



**SPECIFICATION FOR  
CIVIL, STRUCTURAL  
AND  
ARCHITECTURAL WORKS**

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# **GENERAL TECHNICAL SPECIFICATION (GTS)**

## **CIVIL, STRUCTURAL & ARCHITECTURAL WORKS**

### **PART-A SCOPE OF WORK & PREAMBLE TO SOR**

#### **1. CIVIL, STRUCTURAL AND ARCHITECTURAL WORKS**

##### **1.1. GENERAL**

The consortium of Dinesh Engineers Ltd., Resonance Energy Pvt. Ltd., and Tolani projects Pvt. Ltd has been authorized by PNRB in 11 round of bidding for four Geographical Areas (GA's) of

- a) Mandi, Kullu, Kinnaur, and Lahaul & Spiti districts in the state of Himachal Pradesh,
- b) Bikaner & Churu districts in the state of Rajasthan
- c) Pauri Garhwal, Uttarkashi, Rudraprayag, Tehri Garhwal districts in the state of Uttarakhand,
- d) Pithoragarh, Almora, Champawat, Chamoli & Bageshwar districts in the state of Uttarakhand

The consortium has established three companies namely Gasonet Service (HP) Ltd, Gasonet Service (RJ) Ltd, Gasonet Services (UK) Ltd, and GA of one and two above has been transferred to GA of Gasonet Services (HP) Ltd, Gasonet Services (RJ) Ltd respectively and GA of 3 and 4 above has been transferred to Gasonet Services (UK) Ltd

##### **1.1. SCOPE OF SUPPLY**

Contractor shall procure & supply to the site all the materials including cement, reinforcing steel, steel sections, plates, pipes, MS Angle, Chain link fencing, chequered plate, Colour coated steel sheets, False ceiling, mesh, and other accessories, other masonry materials, bitumen/asphalt, admixtures & bonding agents, sealants, kerb stones, paver block, sand, boulder, etc., and any other construction material / item required to complete the civil & structural works.

All costs towards testing/inspection of materials/goods shall be borne by the Contractor.

##### **1.2. SITE WORK**

Complete construction work including supply of labour, construction materials, construction equipment, survey, tools & tackles, dismantling & modification / strengthening, supervision, testing etc. required to complete all the structures, foundations, drains, pavements, finishes, supply, fabrication, erection of steel structures, hoarding, Loading unloading platform, LCV Platform, cat ladder, welded wire mesh fencing and gates etc, painting, including site grading/earthwork in cutting & filling etc. as specified and required to complete the civil works in all respect.



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All enabling works e.g. construction water tank, casting/fabrication yard, electricity, site stores & office, safety and security measures, coordination with other contractors working at site etc. shall be Contractor's responsibility.

Special permits such as 'Hot Permit', 'Fire Safety Permit', "permissions for controlled blasting of rock from concerned authorities" etc. to work at terminals shall be contractor's responsibility.

## **2. SCOPE OF WORK**

The scope of work shall be broadly, but not limited to, the following:

- 2.1.1. Site grading of the plot by removing 150 mm topsoil, stacking it properly and reusing it for planting purposes, including plot development by filling good quality earth as required.
- 2.1.2. Earth filling in embankments for external roads wherever required with providing of RCC Culverts/ Pipe Culvert.
- 2.1.3. Clearing the site, removal of bushes and trees etc as per site requirement.
- 2.1.4. Construction of a 3m / 2m high boundary wall with brick masonry, PCC Coping, with brick pillar at regular intervals etc as per drawing.
- 2.1.5. RCC cable trenches: complete civil works for cable trench including providing inserts, conduits (GI, PVC or HDPE etc.) and PVC coated MS Chequered cover plate / Precast concrete covers as per requirement.
- 2.1.6. Construction of single and double S.S. tube trench as per drawing.
- 2.1.7. Construction of compressor foundation as per drawing.
- 2.1.8. Construction of facilities like 'odourising unit', Green belt etc as per drawing.
- 2.1.9. Construction of Dispenser foundation etc as per relevant drawings.
- 2.1.10. Construction of fore court, approach roads etc. as per drawing.
- 2.1.11. Construction of cable pit, earth pit, drains pits etc as per requirement.
- 2.1.12. Construction of Septic Tank along with Soak Pit and connections.
- 2.1.13. Storm water drainage system in RCC/brick drains with complete civil works as per requirement.
- 2.1.14. Laying of Hume pipes for drainage as per drawing and requirement of site.
- 2.1.15. Construction of Utility/Office building – Control room, Office room, Storeroom, UPS and Battery Room, Electrical Room etc as per relevant architectural drawings.
- 2.1.16. Construction of Bore well as per supplier specification and direction of Engineer in charge.
- 2.1.17. 100 mm thick PCC paver block over sand cushion over ground/on a PCC base (Grade M-10) at locations as specified.
- 2.1.18. Laying PCC kerb stones 125mm x 300 mm over 75 thick PCC base (Grade M-10) as specified.
- 2.1.19. Grouting of all base plates/frames of equipment foundations and structural



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bases.

- 2.1.20. Providing of all inserts, conduits, pre-cast covers, fixing of free issue items into permanent works etc.
- 2.1.21. Providing of approved quality sand for back filling as per requirement.
- 2.1.22. Clearing all construction debris and handing over completed work site.
- 2.1.23. Any other work not specifically mentioned but required to make the station functional.
- 2.1.24. Making as-built details/drawings on one set of construction drawings and return to owner.

### **3. PREAMBLE TO SCHEDULE OF RATES – GENERAL**

The Preamble to **Schedule of Item** is an integral part of the SCHEDULE OF RATES and rates and this is to be considered incorporated into the description of items themselves. For related drawings reference be made to Annexure-I.

The Contractor's rate for any item of work in the schedule of item shall, unless stated otherwise be held to include the cost of all materials including wastage, conveyance and delivery, unloading, storing, fabrication, hoisting, all labour for finishing to required shape and size, tools and plants, power fuel, consumables, all taxes & duties royalties, other revenue expenses, temporary facilities like roads etc.

The item shall include all the safety provisions listed below:

- The site should be cordoned off on all sides by way of 3 Mt. High corrugated GI sheet fixed on metal pipes/angles, leaving space for only a Gate. This fencing should be fixed such that it is not possible for anyone to enter the site from any other location other than the Gate.
- The gate should be made in metal with metal sheet cladding. A guard restricting entry of all unauthorized person/material on site should man the gate. The guard shall also maintain a register of all persons visiting site.
- All persons including all labor, supervisors, visitors etc. on site must wear hand gloves, helmet and safety shoes. The responsibility of this shall rest with the main contractor.
- All workmen while working on height shall wear safety helmets.
- All workmen such as welders/ fitters etc. shall wear protective gloves, protective glasses etc. and as per the requirement and demands of the trade.
- All excavated pits/holes shall be cordoned off with red tape with warning notice.
- All inflammable material shall be kept in non-inflammable containers that are fixed with screwed on caps at all times. The containers should be marked with a danger sign and the name of the material shall be marked on the outside. There should be at least one person who should be responsible for the safe custody of these materials.
- All areas of work shall have appropriate safety signage depending on the



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nature of the work, prominently displayed to prevent any mishap, particularly signs in fluorescent paint for night vision. These signs should be visible from a reasonable distance for vehicular traffic at designated speed limits for a given road/ location. All necessary city traffic rules and signage specifications shall be observed with strict adherence.

- All gadgets must have required safety devices in working conditions as per the manufacturers' recommendations and the law of the country.
- All the persons on site must be insured against injury and death due to accidents.
- The contractor shall not use the site for any activity other than what it is authorized for.
- Children under the age of 18 shall not be allowed to work on site. The contractor shall prepare a secured crèche adjacent to the site, for the children of labor working on site and there shall be at least one person dedicated to look after the safety and other needs of these children at all times.
- All people working at the site shall be physically and mentally fit. The contractor shall ensure that no illegal activity takes place on site and that no person with a doubtful past shall be engaged on site.
- The contractor shall be responsible for the safety of all persons at site.
- Consumption of liquor and smoking shall not be permitted on the site.
- The site shall be illuminated at night when there is work in progress.
- The contractor shall maintain a First-aid box at site to take care of any minor injury.
- The storing of all inflammable/explosive material shall be done as per the laws of the country and best common practice.
- All temporary electrical connections shall be made with the help of insulated connectors to prevent any sparking etc.
- The contractor shall keep the Owner and Consultant completely indemnified by ensuring completely safe working, keeping a third party insurance cover on site.

#### **4. PREAMBLE TO SCHEDULE OF RATES**

##### **4.1. SITE CLEARANCE**

Complete works for the site clearing so that the site is suitable for construction activity. Brief description of major items shall be as follows:

- a) Dismantling of all existing structures in brick masonry/stone masonry/PCC etc. so that the site becomes suitable for construction activity.
- b) Disposal of all material to be cleared from the site to any authorised disposal site/ storage yard.
- c) Provide all assistance/co-ordination/liaison between any and all government/semi government agencies connected with the scope mentioned and also with the body owning/maintaining the access road to the site.



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*Note: Demolition of PCC/Brick Masonry, road will be paid in Cu.M.*

### **4.2. EARTH WORK IN CUTTING & FILLING**

Complete earthwork in Excavation of earth/municipal waste/ malba etc. & filling with available serviceable earth or borrow earth is included in the scope.

Brief description of major items shall be as follows:

- a. Taking pre-work and finished levels.
- b. Stripping and grubbing the top soil and preparation of sub-grade.
- c. Dewatering of excessive water.
- d. Strutting and shoring to retain the earth.
- e. Disposal of unserviceable and surplus earth to authorized dumping ground to any lead.
- f. Borrowing of approved quality good earth from any lead.
- g. Filling in layers of 150 mm.
- h. Watering and compaction up to 95% of its MDD with mechanical means.

Note :

- i) *Payments for item no. EW-1 shall be based on net volume of earth excavated.*
- ii) *Payment for item earthwork in filling shall be compacted net volume of filling after deductions of foundations, culverts, etc.*
- iii) *No separate payment for excavation for foundation / sewerage / forecourt or roadwork (since cost of earthwork is included in respective items).*

Earthwork shall be done as per approved detailed construction drawings to be issued to the successful tenderer. Offer to be prepared by the tenderer based on the enclosed drawings and on lump sum unit rate (per Cu.M).

### **4.3. SAND FILLING AND STONE SOLING**

Complete works in filling is included in the scope. Brief description of major items shall be as follows:

- a) Taking pre-work and finished levels
- b) Borrowing of approved quality sand/stone from any lead.
- c) Filling in layers of 300 mm.
- d) Providing and laying stone ballast 115-150 mm size in layers of 300 mm with spreading blinding material like sand, stone grit, watering and compaction with mechanical means etc. complete the surface as per specifications including cost of material.

Note: *Payments to be done on completed work profiles by considering the plan*



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*dimensions only.*

Sand filling and Stone soling shall be done as per approved detailed construction drawings to be issued to the successful tenderer. Offer to be prepared by the tenderer based on the enclosed drawings and on lump sum unit rate (per Cu.M).

#### **4.4. BRICKWORK IN SUBSTRUCTURE**

Complete works in brick masonry in foundation is included in the scope. Brief description of major civil items shall be as follows:

- i) Earth Work in excavation including backfilling using serviceable surplus material or approved borrow material and transportation of excess earth beyond plot limits. Preparation of sub-base including dewatering and compaction.
- ii) PCC M10.
- iii) Brick work with 1:4 cement mortar in foundation.
- iv) 40mm thick DPC in 1:2:4 wherever applicable.
- v) Plastering on exposed brick surfaces of 15 mm thickness in CM 1:4.
- vi) Lime wash on exposed surfaces of plaster.
- vii) Making weep holes of 150x150 with stone filter pack at 1.0 m intervals in both the directions.

Note: *Only net brick masonry volume quantity shall be measured for payment purpose.*

The construction of brick foundation work shall be done as per approved detailed construction drawings to be issued to the successful tenderer. Offer to be prepared by the tenderer based on the enclosed drawings and on lump sum unit rate (per Cu.M) of brickwork done.

#### **4.5. BRICK WORK IN SUPERSTRUCTURE**

Complete works in brick masonry superstructure is included in the scope. Brief description of major civil items shall be as follows:

- i) Brick works with 1:4 cement mortars in superstructure at all heights.
- ii) Providing shuttering / support etc. as per requirement.

Note : *Only net brick masonry quantity excluding plaster thickness shall be measured for payment purpose.*

The construction of brickwork in superstructure shall be done as per approved detailed construction drawings to be issued to the successful tenderer. Offer to be prepared by the tenderer based on the enclosed drawings and on lump sum unit rate (per Cu.M) of brickwork done.



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### **4.6. PCC WORK**

Providing and laying PCC 1:2:4, 1:3:6 & 1:4:8 in position, construction and handing over of PCC in foundations, drains, trenches, substructure, superstructure and under floor including shuttering/ shoring/ stopper and embedment etc complete in all respects as per scope of work detailed construction drawings (to be released to contractor by owner), technical specifications and direction of Engineer-in-charge.

Brief description of major civil items shall be as follows:

- i) Preparation of bed includes cleaning, leveling, compacting/tamping of surface and providing support from bottom and sides.
- ii) Providing shuttering and stoppers.
- iii) Providing inserts, pockets, recesses, holdfast etc.
- iv) Curing, rendering, finishes to match with adjoining surfaces etc.

*Note : For all these items only net PCC concrete quantity shall be measured for payment and PCC below brick work and RCC works is included in the respective item.*

The construction of PCC work shall be done as per approved detailed construction drawings to be issued to the successful tenderer. Offer to be prepared by the tenderer based on the enclosed typical drawings and on lump sum unit rate (per Cu.M) of PCC work done.

