with the specified dimensions, levels and slopes.

Where so indicated, drains shall be lined or turfed with suitable materials in accordance with details shown on the drawings.

All works on drain construction shall be planned and excavated in proper sequence with other works as approved by the Engineer-in-charge, with a view of ensuring adequate drainage for the area.

Detailed specification of C.C. drain has already been covered in the specifications of brickwork, cement concrete, plastering and painting etc. and may be referred.

**TECHNICAL SPECIFICATION FOR SITE CLEARANCE**

Before the earth work is started, the area coming under cutting and filling shall be cleared of shrubs, wild vegetation, grass, bushweed, trees and saplings of girth upto 30 cm and rubbish removed upto a distance of 50 metres outside the periphery of the area of corporation.

The trees of girth above 30 cm. measured at height of one metre above ground, shall be cut only after permission of the Engineer-in-charge, is obtained in writing.

**Levelling of site :** This includes excavation and back-filling and other leveling operations involved. The materials for leveling the site at required level shall be obtained from the approved sources with preference given to materials becoming available from nearby areas. All the excavated materials shall be the property of UPTPCL. Where the excavated materials is directed to be used in the filling of the site, it shall be directly deposited at the required location.

All hard materials such as hard moorum, kankar rubble etc. not intended for use shall be stacked neatly for future use as directed by Engineer-in-charge. The ground levels shall be taken at 15-20 metres intervals or at closer intervals where local mounds, pits, or undulations are met with. The ground levels shall be recorded in field books for plotting on plans. The labour required for taking levels shall be supplied by the contractor at his own cost.

The actual measurements of the filling shall be calculated by taking levels of the original ground before start of the work after site clearance and after compaction of the filling material by heavy mechanical machinery at optimum moisture content as per IS : 2720 (Part VII), no deduction for voids shall be done in the quantity of earth work so computed.