### **4.7. RCC WORK IN SUB STRUCTURE**

Complete works in RCC foundation for equipment foundation, compound wall, building foundations, foundations, drains, trenches, pile caps, built-up piles and other RCC works e.g. box culvert, pits, tanks etc. is included in the scope.

Brief description of major civil items shall be as follows:

- a) Earth Work in excavation including back filling using serviceable surplus/ borrow material.
- b) PCC M-10 mud mat,
- c) Providing shuttering and strutting of all types
- d) RCC M-25.
- e) Providing and fixing bolts/inserts.
- f) Non-shrink grouting over pedestals for structural base and high strength cementitious grout as per drawings for compressor/ D.G. bases. ( Payable in separate item )
- g) Plastering on exposed RCC surface and application of two coats of bitumen paint faces in contact with soil. In the case of building foundations, the anti-termite treatment shall be applied.
- h) Underground RCC water tanks with food grade paint on the inside. (Painting of food grade paint is included in this item)



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- i) Providing and fixing puddle flange for nozzles/inserts in R.C.C. water tanks fabricated from M.S. pipes up to 900 mm long, welded in the center to 6 mm thick M.S. square plate of size three times the pipe diameter as per standard details; whole piece to be hot dip galvanized, fixed to Reinforcement in RCC walls/slab as per drawing at the time of casting of RCC water tank complete.
- j) Providing and fixing M.S. Structural work fabricated from standard sections e.g. M.S. rounds, angles, channels including cutting to size, drilling, welding, fixing and welding to insert plates in RCC structural members including cutting and making good the walls and floors for pipe supports from floor (in plant room), M.S. ladders and manhole covers for water tanks only.
- k) Providing and fixing M.S. slotted angle iron 40x40x2 mm thick with stone enamel finish & fixed to brick masonry or RCC walls with 12 mm dia bolts embedded in cement concrete blocks 1:2:4 mix (1 cement: 2 coarse sand: 4 stone aggregate 12.5 mm nominal size) 100x100x100 mm size for masonry walls & with expandable anchor fasteners on RCC spaced not exceeding 600 mm with 15 mm dia G.I. spacer between wall & angle complete.

*Note: For all these items only net RCC concrete quantity excluding PCC/Mudmat shall be measured for payment (Bolts, inserts, angles channels will be paid in item structural steel fabrication but not in case of underground RCC tanks).*

The construction of RCC work shall be done as per approved detailed construction drawings to be issued to the successful tenderer. Offer to be prepared by the tenderer based on the enclosed typical drawings and on lump sum unit rate (per Cu.M) of RCC work.

#### **4.8. RCC WORK IN SUPERSTRUCTURE**

Complete works in RCC in superstructure for compound wall/retaining wall, columns & beams is included in the scope.

Brief description of major civil items shall be as follows:

- a) Providing shuttering and strutting of all types
- b) RCC M-25
- c) Providing and fixing bolts/inserts.
- d) Providing and fixing M.S. Structural work fabricated from standard sections e.g. M.S. rounds, angles, channels including cutting to size, drilling, welding, fixing and welding to insert plates in RCC structural members including cutting and making good the walls.



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*Note: For all these items only net RCC concrete quantity shall be measured for payment (Bolts, inserts, angles, channels will be paid in item structural steel fabrication).*

The construction of RCC work shall be done as per approved detailed construction drawings to be issued to the successful tenderer. Offer to be prepared by the tenderer based on the enclosed typical drawings and on lump sum unit rate (per CuM) of RCC work done.

### **4.9. BOUNDARY WALL**

Complete civil works for the following buildings is included in the scope. Brief description of major civil items shall be as follows:

- a) DPC 40 mm with cement concrete 1:2:4 if required.
- b) Brick work ( bricks as per SOR ) in super structure at all height and levels, in cement mortar 1:5
- c) RCC 1:2:4. Including steel reinforcement for coping.
- d) Cement plaster 1:6, 15 mm on both surfaces.
- e) Drip course 25 mm wide over coping.
- f) Grooves 12X12 mm in plaster as per design.
- g) Painting of internal wall surface with three coats of Acrylic emulsion paint as per SOR or approved by Engineer-in-charge, applied by brush followed by roller.
- h) External wall surface to be given 3 coats of white wash.
- i) Expansion joints shall be provided at corners as per drawings.
- j) Height of wall shall be 3000 mm Finished floor level of forecourt.

The construction of the compound wall shall be done as per approved detailed construction drawings to be issued to the successful tenderer. Offer to be prepared by the tenderer based on the enclosed architectural drawings and on lump sum unit rate (per RM) for complete compound wall work in superstructure.

*Note: Only length of completed compound wall shall be measured for payment purpose.*

### **4.10. OFFICE BUILDING**

Complete civil, plumbing, internal water supply and electrical works from plinth beam and above for RCC framed structure buildings are included in the scope.



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#### **4.11. RCC FRAMED STRUCTURE**

Brief description of major items of work shall be as follows:

- a) Setting out for all structures on site.
- b) All the buildings/rooms shall be RCC framed structures with cladding and partitions of brick masonry walls, including loft in RCC.
- c) DPC 1:2:4, with 40 mm thick.
- d) Anti-termite treatment to be applied to all the building foundations, plinth, under aprons and sub-floors.
- e) All structural concrete for RCC elements shall have a minimum strength of 25 MPA at 28 days (M-25 nominal mix as per IS)
- f) Masonry shall be in cement mortar 1:4 and with bricks of strength not less than 75 kg / cm<sup>2</sup>.
- g) Plastering on masonry structures shall be of thickness 15 mm on smooth face, 19 mm on rough surface and 6 mm on RCC ceiling/Chajjas. The cement mortar shall not be leaner than 1:3 on ceiling and 1:4 on walls. Grooves and drip-mould are also included in this item.
- h) Aluminum doors shall be of 10 mm thick glass (ASAHI / MODI TUFF)/or paneled with laminated board mounted on powder coated aluminium frames. Windows of full height shall be powder coated aluminium frame with 8 mm thick glass (ASAHI / MODI TUFF)/laminated board in-fill. Windows from sill height & Ventilators shall be powder coated aluminium frame with 5 mm thick glass louvers/ fixed glazing, with powder coated aluminium hardware. All aluminium frames shall be fixed over aluminium rough ground.
- i) Inside surfaces of office shall be finished with plastic emulsion paint of ICI, Asian paints, Berger and rest of the rooms shall be finished with oil bound distemper and painting of external walls of building with three coat of external acrylic emulsion paint with Polyurethane finish.
- j) Inserts shall be provided to suit technological requirements.
- k) All exposed flat roofs shall be water proofed with two components elastic polymerized acrylic water proofing system using “Euco Elastic Plaster” manufactured by STP including finishing the surface with 40 mm thick cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone) admixed with water proofing compound confirming to IS: 2645 and finally finishing the surface with Trowel with neat cement slurry and preparation of roof surface with khurras at RWP locations.
- l) Under floors shall include filling of river sand and PCC 1:4:8 in level.
- m) Polished vitrified tiles of Kajaria/Somani/Orientor equivalent make on floor and thickness and 100 mm high skirting in office room with 6 mm grout.
- n) Aluminium False ceiling of Luxalon, Trac or equivalent make in MMI control rooms lobbies etc as indicated and as per approved manufacturers detail.
- o) All finishes and any other works not specifically mentioned but required and handing over of premises, complete in all respects.



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- p) External surfaces to be painted with Exterior premium emulsion paints, APEX of Asian Paints/ WEATHERCOAT of Berger/ WEATHERSHIELD OF ICI, and part fascia to be of DOMAL (as per approved design) as per detail, colour scheme, elevation as per approved manufacturer's detail and specified thickness. Aluminium composite panel to be used in elevation at specified locations.
- q) Conduiting, wiring, box & switches, fittings and fixtures for electrical points, telephone, television points and data cabling.
- r) Providing, making, testing and commissioning of light point, fan points, exhaust fan points, 6 Amp sockets, 16 Amp sockets, 20 Amp sockets and Sub-mains with 2.5 sq. mm single core multi strand copper conductor, PVC insulated, 1100 V grade wires in PVC conduit laid in ceiling/wall/ground in GI pipe, complete with grid plate switch 6/16 Amps. in concealed G I box, circuit wiring i.e. tapping from the DB, 1.5 Sq.MM. insulated copper Earthing connections etc. complete as required for all length of circuits and 1 light points controlled by one switch. Light points located on building areas are included.
- s) Supply, installation, testing and commissioning of pre-wired wall/ ceiling/ false ceiling mounted type HPF fluorescent light fixtures including providing and fixing tubes, electronic chokes, starters, earthing, connections and mounting arrangements etc. complete as required. Procurement of light fixtures (ref. Electrical TS clause 03.00) subject to approval by Company/PMC Engineer-in-Charge:
- t) Making as-built drawings and details and providing to owner.
- u) The tentative sizes of the structural elements of the building are given below in the table.

Sl No	Member	Size (in mm)	Remarks
1	columns	300x400 / 350x500	
2	beams	300x450 / 350x600	
3	Slab	150	
4	Lintels	230x200 / 115x200	

#### **4.12. FINISHING WORKS**

##### **A) PLASTER IN CM 1:4**

Complete works in plaster is included in the scope.

Brief description of major items shall be as follows:

- a) Providing and laying cement plaster of specified thickness on walls, ceilings, RCC beams, columns and chajja etc. of mix 1:4 (1 cement, 4 fine sand) including making of typical grooves, drip course etc. including hacking of RCC roof beams and columns surfaces and curing etc. complete. The job



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includes the cost of supplying and fixing of chicken wire mesh at every joint of brick masonry and RCC before commencing the plastering work.

- b) Providing and laying cement plaster of specified thickness on walls, ceilings, RCC beams, columns and chajja etc. of mix 1:4 (1 cement, 4 fine sand) including making of typical grooves, drip course etc. including hacking of RCC roof beams and column surfaces and curing etc. complete. The job includes the cost of supplying and fixing chicken wire mesh at every joint of brick masonry and RCC before commencing the plastering work.

#### **B) EXTERNAL PAINTING**

Supplying and doing/finishing external walls surfaces in approved colour and applying one or more coats of Apex paint of Asian Paints at all heights or approved make of desired colour and approved brand as per scope of work and recommendations of manufacturer, detailed construction drawings (to be released to contractor by Owner), technical specifications and directions of the Engineer-in-charge.

#### **C) INTERNAL PAINTING (OBD)**

Supplying and doing/finishing internal walls and ceilings in plaster of Paris punning to achieve an even finish and applying of 3 or more coats of Oil Bound Distemper of desired colour and approved brand as per scope of work, approved detailed construction drawings (to be released to contractor by owner), technical specification and directions of the Engineer-in-charge.

#### **D) WHITE WASHING**

Whitewashing with Dehradun/ Rajasthan lime 3 or more coats to give an even finish including the cost of adding required adhesive (DDL), blue pigment (Robin blue) etc. on walls ceiling etc. complete as per instruction.

#### **E) PROVIDING AND FIXING GRANITE STONE**

Providing and fixing 20 mm thick granite polished, machine cut granite stone for dispenser islands and similar location of require size and approved quality laid over 20 mm thick base cement mortar 1:4 (1 cement: 4 coarse sand) with joints treated with white cement, mixed with matching pigment, epoxy touchups, including rubbing making edge moulding, curing etc. complete at all levels. The texture, colour, pattern of Granite will be decided by Engineer-in- charge.



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### **F) IPS FLOORING**

Providing and laying 40 mm thick cement concrete floor with 1:2:4 (1 cement: 2 coarse sand: 4 stone aggregate of 12 mm nominal size) with a floating coat of neat cement {Rate include all labour, tools, tackles, PVC/ Glass strips etc. complete}.

### **4.13. STEEL WORKS**

Complete works in **steel structure fabrication** is included in the scope,

Brief description of item shall be as follows: -

**Fabrication** of cascade supporting and covering structures and loading & unloading platform structures including **supply** of raw materials, transportation and delivery at site, site assembly and erection of structures at appropriate locations including application of primer and finishing paints, all works as per specification and drawings. Scope includes all consumables, preparation, wastages, testing charges, sheeting, fasteners etc as per specifications. Scope includes preparation of fabrication drawings, their approval by Owner and preparation of as-built details.

### **A) PROVIDING AND FIXING CHEQUERED PLATE**

Brief description of item shall be as follows: -

Chequered plate in approved panel or over steel structure including cutting, welding, hoisting, fixing in position has to be provided and fixed.

Two or more coats approved quality synthetic enamel over priming coat of approved steel primer to be applied.

### **B) STEEL DOORS AND WINDOWS**

Complete works in steel doors and windows is included in the scope. Brief description of item shall be as follows:-

Steel door/window of approved make fabricated out of 'Z' section conforming to BIS Standard of 3 mm thickness with joints mortice and welded, with 20x5 mm Ms flat hinges fully planed with 2 mm thick MS plate should be supplied, fitted and fixed in position. Glass panes of 8 mm thickness be fitted. Approved quality handles, tower bolts be fitted.

This includes supplying and fixing superior quality heavy-duty chromium plated brass stays, aldrops, and handles, tower bolts painted with two coats of red oxide. The main frame would be a minimum 50x50x6 mm size angle embedded in the walls with MS fasteners etc. complete as directed by EIC.



# **GENERAL TECHNICAL SPECIFICATION (GTS)**

## **CIVIL, STRUCTURAL & ARCHITECTURAL WORKS**

### **4.14. ALUMINIUM DOORS/WINDOWS/PARTITIONS**

Brief description of item shall be as follows: -

Aluminium glazed doors/windows/partitions should be provided and fixed as per scope of work based on detailed construction drawings [to be released to contractor] by owner and as per direction of engineer-in-charge. The powder coating and/or anodizing to be carried out as per approved specification and all the fixtures, floor spring etc to be provided as per standard/ approved make and design.

### **4.15. KERB STONE**

Complete work in fixing of kerb stone is included in the scope.

Brief description of major items shall be as follows:

Kerb stone of approved make at or near ground level as per approved pattern and setting in position with cement mortar 1:3 shall be provided and fixed. This includes the cost of required centering, shuttering and finishing smooth with 6 mm thick cement plaster 1:2 on exposed surfaces with hardener, over 75 mm thick PCC 1:4:8 bed (Kerb stone blocks shall have niche with reflective material fixed on it).

### **4.16. SFRC PRE-CAST SLAB**

Brief description of main items shall be as follows:

Heavy duty 70 mm thick precast SFRC Slab in trenches of KK make or equivalent (size 450x600) shall be provided and fixed as per instruction of Engineer-in-charge.

### **4.17. GROUTING WITH NON-SHRINKABLE COMPOUND**

Brief description of major items shall be as follows:

Ready mix non-shrink cementitious grout of compressive strength  $30\text{N/mm}^2$  /  $45\text{N/mm}^2$  as per SOR shall be provided and laid manually or by pumping at all positions. This shall include shuttering, compacting, edging, repairing, sealing and curing for shutdown repairs, base grouting of rotating equipment and other installation complete. This shall be as per specifications, site sketches/ drawings and direction of the EIC.

Minimum coverage as per manufacturers' recommendations shall be applied in absence of actual field consumption data.



# **GENERAL TECHNICAL SPECIFICATION (GTS)**

## **CIVIL, STRUCTURAL & ARCHITECTURAL WORKS**

### **4.18. PAVER BLOCK**

Brief description of the items shall be as follows:

The paver blocks for parking/forecourt area shall be of M-40 grade concrete and 100 mm thick and for walkway shall be of M-25 grade concrete and 60 mm thick as per technical specifications & SOR. Vendor to provide names of at least three reputed manufacturers. COMPANY will approve the make, size & color after ascertaining technical credentials and manufacturing process. If required, the COMPANY will also visit the manufacturer's factory to witness the technical & manufacturing capability. If the COMPANY is not satisfied, vendor shall have to provide alternative manufacturer.

This shall include Supply of all labor, supervision, tools and tackles, machinery, consumables, materials and all other accessories, not specifically mentioned herein, but required to complete the work in all respects to the satisfaction of COMPANY / Site In-charge.



## GENERAL TECHNICAL SPECIFICATION (GTS)

### **CIVIL, STRUCTURAL & ARCHITECTURAL WORKS**

TABLE-1: TECHNICAL SPECIFICATIONS FOR PAVER BLOCKS

Sr. No.	Description	For 100MM thick	For 60MM thick
1.	Compressive Strength	Not less than 40 N/mm <sup>2</sup>	Not less than 25 N/mm <sup>2</sup>
2.	Sampling	Internal testing - 3 Blocks every 5000 blocks External testing - 3 blocks every 10000 blocks	Internal testing - 3 Blocks every 5000 blocks External testing - 3 blocks every 10000 blocks
3.	Transverse strength	Min. 3 MPa (BIS 1237 – 1980)	Min. 3 MPa (BIS 1237 – 1980)
4.	Water absorption	5.80% max.	5.80% max.
5.	Surface	Non-Skid	Non-Skid
6.	Type	Rubber moulded, glazed	Rubber moulded, glazed
7.	Wear resistance	3 mm average 3.50 mm maximum (LA Abrasion test as per BS 6717)	3 mm average 3.50 mm maximum (LA Abrasion test as per BS 6717)
8.	Weight per Sq.M.	234 Kg. /Sq.M. (Min.)	140.40 Kg. /Sq.M. (Min.)
9.	Testing Procedure	As per IS code.	As per IS code.



## GENERAL TECHNICAL SPECIFICATION (GTS)

### **CIVIL, STRUCTURAL & ARCHITECTURAL WORKS**

#### **PART-B MATERIALS, TESTING, APPROVAL, & REJECTION**

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## **GENERAL TECHNICAL SPECIFICATION (GTS)**

### **CIVIL, STRUCTURAL & ARCHITECTURAL WORKS**

#### **PART-B MATERIALS, TESTING, APPROVAL, & REJECTION**

##### **1. SCOPE**

This section addresses the quality, testing, approval, and storage requirements for materials before they are used on construction projects.

##### **2. Standard**

A high level of quality is required for all materials used in construction works. In all cases, they shall be the best in class available and must be purchased from a reputable manufacturer to ensure consistency in quality and assurance of timely supply.

##### **3. Approval and Testing**

All materials to be used in construction are subject to the approval of the Engineer. The Contractor must submit a request in sufficient advance with material samples, including test results from an approved laboratory and other documentary evidence from the manufacturer, if applicable, and indicate the types of materials and their respective sources. Delivery of materials to the site will commence only after the quality, grading, and sources of materials have been approved by the Engineer.

The quality of all materials once approved shall be maintained throughout construction and periodical tests shall be carried out to ensure that it is maintained. Such routine tests shall be listed under the different materials and/or as may be ordered by the Engineer from time to time.

Where a particular "Brand" or "Make" of material is specified in the Schedule of Items or Technical Specifications, such "Brand" or "Make" of material alone shall be used on the work. Should it become necessary for any reason (such as non-availability/ceased to be produced), to use any material other than the specified "Brand" or "Make", the Contractor shall submit sample of the same to the Engineer for approval together with test certificates and other documents necessary for examining and giving approval thereof. Should such change or substitution of materials, subsequently approved, results in use of material of price lower than that of the material specified in the Schedule of Items or Technical Specifications, the rates of work affected by the substitution shall be proportionately reduced. Similarly, in case the substitution results in use of material of price higher than that specified in the Schedule of Items or Technical Specifications, the rates of work affected by the substitution shall be proportionately increased.



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### **CIVIL, STRUCTURAL & ARCHITECTURAL WORKS**

#### **4. Rejection of Materials**

Any material brought to site which, in the opinion of the Engineer is damaged, contaminated, deteriorated or does not comply with the requirement of this specification shall be rejected.

If the routine tests or random site tests show that any of the materials, brought to site, do not comply in any way with the requirements of this specification or of I.S. Codes as applicable, then that material shall be rejected.

The Contractor at his own cost shall remove from site any and all such rejected material within the time specified by the Engineer.

#### **5. MATERIALS FOR CONCRETE**

##### **5.1. Aggregates**

Aggregates shall comply with the requirements of IS: 383-1970 "Coarse and Fine Aggregates for Concrete". They shall be hard, strong, dense, durable, clean and free from veins and adherent coating, vegetable matter and other deleterious substances; and shall

be obtained from approved sources. Aggregates shall not contain any harmful material such as pyrites, coal, lignite, shale or similar laminated material, clay, alkali, soft fragments, seashells, and organic impurities in such quantity as to affect the strength or durability of concrete.

Aggregates which are chemically reactive with alkalies of cement shall not be used. Aggregates which are not sufficiently clean shall be washed in clean fresh water to the satisfaction of the Engineer.

##### **5.2. Testing**

All aggregates shall be subject to inspection and testing. The Contractor shall submit samples for testing as may be required by the Engineer. Sampling and testing shall be carried out in accordance with IS: 2386-1963 "Methods of Test for Aggregates for concrete".

##### **5.3. Grading**

The Contractor shall ensure that the full range of aggregate used for making concrete is graded in such a way as to ensure a dense workable mix. The delivery of aggregates will commence only when the Engineer has approved the samples and the quality and grade shall be maintained consistent and equal to the approved sample. Before



## **GENERAL TECHNICAL SPECIFICATION (GTS)**

### **CIVIL, STRUCTURAL & ARCHITECTURAL WORKS**

construction commences, the Contractor shall carry out a series of tests on the aggregates and on the concrete made therefrom to determine the most suitable grading of the available aggregates. Once the most suitable grading has been found, the grading shall be adopted

for the construction of the works and periodic tests shall be carried out to ensure that it is maintained.

#### **5.4. Size and grading of fine aggregates**

The grading shall conform to IS: 383-1970 and shall be within the limits of Grading Zone-III. The maximum size of particle shall be 4.75mm and shall be graded down. Sand containing more than 10% of fine grains passing through 150-micron sieve or having the fineness modulus less than 2 shall not be used for concrete work.

#### **5.5. Size and grading of coarse aggregates**

The nominal maximum size of the aggregates for each mark of concrete or for each type of work shall depend upon the description of the particular item in the Schedule of Items and/or according to relevant clauses of IS: 456-1978. The aggregates shall be well graded and the grading shall conform to relevant requirements of IS: 383-1970 depending upon the maximum nominal size as specified or as required.

#### **5.6. Fine aggregate for mortar and grout**

The grading of fine aggregate for mortar and grout shall be within the limits of grading zone III and IV as defined in IS: 383-1970.

#### **5.7. Storage & stacking**

Care shall be taken in the storage to avoid intrusion of any foreign materials into the aggregates and where two types of aggregates are stored close to each other, they shall be separated by a wall or plate. In case of stockpiling, care shall be taken to avoid forming pyramids resulting in segregation of different sized materials. The height of the stacks shall be generally limited to 150 cm.

#### **5.8. Coarse Aggregates**

##### **5.8.1. Types**

The type of coarse aggregate viz., stone chips, gravel or broken brick shall be as described in the Schedule of Items. Unless otherwise specified in the Schedule of Items, stone chips shall be used as coarse aggregate.



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### **CIVIL, STRUCTURAL & ARCHITECTURAL WORKS**

#### **5.8.2. Stone chips**

It shall be crushed or broken from hard stone obtained from approved quarries of igneous or metamorphic origin. The stone chips shall be hard, strong, dense, durable and angular in shape. It shall be free from soft, friable, thin, flat, elongated or laminated and flaky pieces and free from dirt, clay lumps, and other deleterious materials like coal, lignites, silt, soft fragments, and other foreign materials which may affect adversely the strength & durability of concrete. The total amount of deleterious /foreign materials shall not exceed 5% by weight according to the relevant clause of IS: 383-1970. If found necessary the stone chips shall be screened and washed before use.

#### **5.8.3. Gravel**

It can be either river bed shingle or pit gravel. It shall be sound, hard, clean, irregular in shape and suitably graded in size with or without some broken fragments. It shall be free from flat particles, powdered clay, silt, loam and other impurities. Before using, the gravel shall be screened and washed to the satisfaction of the Engineer. However, the Foreign deleterious materials shall not exceed 5% by weight.

#### **5.8.4. Broken bricks / Brick aggregates**

These shall be obtained by breaking well burnt or over burnt dense brick bats. They shall be homogeneous in texture, well graded in size, roughly cubical in shape, clean and free from dirt, clay, silt or any other deleterious matter. Before use, these shall be screened.

#### **5.9. Fine Aggregates**

Unless specified otherwise it shall either be natural river sand or pit sand.

Sand shall be clean, sharp, strong, angular and composed of hard siliceous material. It shall not contain harmful organic impurities in such form or quantities as to affect adversely the strength and durability of concrete.

Sand for reinforced concrete shall not contain any acidic or other impurities which is likely to attack steel reinforcement.

The percentage of all deleterious materials including silt, clay etc., shall not exceed 5% by weight. If directed, sand shall be screened or washed before use to the satisfaction of Engineer.

#### **5.9.1. Crusher dust**



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Crusher stone dust (that is retained on 300 micron sieve ) may be used as replacement for certain quantum of sand aiming to improve the fineness modulus of fine aggregate. The quantum of replacement for sand shall be arrived at by suitable trial mixes. The Engineer will decide the final usage of crusher dust depending on the circumstances.

#### **5.10. Cement**

Ordinary Portland cement / Portland slag cement complying with the requirements of IS:269-1989 and I.S. 455-1989 respectively shall be used for making plain and reinforced concrete, cement grout, and mortar.

Other types of cement may be used depending upon the requirements of certain jobs with the approval of the Engineer. These shall conform to the following standards:

Portland Pozzolana Cement	IS: 1489-1991.
Rapid Hardening Portland Cement	IS: 8041-1990
43 Grade Ordinary Portland Cement	IS: 8112-1989
53 Grade Ordinary Portland Cement	IS: 12269-1987
Hydrophobic Portland Cement	IS: 8043-1991
High alumina cement for structural work	IS: 6452-1989
White Portland cement	IS: 8043-1989
Sulphate Resisting Portland Cement	IS: 12330-1988

##### **5.10.1. Testing of samples**

The Contractor shall supply a copy of the manufacturer's test certificate for each consignment of cement supplied by him and consignments shall be used on work in the order of delivery. The Contractor shall supply samples of cement to the Engineer as frequently as he may require for testing. The sampling of cement for testing shall be according to IS: 3535-1986. All tests shall be in accordance with the relevant clauses of IS:4031 (Part-I to Part-15) 1988 to 1991 & IS:4032-1985.

##### **5.10.2. 5.10.2 Contractor's responsibility**

From the time a consignment of cement is delivered at site and tested and approved by the Engineer until such time as the cement is used on the works, the Contractor shall be responsible for keeping the same in sound and acceptable condition and at his expense and risk. Any cement which deteriorates while in the Contractor's charge and is rejected as unsuitable by the Engineer, shall be removed from the site to outside the limits of work at the cost of contractor within two days of ordering such removal by the Engineer.

##### **5.10.3. Stock of cement**



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In order to ensure due progress, the Contractor shall at all times maintain on the site at least such stock of cement as the Engineer may from time to time consider necessary. No cement shall be used upon the works until it has been accepted as satisfactory by the Engineer.

The cement shall be stored in such manner as to permit easy access for proper inspection and in a suitable weather-tight, well-ventilated building to protect it from dampness caused by ingress of moisture from any source. Different types of cement shall be stored separately.

Cement bags shall be stacked at least 15 to 20 cm clear of the floor leaving a space of 60 cm around the exterior walls. The cement shall not be stacked more than 10 bags high. Each consignment of cement shall be stacked separately to permit easy access for inspection

#### **5.10.4. Water**

Water used for mixing concrete and mortar and for curing shall be clean and free from injurious amounts of oil, acid, alkali, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel. The pH value of water shall generally be not less than '6'. Water has to meet the requirements mentioned in clause 4.3 of IS: 456-1978. Water shall be obtained from an approved source. Where it is obtained from a source other than a supply main, it shall be tested to establish its suitability. Water for construction purpose shall be stored in proper storage tanks to prevent any organic impurities getting mixed up with it.

#### **5.10.5. Admixture for Concrete**

##### **5.10.5.1. Approval**

Admixtures to concrete shall not be used without the written consent of the Engineer. When permitted, the Contractor shall furnish full details from the manufacturer and shall carry out such test as the Engineer may require before any admixture is used in the work.

##### **5.10.5.2. Integral water proofer**

Admixtures used as integral water proofer shall be free of chlorides and sulphates and shall conform to IS: 2645-1975. The application and doses shall be as per the manufacturer's specification.

#### **5.10. Interval of Routine Test**



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### **CIVIL, STRUCTURAL & ARCHITECTURAL WORKS**

The routine tests of materials, delivered at site, shall be at the following intervals:

**Aggregates** - Fortnightly or for every 200 m<sup>3</sup> for each aggregate whichever is earlier and in other respects generally as per IS: 2386 (Part 1 to 8)-1963.

**Cement** - Fortnightly or for each consignment, within 4 days of delivery and in other respects generally as per IS :4031-1988.

**Water** - Once in two months for each source of supply and in other respects generally as per IS : 456-1978.

**Reinforcement** - For each consignment within 4 days of delivery in accordance with I.S. 1786-1985, I.S. 1599-1985 and I.S. 1608-1972.

#### **6. STEEL**

##### **For Reinforcement**

Reinforcing bars for concrete shall be round steel bars of the following types as may be shown on the drawing:

i) Plain mild steel bars conforming to Grade-I of IS: 432-1982 "Mild Steel & Medium Tensile Steel for Concrete Reinforcement".

ii) "High strength deformed steel bars conforming to IS : 1786-1985 for Concrete Reinforcement".

iii) Reinforcement fabrics conforming to IS:1566-1982 "Hard Drawn Steel Wire Fabric for Concrete Reinforcement".

All reinforcement bars shall be of uniform cross-sectional area and be free from loose mill scales, dust, loose rust, coats of paint, oil or other coatings which may destroy or reduce bond. Unit weight of reinforcement bars conforming to I.S. 1786-1985 is as given below.

Nominal Size (Dia)	Mass Per Metre Run (mm) (Kg)
6	0.222
8	0.395
10	0.617
12	0.889
16	1.580
18	2.000
20	2.470
22	2.980
25	3.850



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28	4.830
32	6.310

#### **Binding wire**

Binding wire for reinforcement shall be annealed steel wire 20 BWG conforming to IS : 280 -1978 "Specification for Mild Steel Wire".

#### **Light structural work and inserts**

Steel for light structural work and for preparation of inserts and embedments shall conform to IS: 2062-1992 "Steel for general structural purposes - Specification."

#### **Steel Tubes**

Steel tubes for use in light structural work and inserts shall be of light or medium class (as may be specified in drawings or the schedule of items) and of grade YST 25 conforming to IS: 1161 - 1979 "Specification for Steel Tubes for Structural Purposes".

#### **Foundation Bolts**

Bolts to be embedded in concrete shall, unless otherwise detailed in drawings, conform to IS: 5624-1970 "Specification for Foundation Bolts". Material for bolts, shall, unless otherwise mentioned in drawings or the schedule of items, be of steel conforming to IS: 2062-1992.

Nuts and locknuts shall conform to IS: 1363 (Part 1 to 3) -1992 "Specification for Black Hexagon Bolts, Nuts and Lock Nuts (Diameter 6-39 mm) and Black Hexagon Screws "Specification for Hexagon Bolts and Nuts (M-42 to M-150)".

Plain washers shall conform to IS: 2016 -1967 "Specification for Plain Washers and spring washers shall conform to IS : 3063 -1972 "Spring Washers for Bolts, Nuts & Screws".

#### **Steel Tubes for Non-structural use**

Steel tubes for non-structural use shall conform to IS : 1239 (Part-I) -1990 "Specification for Mild Steel Tubes, Tubular and Other Wrought Steel fittings, Part-I : Mild Steel Tubes".

Fittings for steel tubes used for non-structural purposes shall conform to IS : 1239 (Part-II) -1992 "Specification for Mild Steel Tubular and Other Wrought Steel Pipe Fittings".



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#### **Threaded Fasteners**

Bolts and nuts for fastening shall conform to IS:1367 (Part 1)-1980 "Technical Supply Conditions for Threaded Fasteners".

#### **Testing**

Test certificates from manufacturer shall be submitted for each consignment. Any additional test which the Engineer may require shall be done according to IS : 1786-1985, 1566-1982, 280-1978, 2062-1992, 1161-1979, 2614-1969, 3063-1972, 1239 (Part 1 and 2)-1990 and 1992 and 1367-1980.

## **7. BRICK AND STONES**

### **7.1. Bricks**

Bricks for masonry in foundations, walls, and other locations shall be common burnt clay building bricks having minimum crushing strength of 5 N/sq.mm., or such other strength as may be described in the Schedule of Items when tested in accordance with IS : 1077-1992 "Common Burnt Clay Building Bricks". They shall be sound, hard, and thoroughly well burnt, with uniform size having rectangular faces with parallel sides and sharp straight right angled edges, and be of uniform color with fine compact uniform texture. Bricks shall be of uniform deep red cherry or copper color.

They shall be free from flaws, cracks, and nodules of free lime. Water absorption after 24 hours immersion in cold water shall be not more than 20% by weight. They shall not absorb more than 10% by weight of water after immersion for six hours. They shall emit a clear metallic ringing sound when struck by a mallet and shall not break when dropped on their face, from a height of 60 cm.

Fractured surfaces shall show homogeneous, fine-grained uniform texture, free from cracks, air holes, laminations, grits, lumps of lime, efflorescence or any other defect which may impair their strength, durability, appearance, and usefulness for the purpose intended. Under burnt or vitrified bricks shall not be used. Samples of bricks brought to the site shall be tested periodically for compression and other tests according to IS : 3495 (Parts-1 to 4) -1992 "Method of Test for Burnt Clay Building Bricks".

Where the size of bricks is not specifically mentioned, it shall be taken to mean conventional sizes as is commonly available in the area. In case modular bricks are to be used, it shall be accordingly specified in the Schedule of Items. The bricks shall



## **GENERAL TECHNICAL SPECIFICATION (GTS)**

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be classified on the basis of average compressive strength as given in Table 1 of IS : 1077-1992.

#### **Handling**

Bricks shall be unloaded by hand and carefully stacked and all broken bricks shall be removed from the site.

#### **Samples and Inspection**

Representative samples shall be submitted by the contractor and approved samples retained by the Engineer for comparison and future reference. Bricks shall be obtained from approved manufacturer. All bricks shall be subject to inspection on the site and shall be to the approval of the Engineer who may reject such consignment as are considered by him to be inferior to the quality specified. The Contractor shall provide all labour and plant required for the inspection and conduct such test as shall be required by the Engineer without additional charges.

#### **7.2. Stone (granite, trap, sandstone, quartzite etc.)**

Stone used shall be strong, durable, dense, compact, close grained, homogeneous, fire resistant and shall be obtained from sources approved by Engineer. Stones shall additionally be hard, sound, free from cracks, decay and other flaws or weathering and shall be easily workable. Stones with round surfaces shall not be made use of.

Stones shall have a crushing strength of not less than 200 kg/cm<sup>2</sup>. Stones with lesser crushing strength may be used in works with prior approval of the Engineer. Stones shall be non-porous and when tested in accordance with IS : 1124 -1974 "Method of Test for Determination of Water Absorption Etc.," shall show water absorption of less than 5% of its dry weight when soaked in water for 24 hours.

Tests for durability and weathering shall be done in accordance with IS : 1126-1974 and IS : 1125-1974 respectively. The working of stones to required sizes and their dressing shall be as per IS : 1127-1970 "Recommendation for dimensions and workmanship of natural building stones for masonry work" and IS : 1129 -1972 "Dressing of Natural Building Stones". Stones especially limestone and sand stones shall be well seasoned by exposure to air before use in construction works.

##### **7.2.1. Size**

Normally stones shall be of size that could be lifted and placed by hand, between 20 to 30 kg per piece. The length of stones shall not exceed 3 times the height and the breadth on base shall not be greater than 3/4 of the thickness of wall or less than 15cm. The height of stone may be upto 30cm.



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#### **8. Sand for Masonry Mortar**

Sand for masonry mortars shall be natural sand, crushed stone sand or crushed gravel and shall comply with IS : 2116 - 1980 "Sand for Masonry Mortars". The sand shall be hard, durable, clean and free from adherent coatings and shall not contain amount of clay, silt and fine dust more than 5% by wt. Sand shall not contain any harmful impurities such as iron pyrites, alkalies, salts, coal, mica and organic matters. The particle size grading of sand for use in mortars shall be within the limits as specified in Table I of above code.

##### **8.1. SAND FOR PLASTERING**

Sand for use in mortars for internal wall, ceiling and external plastering and rendering shall conform to IS:1542 -1992. It shall not contain any harmful impurities such as iron pyrites, alkalis, salts, coal, mica and organic matters. Percentage of salt and dust shall not be more than 5% by weight. Grading of sand shall be within the limits specified in clause no. 5.1 of above code. Fineness modulus of naturally occurring sand shall not be less than 1.5.

#### **9. Rubble**

Rubble of approved quality shall be used and shall be clean and free from dirt. The loose and weathered sections shall be removed before use. Rubble used as hard core shall have a least lateral dimension (thickness) between 100mm and 225mm, depending on the thickness of hardcore.

#### **10. PAINTS**

All paints, varnishes, distemper or other surface coating materials shall be of approved quality conforming to the appropriate Indian Standard, wherever such standard is available, and be obtained from a manufacturer of repute. If there is more than one quality for one particular product, only first quality shall be used unless otherwise stated in the Schedule of Items.

##### **10.1. Sampling and Testing**

The Engineer may, at his discretion, require samples of paint to be tested. In such cases testing will be according to IS : 101 (Part 1 to 8) - 1964 to 1993.

##### **10.2. Storage**

Paints, primers, distempers and varnishes shall be delivered in sealed containers. They shall be stored in cool dry condition to the satisfaction of the Engineer.



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Paints for Priming Ready mixed paints for priming coats of steel and iron work shall either comply with IS : 2074-1992 "Ready Mixed Paint", "Red Oxide Zinc Chrome Priming" or Red Oxide metal primer as specified. For wood work it shall be pink/white wood primer as specified by the manufacturer of the synthetic enamel paints, conforming to IS : 3536- 1966.

#### **10.3. Paints for finishing**

Ready mixed oil synthetic enamel paint of approved manufacturers like Berger, Jenson & Nicholson, Shalimar, I.C.I., Asian, Garware and Goodlass Nerolac paints only shall be used unless otherwise specified.

Paint shall be of first grade quality of the above manufacturers ie., Luxol Brolac, Superlac, Dulox gloss, Apocolite, Garcoat and Nerolac respectively. If for any other reason, thinning is necessary, the brand of the thinner recommended by the manufacturer, shall only be used with the specific permission of the Engineer.

#### **10.4. Whitewash**

White wash shall be prepared from freshly burnt fat, white in colour lime slaked on spot, conforming to IS : 712-1984 mixed and stirred with sufficient water to make a thin cream.

#### **10.5. Primer**

Primer shall conform to requirements laid down in IS : 3384-1986. It is to be prepared by blending turpentine and blown grade bitumen in the ratio of 60:40 by weight.



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### **CIVIL, STRUCTURAL & ARCHITECTURAL WORKS**

#### **PART-C WORKMANSHIP & METHOD OF EXECUTION**

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29.

## **PART-C Workmanship & Method of Execution**

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### **1. GENERAL**

A high standard of workmanship in all trades will be required. The Contractor shall ensure that only skilled and experienced workmen are employed.

The Contractor's supervising staff shall be fully qualified and experienced in the types of work being carried out under their supervision and shall be capable of ensuring that work is executed efficiently and as per specification.

### **2. Temporary works**

Where required, the Contractor shall furnish such details of his temporary works as may be called for by the Engineer and the Contractor shall satisfy the Engineer as to their safety and efficiency. The Engineer may direct that temporary works, which he considers unsafe or insufficient, shall be removed and replaced in a satisfactory manner.

### **3. Baselines and benchmarks**

The Contractor shall establish and maintain, to the satisfaction of Engineer, the base lines and bench marks, based on which the works are set out. Where such base lines and bench marks are provided by the Engineer, the Contractor shall maintain these throughout the period of construction without causing any disturbance to them.

The Contractor shall set out all the works to be executed by him, in line with the standard base lines, levels, position and bench marks and truly as per drawings within the accepted tolerance limits at no extra cost to Owner. The Contractor shall be solely responsible for the setting out of all the works, to be executed by him and the approval of such setting out by the Engineer shall in no way absolve the Contractor his responsibility for carrying the work to the true lines, levels and positions as per drawings.

### **4. Dewatering**

The Contractor shall carry out all the works, in dry and workable condition and maintain the same in dry condition till the final handing over of works at no extra cost to the Owner. For this the Contractor shall make all the necessary provisions of dewatering, wherever necessary, to the entire satisfaction of the Engineer.

### **5. Safety of existing work**

Before taking up any construction adjoining other property or existing work, the Contractor shall take all steps necessary for the safety and protection of such property or work at no extra cost to the owner.

The Contractor shall take all precautions necessary to prevent damage to or interference with underground or overground services such as cables, drains, piping or piles, whether



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shown on drawings or not. Equipment etc., mounted in position shall be protected against falling debris etc., by means of tarpaulin or such other material at no extra cost to the owner.

#### **6. EARTH WORK**

This chapter deals with earth work and excavation for civil works in site, formation/oversite leveling, foundations, cutting and grading for roads/pavement and railways, canals, embankments other than water retaining embankments trenching for drainage and other buried services and the like. The Contractor shall carry out the excavation strictly to the lines and levels, in conformity with the drawings or instructions of the Engineer.

Before commencement of earthwork block levels of existing ground shall be taken by the Contractor jointly with the Engineer, plotted and signed in token of acceptance of ground levels. Excavation shall not be commenced until the initial ground levels have been recorded and accepted. Reference lines, bench marks and base lines shall be set out by the Contractor for control of earthwork operation. Setting out shall be done with pegs, blocks, bamboo poles or rails, marking boundaries or centre lines, as the case may be, and the same maintained for reference and future checking.

All setting out operations shall be got checked and approved by Engineer. However, such checking and approval by the Engineer shall in no way absolve the Contractor of his responsibilities for carrying out the work to the true lines, levels and positions as per drawing, and in case any error is noticed at any stage in the contractor's work, it shall be corrected/rectified by him without any cost to the Owner.

##### **6.1. Site clearance and demolition**

The site shall be cleared of all trees, stumps, roots, brush wood, bushes and other objectionable materials. Useful and saleable material, if any, shall be the property of the owner and shall be stacked properly as directed by the Engineer. The areas to be covered with embankments shall be stripped of top soil to required depths to expose acceptable founding strata. Top soil unsuitable for use in embankment construction and other fills shall be disposed off as directed. All combustible materials shall be stacked and burnt in locations sufficiently remote to eliminate all danger of fire hazards. All old concrete, brick works and drains which interfere with construction works shall be dismantled with the approval of the Engineer taking all necessary precautions prescribed in safety specification. Top soil which is suitable for use in construction work shall be stockpiled for later use. Other objectionable materials such as trash, debris, stones, brick, broken concrete, scrap metal etc., shall be disposed off as directed by the Engineer.

##### **6.2. Excess excavation**

All excavation done beyond the specified limits or directions of Engineer shall be considered as excess excavation. They shall be made good as prescribed below by the Contractor at his cost:



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- i) Excess excavation in case of site leveling shall be made good by filling and compacting with material same as the surrounding material. Degree of compaction shall be at least the same as the surrounding material.
- ii) Excess excavation in case of trenches shall be made good by filling and compacting with selected earth to the same compaction as the surrounding material or as directed by Engineer. This shall be done in layers not exceeding 150 mm thick, moistened and thoroughly compacted by tamping.

#### **7. Plain Cement Concrete & Reinforced Cement Concrete**

##### **7.1. Scope**

This chapter covers the workmanship, special requirements & regulations with which the contractor must comply to achieve the following two objectives:

- (a) The provision, at all locations on the site, of dense workable concrete, having the specified characteristic strength.
- (b) The placing of concrete at all elevations, well compacted by vibrations, in well aligned and well-fixed formwork ensuring the internal and external dimensions of structures as per drawings and maintaining the size, shape number and locations of reinforcements, inserts etc., as specified in the drawings providing the surface finish after stripping off the formwork to ensure the structural configurations as per drawings as well within the specified tolerance limits, curing and guaranteeing the characteristic strength, all as specified.

The mixing, placing, compacting, curing and finishing of concrete shall be done according to IS: 456-1978 "Code of Practice for Plain and Reinforced Concrete".

##### **7.2. Mix Design**

At the commencement of the contract, the Contractor shall make preliminary tests to determine the proportions by weight of cement, fine aggregates, coarse aggregates, and water necessary to produce the required grades of concrete. The mix proportions shall be selected to ensure that the workability of the fresh concrete is suitable for the conditions of handling and placing and when concrete hardens, it shall have the required strength, durability, and surface finish. The Contractor shall get approval of the Engineer to such proportions before he starts concreting.

However, such approval shall not relieve the Contractor of his responsibility to produce concrete having compressive strengths as per the standard. No departure from the approved proportions will be permitted during the works unless and until the Engineer gives written authorization for any change in proportion. The Engineer shall have authority at any time to check whether the mixing of concrete is being carried out according to the approved proportions.

For all major and important R.C. works and for all special works, the design of mixes shall be made by the Contractor at his own cost, for each grade of concrete as well as for various workability. The design of mixes shall be made according to I.S. 10262-1982 or any other approved standard methods.

The concrete made by designing the mix is termed hereinafter as "Design Mix Concrete". The cement content for various grades of concrete shall be based on the design mix. However, irrespective of requirement of cement found out from design mix, the minimum cement content & maximum cement content of concrete shall be in accordance with Clause No. 8.2.4.1 & Clause No. 8.2.4.2 of I S 456 -2000 respectively.



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#### **7.3. Water/Cement Ratio**

Where a particular water/cement ratio is stipulated in the design or drawing along with the characteristic grade of concrete the design of mix shall be carried out by adjusting the other variable factors to obtain the characteristic strength of concrete with stipulated water/cement ratio.

In the structures where the impermeability and shrinkage of concrete have an important bearing on the durability and serviceability of the structures, such as water retaining structures, basements, underground premises, tunnels, pump houses, exposed structures near sea side or deserts, prestressed structure, thin precast members etc. the water cement ratio shall be kept low and preferably not exceeding 0.45.

The water cement ratio, as achieved in the Mix Design, or as specified in the drawings shall be adhered to strictly and shall not be varied without the permission of the Engineer.

#### **7.4. Workability**

The workability of fresh concrete shall be such that the concrete is just suitable for the conditions of handling & placing so that after compaction it becomes completely consistent and homogeneously surrounds all the reinforcement and completely fills the formwork.

The workability of fresh concrete at the place of batching/mixing shall be measured by compacting factor test and at the place of disposition by means of slump test. During the finalisation of Trial Mixes, the relationship between compacting factor and slump test shall be established for each grade of concrete as well as for various levels of workability. The workability tests shall be carried out in accordance with IS:1199-1959.

Normally, in the condition of low water cement ratio as well as for medium/high workability, the workability shall be achieved by increasing the cement content, in consistent with added water.

In cases where the cement content is to be limited to reduce the heat of hydration, and the water/cement ratio is also to be kept low to reduce the permeability or due to other requirements the desired workability may be achieved with use of limited doses of plasticiser or air entraining agent. In such cases the method of mixing and dosage of the plasticiser/air entraining agent shall be according to the manufacturer's specification and with the approval of the Engineer.

#### **7.5. Durability**

The durability of concrete, depending on the exposure condition, is to be taken into account while designing the mix. For given aggregates, the cement content should be sufficient to make sufficiently low water cement ratio and Appendix A of IS: 456-1978 shall be taken as guideline for durability considerations.

#### **7.6. Trial Mixes**

After approval of the Mix Design by the Engineer, the Contractor shall make in presence of Engineer the Trial Mixes for each grade of concrete as well as for required workability.



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Before starting the trial mixes, necessary preparatory works like sieve analysis of the aggregates, determination of densities of different ingredients and moisture contents in the aggregates, shall be completed according to the I.S. Codes 383-1970 and 2386-1963. Each trial mix shall be handled and compacted by the method which the Contractor proposes to use for that mix in the works and the mixes shall not show tendency of inadequate compaction by the method proposed.

The compacting factor and the slump of each trial mix shall be determined immediately after mixing and the values shall not exceed the maximum value obtained in the mix design.

Six numbers of 150 mm test cubes shall be made from each trial mix. These shall be cured and tested in accordance with relevant I.S. codes. In order to have the specified characteristic strength in the field, the concrete mix as designed in the Design Mix shall have higher average compressive strength depending on the degree of quality control at site.

If the size and special requirement of the work so warrants, the trial may be extended to cover larger ranges of mix proportions as well as other variables such as alternative source of aggregates, maximum size and grading of aggregates and different type and brands of cement.

Before the commencement of the concreting works of a particular grade of concrete, the Contractor must complete the work of trial mixes and subsequent testing of the test cubes obtained therefrom the design of the Approved Mix for that particular grade of concrete.

The entire cost of all the trial mixes including all the preparatory works for trial mixes, preparation of test cubes and their testing shall be borne by the Contractor.

#### **7.7. Nominal Mix Concrete**

Nominal mix concrete may be used for all concrete of Grade M-10 and below. If design mix concrete cannot be used for any reason for Grade M-15 & M-20, nominal mix concrete may be used with the permission of Engineer, Nominal mix concrete shall not be used, in any case for Grade of concrete above M-20.

The proportioning of materials for nominal mix concrete shall be in accordance with Table-3 of clause 8.3 of I.S. 456-1978. The stipulations of Clauses 8.3.1 & 8.3.2 of IS: 456-1978 shall also be taken into consideration.

#### **7.8. Volumetric Mix Concrete**

Where concrete is specified in volumetric proportions such as 1:4:8, 1:3:6, 1:2:4, 1:1 1/2:3, 1:1:2 etc., in the schedule of items, coarse and fine aggregates shall be measured by volume and cement by weight. The water cement ratio shall be within 0.45 to 0.70 depending upon the workability.

### **8. Batching of Concrete**

#### **8.1. Cement**

Cement shall always be batched by weight. A separate weighing device shall be provided for weighing cement. Where the weight of cement is determined by accepting the weight per bag, number of bags shall be weighed separately to determine the average net weight of cement per bag and the same shall be checked regularly



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#### **8.2. Aggregates**

For both Design Mix concrete and Nominal Mix concrete, the aggregates (coarse and fine) shall be batched by weight.

In particular cases, or where weigh-batching is not possible proportioning by volume batching may be allowed by the Engineer, provided the Contractor guarantees the uniformity of aggregates throughout the period of construction. For this purpose, the Contractor shall submit to the Engineer sufficient data indicating the weight/volume relationship of aggregates for different types of concrete and after such approval, periodic checks on the weight/volume relationship of the aggregates shall be made by the Contractor to the satisfaction of the Engineer. Where aggregates are moist and volume batching is adopted, allowance shall be made for bulking in accordance with I.S. 2386 (Part-III)-1963.

Suitable adjustments shall be made for the variation in the weight of aggregates due to variation in their moisture contents.

#### **8.3. Water**

Water may be measured either by weight or by volume. When measured by volume, it shall be by well calibrated conical shaped jar or vessel or from a calibrated tank fitted to the mixer.

#### **8.4. Adjustment of water due to moisture contents in coarse and fine aggregates**

It is very important to maintain the water-cement ratio constant at its correct value. For the correct determination of amount of water to be added in the concrete mix, to maintain the water-cement ratio constant, the amount of moisture content in both coarse and fine aggregates shall be taken into consideration, be as frequently as possible, the frequency for a given job being determined by the Engineer according to weather conditions.

#### **8.5. Determination of moisture content in the aggregates**

Determination of moisture content in the aggregates shall be according to I.S. 2386 (Part-III)-1963. Where tests are not conducted, the amount of surface water may be estimated from the following table:

Aggregates Surface water carried by Aggregates:

	% by weight	Lit / m <sup>3</sup>
Very wet sand	7.5	120
Moderately wet sand	5.0	80
Moist sand	2.5	40
Moist gravel & stone chips**	1.25 - 2.5	20-40 **

- Coarser the aggregate, less the water it will carry.



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#### **8.6. Admixtures**

Any solid admixture, to be added, shall be measured by weight, but liquid or semi-liquid admixture may be measured by weight or volume.

#### **8.7. Accuracy of batching**

The accuracy of batching shall be within the following tolerance:

Cement within plus or minus	2% by weight.
Aggregate within plus or minus	5% by weight.
Water within plus or minus	0.5% by weight.

#### **8.8. Mixing of Concrete**

Machine mixing Concrete shall always be mixed in mechanical mixer. Water shall not, normally, be charged into the drum of the mixer until all other ingredients are already in the drum and mixed for at least one minute. Mixing shall be continued until there is uniform distribution of materials and the mass is uniform in colour and consistency. The mixing time from the time of adding water shall be in accordance with IS: 1791- 1985 but in no case less than 2 minutes or at least 40 revolutions.

#### **8.9. Hand mixing**

When hand mixing is permitted by the Engineer it shall be carried out on a water tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency. In case of hand mixing 10% extra cement shall be added to each batch at no extra cost to the Owner.

#### **9. Transportation of concrete**

Concrete shall be transported from the place of mixing to the place of placing concrete as rapidly as practicable by such means which will prevent the segregation or loss of any of the ingredients and maintain the required workability. No water shall be mixed with the concrete after it has left the mixer.

Where concrete is transported over long distances, the Contractor shall provide suitable means by which different grades of concrete are readily identifiable at the place of final deposit.

#### **10. Actions before placement of concrete**

##### **10.1. Programme of works**

At the beginning of every fortnight, the contractor shall give his detailed concreting programme for that fortnight to the Engineer. Such programmes, shall specify all information such as the locations where concrete is to be poured, type/grade of concrete, volume of concrete to be poured, number and Type of vibrators proposed to be used as



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well as proposed to keep as standby, number of skilled technicians and supervisors proposed to be engaged, the proposed time and period of pouring etc.

#### **10.2. Checking & approval**

Before placement of concrete, the contractor shall get all the form works, reinforcements, inserts, conduits, openings, surface preparation etc., checked and approved by the Engineer. To facilitate such checking, the contractor shall complete all his works according to the drawings and specifications well in advance before placement of concrete at least 36 hours for all major/important/complicated works and 24 hours for all minor/ordinary/simple works. The checks are purely in the interest of the work and to draw the contractor's attention to his contractual obligations to execute the works according to the drawings/specification and do not relieve the contractor from his responsibility in getting the end results for the quality & strength of concrete and for maintaining the shape, level & dimensions of the finished concrete, as well as the inserts, openings, other features within the tolerance limits.

#### **10.3. Preparatory Works/Surface Preparation**

Inside the formwork (cleaning, surface preparation etc.) The interior of the form works, where the concrete is to be placed, shall be thoroughly washed by high pressure water jet or air jet to completely clean the entire volume from all sort of dirt, grease/oil, foreign and deleterious materials etc. The reinforcement shall be completely clean and free from all sorts of dirt, grease/oil, rust, foreign/deleterious materials etc., Before placement of concrete, the form works coming in contact with concrete, shall be coated with form oil or raw linseed oil material or provided with any approved material to prevent adhesion of concrete to the form work, but utmost care shall be taken so that such oily material do not come in contact with the reinforcement.

#### **11. Placing and Compaction of Concrete**

The concrete shall be placed and compacted before setting commences & should not be subsequently disturbed. No water shall be mixed with the concrete after it has left the mixer. Method of placing should be such as to preclude segregation.

An approved mechanical vibrator shall be used for compacting concrete, and concrete shall not be over vibrated or under vibrated.

No concrete shall be placed until the place of deposit has been thoroughly inspected and approved by the Engineer. all inserts and embedments properly secured in position and checked and forms properly oiled. No concrete shall be placed in the absence of the Engineer.

Concreting shall not be carried on during rains unless all precautions have been taken by the Contractor and necessary permission has been given by the Engineer. Suitable measures shall be taken to control the temperature of concrete.

Concrete shall not be dropped from a height of more than 2m except



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through a chute, the design and type of which shall be subject to approval of the Engineer.

The concrete shall be placed, spread and compacted by approved mechanical vibrator. Vibrators shall not be used for pushing concrete to adjoining areas.

For members involving vertical placing of concrete (e.g. columns, walls etc.), each lift shall be deposited in horizontal layer extending the full width between shuttering and of such depth that each layer can be easily and effectively vibrated and incorporated with the layer below by means of compaction.

For member involving horizontal placing of concrete (e.g. slabs, beams etc.,) the concrete shall be placed along the line of starting point in such quantities as will allow members to be cast to their full depth along the full width between side shuttering and then gradually brought towards the finishing point along its entire front parallel to the starting line. Vibration and surface finish shall follow behind the placement as closely as possible.

Utmost care shall be taken to avoid the displacement of reinforcements/embedded parts or movement of formwork or damage to faces of the form work or transmission of any harmful vibration/shocks to the concrete which has not yet hardened sufficiently.

If any unforeseen occurrence results in a stoppage of concreting for one hour or such other time as might allow the concrete, already placed, to begin to set before the next batches can be placed, the Contractor shall make at his own cost, suitable tongue, and groove construction joint, as approved by the Engineer. Any additional reinforcement required as directed by the Engineer shall also be provided by the Contractor at his own cost. Before placement of new batches of concrete over that construction joint, the surface preparation according to this specification stipulated earlier, shall be done by the Contractor at his own cost.

#### **12. Cold joint**

An advancing face of a concrete pour, which could not be covered before expiry of initial setting time for unexpected reasons, is called a cold joint. The Contractor shall remain always vigilant to avoid cold joints. If however, a cold joint is formed due to unavoidable reasons, the following procedures shall be adopted for treating it :

(a) If the concrete is so green that it can be removed manually and if vibrators can penetrate the surface without much effort, fresh concrete can be placed directly over the old surface and the fresh concrete along with the old concrete shall be vibrated systematically and thoroughly.

(b) In case the concrete has hardened a bit more than (a), but can still be easily removed by a light hand pick, the surface shall be raked thoroughly and the loose concrete removed completely without disturbing the rest of the concrete in depth. Then a rich mortar layer of 12 mm thickness, shall be placed on the cold joint and then the fresh



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concrete shall be placed on the mortar layer and vibrated thoroughly, penetrating deep in to the layer of concrete.

(c) In case the concrete at the joint has become so stiff that it cannot be remoulded and mortar or slurry does not rise in spite of extensive vibration, a tongue and groove joint shall be made by removing some of the older concrete and the joint shall be left to harden at least for 12-24 hours. It will then be treated as regular construction joint and the surface preparation of the same, before placement of concrete, shall be as described in the appropriate clauses of these specifications.

#### **13. Curing of Concrete**

The purpose of curing is to prevent loss of moisture from the concrete itself so that the cement inside the concrete is sufficiently hydrated which of course is slow and prolonged process. As soon as the concrete has hardened sufficiently the curing shall be started. To cure the concrete properly and sufficiently is also the sole responsibility of the contractor.

##### **Different methods of curing**

Any one of the following methods may be used for curing as approved by the Engineer.

(a) Curing by direct water.

(b) Curing by covering the concrete with absorbent material and kept damp.

Curing by direct water This is done either by ponding or spraying water.

(a) Ponding is widely used for curing slab and pavements. Earth bunds are formed over the slabs and water is pumped or poured into them and the same is replenished at interval to make up for the loss of evaporation. As this type of curing is one of the best methods, 10 days of curing after final setting is sufficient.

(b) By spraying water Curing is done by spraying water by suitable means at approved time intervals. While spraying, it shall be ensured that the complete area is covered. In order to avoid cracking, cold water shall not be applied to massive members immediately after striking the form work, while the concrete is still warm. Alternate wetting and over drying shall be avoided. Curing by spraying water shall be continued at least for 18 days after final setting.

Curing of concrete with absorbent material kept damp

The entire concrete surface is covered either with hessian, burlap, sawdust, sand, canvas or similar material and kept wet continuously for at least 12 days after final setting.

#### **14. Testing of Concrete**

The Contractor shall carry out, entirely at his own cost, all sampling and testing in accordance with the relevant I.S. standards and as supplemented herein. The Contractor



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shall get all tests done in approved Laboratory and submit to the Engineer, the test result in triplicate within 3 days after completion of the test.

#### **14.1. Consistency test (tests of fresh concrete)**

At the place of deposition/pouring of the concrete, to control the consistency, slump tests and/or compacting factor tests shall be carried out by the Contractor in accordance with I.S. 1199-1959 as directed by the Engineer.

The results of the slump tests/compacting factor tests shall be recorded in a register for reference duly signed by both the Contractor and the Engineer. That register shall be considered as the property of the Owner and shall be kept by the Contractor at site in safe custody.

The results of the slump tests/compacting factor tests shall tally, within accepted variation of plus or minus 12% with the results in the respective design mix, in case of mix design concrete and with the values indicated in the table under clause 6.1 of IS: 456 in case of nominal mix concrete.

For any particular batch of concrete, if the results do not conform to the requirements as specified in above or do not conform to any requirement of this specification, the Engineer has the right to reject that batch and the Contractor shall remove the same immediately from the site, at no cost to the Owner.

#### **14.2. Strength test of concrete**

While placing concrete, the Contractor shall make 6 nos. of 15 cm test cubes from particular batches of concrete as desired by the Engineer. The frequency of taking test cubes shall be either according to clause 14.2 of IS: 456-1978 or as directed by the Engineer.

The cubes shall be prepared, cured and tested according to IS: 516- 1959. Out of 6 nos. of test cubes 3 shall be tested for compressive strength at 7 days after casting and the remaining 3 at 28 days after casting.

A register shall be maintained at site by the Contractor with the following details entered and signed by both the Contractor and the Engineer. That register shall be considered as the property of the Owner.

- (a) Reference to the specific structural member
- (b) Mark on cubes
- (c) The grade of concrete
- (d) The mix of concrete
- (e) Date and time of casting
- (f) Crushing strength at 7 days
- (g) Crushing strength at 28 days
- (h) Any other information directed by the Engineer.



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#### **14.3. Acceptance criteria for test cubes**

The acceptance criteria of concrete on strength requirement shall be in accordance with the stipulations under clause 15 of IS: 456-1978.

#### **14.4. Non-destructive tests on hardened concrete**

If there is doubt about the strength or quality of a particular work or the test results do not comply with the acceptance criteria as stipulated under clause 15 of IS: 456-1978, non-destructive tests on hardened concrete like core test and/or load tests or other type of non destructive tests like ultrasonic impulse test etc. shall be carried out, as may be directed by the Engineer, by the Contractor at entirely his own cost.

The core tests and load tests shall comply with the requirements of clause 16.3 and 16.5 of IS: 456-1978 respectively. In case of other types of special tests like ultrasonic impulse test etc., the stipulation of clause 16.6 of IS: 456-1978 shall be applicable.

#### **14.5. Concrete below specified strength**

In case of failure of test cubes to meet the specified requirements the Engineer may take one of the following actions:-

- 1) Instruct the Contractor to carryout additional test and/or works to ensure the soundness of the structure at Contractor's expense.
- 2) Reject the work and instruct that section of the works to which the failed cubes relate shall be cut out and replaced at Contractor's expense and the resultant structures affected due to such rejection shall be made good at contractor's expense.
- 3) Modification/remedial measures if approved by the engineer to be carried out at contractor's expense.
- 4) Accept the work with reduction in the rate in appropriate item subject to the provisions of clause 15 of IS 456-1978 provided it is technically acceptable.

The reduction in the rate shall be as given below :-

- i) When test strength of the sample is above 90% of the characteristic strength, payment shall be made 10% less than the contract rate.
- ii) When test strength of the sample is between 80-90% of the characteristic strength, payment shall be made 25% below than the contract rate.

#### **14.6. Concrete failed in non-destruction tests**

In case the test results of the core tests or load tests in a particular work do not comply with the requirements of respective clause (16.3 for core test and 16.5 for load tests) of IS: 456-1978 the whole or part of the work concerned shall be dismantled and replaced by the Contractor as may be directed by the Engineer at no extra cost to the Owner and



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to the satisfaction of the Engineer. No payment for the dismantled concrete including relevant form work, reinforcement, embedded fixtures etc. shall be made. In the course of dismantling if any damage occurs to the adjacent structure or embedded item, the same shall be made good, free of charge by the Contractor, to the satisfaction of the Engineer.

#### **15. Steel Reinforcement**

Steel reinforcement shall be stored in such a manner that they are not in direct contact with ground. Bars of different classifications and sizes shall be stored separately. In cases of long storage or in coastal areas, reinforcement shall be stacked above ground level by at least 15 cm, and a coat of cement wash shall be given to prevent scaling and rusting at no extra cost of the owner.

##### **15.1. Bending and placing**

Bending and placing of bars shall be in conformity with IS: 2502-1963 "Code of Practice for Bending and Fixing of Bars for Concrete Reinforcement" and IS: 456 -1978 "Code of Practice for Plain and Reinforced Concrete".

##### **15.2. Tests**

Test pieces of welded bars shall be selected and tested in accordance with the provisions of IS: 2751-1979. The number of tests will be as laid down in IS: 2751-1979 or such larger number as the Engineer may decide having regard to the circumstances.

##### **15.3. Cleaning**

All steel for reinforcement shall be free from loose scales, rust coatings, oil, grease, paint or other harmful matters immediately before placing the concrete. To ensure this, reinforcements with rust coatings shall be cleaned thoroughly before bending/placement of the same.

#### **16. Shuttering**

All shuttering, formwork, supports and staging shall be designed by the Contractor and be subject to approval by the Engineer. The Contractor shall submit drawings and calculations to the Engineer for scrutiny when called upon to do so. The shuttering shall be designed for a live load of 400 Kg/m<sup>2</sup> in addition to the weight of the green concrete, or such other load as the Engineer may specify. The Contractor shall be responsible for the correctness and strength of the formwork including its supports and centering and approval by the Engineer will not relieve him of his responsibilities.

The staging and supports may be of round or sawn timber or tubular or other shapes in steel. Round timber shall preferably extend over the full height in one piece. These shall be securely jointed or otherwise fastened and spaced at suitable intervals as the design may warrant and shall be suitably braced at regular intervals horizontally and diagonally. The form work shall be of steel plate on steel frame, wooden boards with steel sheet



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lining, or plywood or seasoned timber board. Where ornamental and curved surfaces are required, the material shall be very good seasoned timber or plywood which can be shaped correctly.

#### **16.1. Fixing**

The shuttering shall conform to the shapes, lines, levels and dimensions shown in the drawing. It shall be fixed in perfect alignment and securely braced so as to be able to withstand, without appreciable displacement, deflection or movement of any kind, the weight of all construction, movement of persons and plant. It shall be so constructed as to remain rigid during the placing and compacting of concrete without shifting or yielding and shall be sufficiently watertight to prevent loss of slurry from the concrete. All props shall be supported on sole plates and double wedges. At the time of removing props these wedges shall be gently eased and not knocked out. The form work shall be so designed that the sides are independent of the soffits and the side forms can be removed easily without any damage or shock to the concrete.

#### **16.2. Wrought shuttering**

Wrought shuttering shall be such as to produce a first-class fair face on the concrete free from board marks or any other disfigurements. This shall be used for exposed surfaces where specified or directed by the Engineer. It may be made of heavy-quality plywood or steel sheets having smooth, plain surface. The joints in shuttering shall be arranged in a regular pattern approved by the Engineer. Wrought shuttering shall be aligned within a tolerance of 3 mm.

#### **16.3. Rough shuttering**

Rough shuttering shall be used for all surface of concrete walls, footings etc., which are not exposed in the finished work or which are to receive plaster and as directed by the Engineer. It may be made of timber, ordinary plywood or steel sheets.

#### **16.4. Different cases-**

Wherever concreting of narrow member is required to be carried out within shutters of considerable depth, temporary openings in the sides of the shutters shall, if so directed by the Engineer, be provided to facilitate cleaning, pouring and consolidation of concrete.

In liquid retaining structures and structures below ground water level, through bolts for the purpose of securing and aligning the form work shall not be used.

Forms shall be given an upward camber, if so desired by the Engineer, to ensure that long beams do not have any sag. The camber may be 1 in 250 or as the Engineer may direct.

The joints in form work shall be sealed by adhesive tapes or by other means, to prevent any leakage of slurry or mortar if so directed by the engineer.



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#### **17. Preparation for concreting**

Before any concreting is commenced the shuttering shall be carefully examined for dimensional accuracy and safety of construction. The space to be occupied by concrete shall be thoroughly cleaned out to remove rubbish, debris, shavings and saw dust. The surface in contact with concrete shall be coated with an approved substance such as mould oil or other non-staining mineral oil to prevent adhesion. Where necessary the surface shall be wetted to prevent absorption of moisture from concrete. Care shall be taken to avoid the reinforcements coming in contact with shutter oil.

#### **18. Removing Shuttering**

Removal of forms shall never be started until the concrete has thoroughly set and aged to attain sufficient strength to carry twice its own weight plus the live load that is likely to come over it during construction.

Removal of forms shall not entail chipping or disfiguring of the concrete surface. Shuttering shall be removed without shock or vibration and shall be eased off carefully in order to allow the structure to take up its load gradually.

Under normal circumstances (generally where temperatures are above 21 degree 'C'), and where ordinary Portland cement is used shuttering may be struck after the expiry of the following periods:-

<b>1.</b>	Walls, columns & vertical faces	24 to 48 hours as may be directed by the Engineer.
<b>2.</b>	Bottom of slab up to 4.5 m span	7 days
<b>3.</b>	Bottom of slab above 4.5 m span, bottom of beam and arch, rise upto 6 m span	14 days
<b>4.</b>	Bottom of beam and arch rise over 6 m span	21 days

These periods may be increased at the discretion of the Engineer. Special care shall be taken while striking the shuttering of cantilevered slabs and beams, portal frames etc.

Before removing the form work, the Contractor must notify the Engineer to enable him to inspect the condition of the finished concrete immediately after the removal of the form works.

#### **19. Contractor's responsibility**

Any damage resulting from faulty preparation, premature or careless removal of shuttering shall be made good by the Contractor at his own expense.

#### **20. Irrecoverable shuttering**



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In cases where the shuttering cannot be removed without damaging the structure itself or where removal of shuttering is rendered impossible due to the nature of construction or where the Engineer may so instruct, such shuttering shall be classified as irrecoverable shuttering. However, such abandoning of shuttering will be permitted only in situations where it will not remain exposed or otherwise cause damage of any kind.

**Metal Forms** Where permanently left-in-place metal forms or deck are shown in drawings or otherwise ordered to be provided by the Engineer, they shall satisfy the requirements with regard to load carrying capacity. The metal forms shall be obtained from a reputed manufacturer, whose performance guarantee shall be obtained and submitted to the Engineer. Designs and drawings giving full details shall be submitted to the Engineer in advance for approval.

#### **21. MASONRY**

This specification deals with masonry and allied works in foundation, plinth and superstructure.

##### **21.1. Selection of Mortars**

Mortar for masonry shall conform generally to IS: 2250-1981 "Code of Practice for Preparation and Use of Masonry Mortars", and proportion shall be as specified in the drawing or in the Schedule of Items.

##### **21.2. Cement Mortar**

Cement mortar shall be prepared by mixing cement and sand in specified proportion. It is convenient to take unit of measurement for cement as a bag of cement weighing 50 Kg equivalent to 0.035 cubic metre. Sand is measured in boxes of suitable size (say of 40 x 35 x 25 cm). It shall be measured on the basis of dry volume. In case of damp sand, the quantity shall be increased suitably to allow for bulkage in accordance with IS:2386-1963 (part-III) or by any approved method.

The mixing of the mortar shall be done preferably in a mechanical mixer. This condition may be relaxed by the engineer taking into account the nature, magnitude and location of the work.

If mixed in the mixer, cement and sand in the specified proportion shall be fed in the mixer and mixed dry thoroughly, water shall be then added gradually and wet mixing continued for at least 3 minutes. In case of hand mixing also after mixing dry on a water-tight masonry platform, water shall be added and the mortar turned over and over, backward and forward several times.

Fresh mixed mortar, in case becoming stiff due to evaporation of water may be retempered by adding water as frequently as needed to restore the requirement of the consistency but this shall be permitted only upto a maximum of 2 hours from the time of addition of cement in the mortar.



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#### **22. Brick Work**

Bricks shall not be dumped at site. They shall be carefully handled and carefully stacked in regular tiers to avoid breakage and defacement of bricks and prevent contamination by mud or other materials. The supply of bricks shall be so arranged that as far as possible at least two days' requirement of bricks is available at site at any time. Bricks selected for different situations of work shall be stacked separately.

##### **22.1. Soaking & Cleaning bricks**

Bricks required for masonry shall be cleaned to be free from dirt, dust and sand and fully soaked in clean water by submerging in vats before use, till air bubbling ceases. The bricks shall not be too wet at the time of use. After soaking they shall be removed from the tank sufficiently early so that at the time of laying they are skin dry and stacked on a clean space.

##### **22.2. Laying of bricks**

Brickwork in general shall be as per IS 2212-1991. Bricks shall be laid in English bond, unless otherwise specified, with frogs upward over a full bed of evenly laid mortar, and slightly pressed and tapped into final position to the lines levels and shape as shown in the drawing fully embedded in mortar. All joints including inside faces shall be flushed and packed. Not more than 8 courses shall generally be laid in a day. The first course itself shall be made horizontal by providing enough mortar in the bed joint to fill up any undulations. The horizontality of courses and the verticality of wall shall be checked very often with spirit level and plumb bob respectively.

Horizontal joints shall be truly horizontal and vertical joints shall line up in every alternate course. The joints shall not exceed 10 mm in thickness and shall be well finished and neatly struck. The joints shall be kept uniform throughout the brick work. All the brick joints of the face works shall be neatly raked out to a minimum depth of 15 mm with the help of raking tools and the faces of brick wall cleaned with wire brush to remove any splashes of mortar before the close of the day's work, while the mortar is still green and the last brick layer shall be cleaned with wire brush and the frogs free from mortar.

Walls coming in contact with R.C.C. structures shall perfectly be bonded with M.S. inserts or lugs where shown on drawings and the sides butting against the R.C.C. structures neatly and efficiently flashed and packed with rich mortar & cement slurry at no extra cost (cost of M.S. inserts or lugs used shall be measured and paid separately under relevant items). Where such lugs are not required to be provided, brick work shall be built tightly against columns, slabs or other structural parts, around door and window frames with proper distance to permit caulked joint. Where drawings indicate structural steel column or beam to be partly or wholly covered with brick work, bricks shall be built closely against all flanges and webs, with all spaces between steel and brick work filled solid with mortar not less than 10 mm thick.



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Damaged or broken brick or brick bats shall not be used in brick work. Cut bricks may be used to complete bond or as closers or around irregular openings.

Bricks shall not be thrown from heights to the ground but shall be handled carefully and put gently in position to avoid damaging their edges.

Selected bricks of regular shape and dimension shall be used for face work.

Making of grooves, sleeves and chases shall be done, during the construction, to the lines, levels and position as shown in the drawing or as instructed by the Engineer. Such sleeves shall slope outward in external walls so that their surface cannot form channels for the easy passage of water inside.

Fixtures, plugs, frames, pipes, inserts etc., if any, shall be built in at the right places to the lines & levels as shown in the drawings while laying the course and not later by disturbing the brick work already laid.

Brick walls of one brick thick or less shall have one selected face in true plane and walls more than one brick thick shall have both the faces of wall in true plane.

All connected brick work shall be carried out simultaneously with uniform heights throughout the work, and in exceptional cases, with the approval of the Engineer, the brick work built in any part of the work may be lower than another adjoining wall/connected wall by a maximum of one metre and the difference in height of adjoining wall/connecting wall shall be raked back according to bond by stepping at an angle not steeper than 45 degree, without sacrificing the necessary bond, horizontality of layers, verticality of joints and the wall. Tothing shall not be allowed in brick work, for raking back. The top layer just below the R.C.C slab or beam shall be laid with frogs down over a layer of mortar on full width.

#### **22.3. Openings in brick work**

Openings shall be made in brick work, which may be of any shape, size, at all levels, heights or depths, including round openings, as shown in the drawing or as directed by the Engineer, maintaining the necessary bond using a minimum of cut bricks. Openings in external face walls, the sills, jambs, soffits of opening may be rebated, and the sill shall be sloped slightly for drainage of rainwater.

All exposed brick work shall be rubbed down, thoroughly washed, cleaned and pointed as specified. Where face bricks of specific quality are used the same shall be rubbed with carborundum stone.

#### **22.4. Half-brick masonry**

Half-brick work shall be done in the same manner as for brick work except that all courses shall be laid in stretchers. Both faces shall be true to plane, and the joints raked on both faces.



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Where reinforcement is considered necessary or specified and shown in drawing, M.S. bars or hoop iron shall be provided as stipulated in the Schedule of Items or as directed by the engineer. The reinforcement shall be cleaned of rust and loose scale with a wire brush and shall be laid straight on the mortar and lapped with the dowel bars provided in the column, securely anchoring them at their ends where the half-brick wall butts. The batching of mortar usually shall be in the proportion of 1:4 or as stipulated in the Schedule of Items. Half of the mortar for the joints shall first be laid and the other half laid after the reinforcement is laid in position, so that the reinforcement is fully embedded in position.

#### **22.5. Brick on edge masonry**

The work brick on edge masonry wall in superstructure shall be done in the same manner as mentioned for brick work except that it shall always be reinforced with wire mesh netting of approved variety as specified in the item and embedded in cement mortar at interval as specified in the Schedule of Items. The wire netting shall be continuously laid and securely anchored with the dowel bars provided & projecting from the walls/RCC structure or steel structures at their ends where brick on edge wall butts. The batching of mortar usually shall be in the proportion of 1:3 or as stipulated in the Schedule of Items.

#### **22.6. Protection of brick work**

The brick wall shall be protected and covered with gunny bags or waterproof sheets from the effects of inclement weather, rain, frost, etc., during the construction and until the mortar sets. Care shall be taken during construction that the edges of jambs, sills and soffits of openings are not damaged.

#### **23. Curing**

All brick works shall be kept moist for 10 days after laying.

#### **24. Scaffolding**

Necessary and suitable scaffolding shall be provided at all heights to facilitate the construction of brick wall. Scaffolding shall be sound, strong and all supports, and other members shall be sufficiently strong and rigid, stiffened with necessary bracings and shall be firmly connected to the walls securing them against swing or sway. Planks shall be laid over the scaffolding at required levels. Scaffolding shall preferably be of tubular steel, although the Engineer may permit other material, depending upon the circumstances.

Scaffolding shall be double, having two sets of vertical supports, particularly for the face wall and all exposed brick work. Single scaffolding may be used for buildings upto two storeys high or at other locations, if permitted by the Engineer. In such case the inner ends of horizontal members shall rest in holes provided in header course only. Such holes shall not be allowed in pillars under one metre in width, or immediately near the skew backs or arches. The holes thus left in masonry shall be filled with bricks set in rich mortar and the surface made good on removal of scaffolding.



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If for any reason the Contractor is required to erect scaffolding in property other than that belonging to the Owner, including municipal corporation or local bodies, necessary permission shall be obtained by the Contractor from the appropriate authorities and necessary licensing fees if any shall have to be borne by him.

All scaffoldings once erected shall be allowed to remain in position, efficiently maintained by the Contractor, till all the finishing works required to be done are completed and shall not be removed without the approval of the Engineer. The Contractor shall allow workmen of other trades to make reasonable use of the scaffolding without any extra cost.

#### **25. PLASTERING AND POINTING**

Plastering shall be done in accordance with provisions of IS: 1661- 1972. Mix proportions of mortar for plastering and thickness of plaster shall be as given either in the drawing, or as per Schedule of Items or as directed by the Engineer. For special plaster work, necessary admixtures shall be added to mortar in required proportion as per manufacturer's specifications or as specified herein. The thickness mentioned in the Schedule of Items shall be minimum thickness.

##### **25.1. Preparation of surface**

The surface to be plastered shall be cleaned of all extraneous matter and rubbish. In masonry the joints shall be raked to a minimum depth of 12 mm and cleaned with wire brush. Concrete surfaces to be plastered shall be roughened and hacked to form key for plastering.

All plastered surfaces shall be finished smooth with a wooden float in one plane and all internal angles shall be finished slightly rounded. If desired by the Engineer, any unevenness shall be rubbed down by carborundum stones. The surface to be plastered shall be wetted evenly before the application of plastering. Trimming of projections on brick/concrete surfaces wherever necessary shall be done. For one coat plastering the plaster shall be laid slightly thicker than the specified thickness and the surface then levelled with flat wooden float to the required thickness. For two coat plaster work, the first coat (usually half of total thickness) shall be applied as detailed above except that the surface shall be left rough and keys formed for the application of second coat.

The second coat shall be laid on with a wooden float to the specified thickness and shall be applied a day or two after the first coat has set, but has not dried up. Cement mortar for plastering work shall be used within 30 minutes after adding water to cement and should be kept agitated at intervals of 20 minutes. If specified cement punning shall be done over the plastered surface by sprinkling neat cement powder evenly on the surface and rubbed smoothly with a trowel to give a fine coating. The plaster shall be kept wet for at least seven days and protected from extreme temperature and weather during this period. The arises of doors and windows shall have richer mortar 1:3 in a width of 75 mm on either side or as required at respective location.



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Concrete beams, slabs, columns etc. framing into masonry are to be plastered along with masonry walls with these edges wrapped with chicken wire mesh of gauge 24. Overlapping of mesh shall be minimum 75 mm on either side of the edge of the concrete element. Minimum lap for chicken wire mesh shall be 50 mm.

#### **25.2. Cement Pointing**

Where shown on drawing, Schedule of Items, or as directed by the Engineer, exposed brick faces shall be cement rule pointed. The mortar shall be raked out of the joints to a depth of 12 mm. The dust shall be brushed out of the joints and the wall well wetted. Unless otherwise specified the pointing shall be made with cement and sand mixed in proportion 1:3.

The joints of the pointed work shall be neatly finished truly vertical and horizontal or as directed and the lines shall be kept wet till the cementing material has set and become hard. If required, the whole brick face shall be rubbed and polished with fine grade of carborundum stones. Particular care shall be taken to see that no brick face or brick edge is damaged during this work.

#### **25.3. Curing**

The pointing shall be kept wet for 7 days. During this period, it shall be suitably protected from all damages.

### **26. WHITEWASHING, COLOUR WASHING AND PAINTING**

This chapter deals with whitewashing, colour washing, distempering, cement washing, emulsion painting, silicate painting etc., to concrete and masonry surfaces and painting to the wood works and steel works. For the items which have not been completed or partly covered in this chapter, specifications suggested by the manufacturers for the materials, surfaces preparation, workmanship and all bye works shall be strictly followed and shall be carried out as per direction of the Engineer.

Wherever scaffolding is required/necessary, it shall be erected on double support tied together by horizontal pieces, over which the scaffolding planks shall be fixed. No part of it shall rest on or touch the surface which is being washed/painted. Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage or scratches to walls. For whitewashing the ceiling, proper stage scaffolding shall be erected. The surface on which wash is to be applied shall be thoroughly brushed free from mortar droppings and foreign matter.

#### **26.1. Whitewash**

The wash shall be prepared from fresh stone white lime of approved quality and shall be thoroughly slaked on the spot mixed and stirred with sufficient water to make a thin



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cream. This shall be allowed to stand for 24 hours and then shall be screened through a clean coarse cloth. 4 Kg of gum dissolved in hot water shall be added to each cubic metre of the cream.

The approximate quantity of water to be added in making the cream will be 5 litres of water to 1 Kg of lime. Indigo/ultramarine, blue up to 3 gm per kg of lime dissolved in water shall then be added and wash stirred well. Water shall then be added at the rate of about 6 litres per kg of lime to produce a milky solution. The whitewash shall be applied with approved brushes to the specified number of coats.

The operation for each coat shall consist of stroke of brush given from the top downwards, another from the bottom upwards over the first stroke and similarly one stroke horizontally from the right and another from the left before it dries. The whitewashing on ceiling shall be done prior to that on walls. Each coat shall be allowed to dry before the next one is applied and shall be subjected to inspection and approval by the Engineer. No portion of the surface shall be left out initially to be patched up later on. The finished dry surface shall not show any signs of cracking and peeling, nor shall it come off readily on the hand when rubbed. Doors, windows, floors and such other parts of the building not to be whitewashed shall be protected from being splashed upon.

A priming coat of whitewash with lime shall be applied before applying two or more coats of the colour wash (as specified). Entire surface should represent a smooth and uniform finish. Sample of colour wash shall be duly approved by the Engineer before application. Same specification as that of whitewash shall be followed for colour wash also using necessary amount of colouring ingredient of approved tint.

#### **26.2. Whitewashing with Whiting**

Whiting (ground white chalk) shall be dissolved in sufficient quantity of warm water and thoroughly stirred to form a thin slurry which shall then be screened through a clean coarse cloth. 2 Kg of gum and 0.4 Kg of copper sulphate dissolved separately in hot water shall be added for every cum. of slurry which shall then be diluted with water to the consistency of milk so as to make wash ready for use. Other specification remains same as per whitewashing with lime.

#### **26.3. Cement Primer Coat**

The surface shall be thoroughly cleaned of dust, mortar, droppings etc., and shall be allowed to dry for at least 48 hours. It shall then be rubbed thoroughly by sandpaper to give a smooth and even surface. Any unevenness shall be made good by applying putty, made of plaster of paris mixed with water on the entire surface including filling up the undulation and then sand papering the same after it is dry. The cement primer shall preferably be applied by brushing and not by spraying. Horizontal strokes shall be given first and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as smooth as possible, leaving no brush marks.

#### **26.4. Water-proof cement paint**



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The prepared surface shall be thoroughly wetted with clean water before waterproof cement paint is applied. The paint shall be prepared strictly as per manufacturer's specifications, in the absence of which it shall be mixed in two stages. The first stage shall comprise of 2 parts of waterproof cement paint and one part of water stirred thoroughly and allowed to stand for 5 minutes. Care shall be taken to add the paint gradually to the water and not vice versa. The second stage shall comprise of adding further one part of water to the mix and stirring thoroughly to obtain a liquid of workable and uniform consistency. The paint shall be mixed in such quantities as can be used up within an hour of its mixing. Paint shall be applied with brushes or spraying machine. The solution shall be kept well stirred during the period of application. It shall be applied as far as possible on the surface which is on the shady side of the building so that direct heat of the sun on the surface is avoided. Painted surfaces shall be sprinkled with water 2 or 3 times a day. This shall be done between coats and for at least 2 days following the final coat. The curing shall be started as soon as paint has hardened so as not to damage by sprinkling of water say about 12 hours after the application. A uniform shade should be obtained after application of paint. Cement paint shall not be applied on surfaces already treated with whitewash, colour wash, distemper, varnish paint etc., and on gypsum, wood and metal surfaces.

#### **26.5. Synthetic washable distemper**

The surface shall be prepared as for Cement Primer Coat. A primer coat of cement or distemper primer shall be applied as specified in the description of the item. Unevenness in the plaster shall be made good by applying plaster of Paris putty mixed with distemper of the colour to be used on the entire surface including filling up the undulations. The surface shall then be rubbed down with a fine grade sandpaper and made smooth. After the primer coat has dried for at least 48 hours, the surface shall be lightly sand papered to make it smooth, taking care not to rub the priming coat out. All loose particles shall be dusted off. One coat of distemper properly diluted with thinner, shall be applied with brushes/rollers in horizontal strokes followed immediately by vertical ones which together constitute one coat. The subsequent coats shall be applied in the same way. Two or more coats of distemper as are found necessary shall be applied to obtain an even shade. A time interval of at least 24 hours shall be allowed between consecutive coats. The brushes shall be of 15 cm. double bristled type. They shall be maintained in proper condition and those that are dirty or caked will not be allowed to be used. The finished surface shall be even and uniform without patches, brush marks, distemper drops etc. Sufficient quantity of distemper shall be mixed to finish one room for applying one coat in one operation.

#### **26.6. Dry Distemper**

The surface shall be prepared in the same manner as for synthetic washable distemper. A primer coat using approved whiting shall be applied over the prepared surface. Distemper prepared as per manufacturer's direction shall be applied and each coat shall be allowed to dry before subsequent coat is applied. The finished surface shall be free from chalking when rubbed, even, uniform and shall show no brush marks.



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#### **26.7. Plastic emulsion paint**

The surface on which plastic paint has to be laid must be thoroughly cleaned and prepared and all defects rectified and finally prepared in the same manner as for synthetic washable distemper. The surface shall be dry and rubbed smooth by means of sandpaper to the satisfaction of the Engineer. One coat primer and two coats of plastic emulsion paint are to be applied. The work is to be carried out under direct guidance and instructions from the manufacturers whose expert advice and supervision are to be made available in order to achieve the high-grade finish. The painters employed for this work must be capable of producing the highest standard of workmanship required. If the finish is of doubtful nature, the contractor shall have to rectify at his own cost to the entire satisfaction of the Engineer.

#### **27. REPORTING OF ACCIDENT**

All accidents, major or minor must be reported immediately. The Contractor will provide first aid to the injured person immediately and the injured person shall report to the first aid station along with the 'INJURED ON WORK' form duly filled in quintuplicate and submit to the Medical Officer of the First Aid Station". Serious Injury In case of serious injury, the following procedure shall be adopted by the Contractor:

1. Provide First Aid at his own First Aid Station.
2. Take the injured person to the Hospital along with the "INJURED ON WORK" form duly filled in.
3. Reporting the accident to the Owner/Engineer by the Contractor.

#### **Fatal Accident**

Fatal accident must be reported immediately to the Engineer/Owner as well as to the Police.

Penalty

Failure to observe the Safety Rules will make the Contractor liable to penalty by way of suspension of work, fine and termination of contract.

#### **28. APPROVED VENDOR LIST**

<b>Sl No</b>	<b>Items/Name of Products</b>	<b>Makes / Brands / Manufacturers</b>
1	Cement	Ambuja, ACC, JK, Grasim, Ultratech, Birla, Bangur
2	Reinforcement Steel	TATA, SAIL, KAMDHENU, JINDAL, JSW
3	Concrete Admixture	Pidilite, Fosroc, CICO, Sika.
4	Integral water proofing compound	STP, Pidilite, Fosroc, CICO, Sika.
5	Grout	Shrinkomp, Fosroc, Fairmate
6	Wall care Putty for Base	Birla Wall care putty, Berger, Jenson & Nicholson,



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	preparation	JK White
7	White Cement	Birla, JK
8	Cement based Paints	Super Snowcem, Duracem, Super Acrocem.
9	Dry Distemper / Oil bound Distemper	Goodlass Nerolac Paint, Shalimar Paint, Jenson & Nicholson, Asian Paint, Berger. ICI Dulux
10	Plastic Emulsion Paint	Asian, Berger, ICI, Nerolac, Jenson & Nicholson, Shalimar, Garware & Goodlass

\*\*Any materials not fully specified in these specification and which may be offered for use in the works shall be subject to approval of Engineer, without which it shall not be used anywhere in the construction works.



# **JOB SPECIFICATION FOR SS TUBING AND ELECTRICAL WORKS**

**A. SCOPE OF WORK**

This document is a brief scope of work that includes the supply of SS Tubes, Fittings, Valves, Portable Fire Extinguishers, loading/unloading of equipment, etc. and carrying out an erection, testing, commissioning of SS Tubing and equipment erection Works at Daughter CNG Stations at various locations as per the advice from Gasonet.

- Supply, Laying, Testing and Commissioning of SS Tubes, Fittings and valves, complete with fixing arrangement with existing angle support by U-clamps/Bracket in trench and supports above ground for CNG application.
- Carrying out pneumatic testing and purging with nitrogen as per approved procedures, providing all tools, tackles, instruments, manpower and other related accessories for testing tubes.
- Receipt of free issue items from CLIENT's stores (i.e. Compressor, Cascades & Dispenser), loading, transportation and unloading at project sites. Proper storing, stacking, identification, providing security and insurance during and before erection, and commissioning.
- Handing over the completed work to the client for their operation/ use purposes.
- Loading material/equipment on a truck from stores and Safe transportation to various sites.
- Unloading, placement and alignment on foundation –either on the ground or above ground (+ 3.5 m) on rooftop/platform top (cascades only).
- Transit Insurance of equipment from stores to site.
- All equipment transported shall be securely boarded and transported without causing any damage to equipment. Any damage caused during loading; transportation & unloading shall be recovered from the contractor.
- Cut the ends square with a hacksaw and a suitable guide. Tube cutters are satisfactory for most tube materials, but end-to-work hardened stainless steel. Proper care shall be exercised while cutting the SS tubes to avoid hardening.
- Burrs must be removed inside and outside for proper entry into the fitting to prevent contamination and restricted flow. 'Swagelok/Parker' de-burring tool shall be used.
- Remove all fittings, chips, and grit before attachment of fittings.
- The work shall be carried out in the best workmanship-like manner, in conformity with these specifications, approved drawings and the instructions of the Gasonet Gas Site-in-charge from time to time.
- The contract shall include clearing of temporary construction, waste materials and loose earth, which might get collected in and near the work site consequential to the execution of work under this contract.
- Any other work not specifically mentioned herein but required for the satisfactory completion/ operation/ safety/ statutory/ maintenance of the works shall also be covered under the scope of work and has to be completed by the contractor within the specified schedule at no extra cost to Gasonet.
- Technical Specifications of Gasonet shall be followed for any execution activity at the site.
- Supply of Safety equipment shall be as per technical specifications; Tagging of each equipment



shall be required with all the required details. Suitable Tags shall be done to stand the external environment.

- Supplier/Contractor shall procure the below set of equipment for each site, and Installation of Tube & fitting shall be done by using the following equipment:

- Tube Bender
- Tube cutter
- Pre-Swaging tool
- Tee ranch
- De-burring tool
- Threaded gauge
- Depth tool
- Gap inspection gauge
- Temperature Gun and Pressure Gauge
- Vices
- Teflon tape (Standard make)
- Depth tool
- 6-inch ruler
- Indelible pen or felt tip marker - low chloride.
- Open-end wrenches in two sets
- Personal protection equipment

#### Applicable Codes & Standards

The bidder shall supply, install and commission the material as per design and engineering, confirming the following code & standards but not limited to

- All rigid piping, tubing, fittings and other piping components shall conform to the recommendations of ANSI B 31.3. "Process Piping Guide". All piping elements shall be designed for the full range of Pressure, Temperature and loading to which they may be subjected with a factor of safety of at least 4 (four) based on the minimum specified tensile strength at 20°C.
- National Fire Protection Association Code,
- Oil Industry Safety Directorate Norms,
- ASTM A 269 - Standard Specification for Seamless and Welded Austenitic Stainless-Steel Tubing for General Service.
- ASME SA-479 - Standard Specification for Stainless Steel Bars and Shapes for use in Boilers and other Pressure Vessels.
- ASME A-182 – Standard Specification for Forged or Rolled Alloy and Stainless-Steel Pipe Flanges,
- ASME 31.8 - Gas Transmission and Distribution Piping Systems.
- ANSI B1.20.1 - Standards on Pipe Threads
- Gas Cylinder Rules (Latest Edition)
- CCoE / PESO Guidelines (Latest Edition).
- NZS 5425 - Code of practice for CNG compressor and refueling station (New Zealand Standards). All the above codes shall apply to the proposed job.

#### MATERIAL SPECIFICATION

The piping material specification in package units shall strictly conform to the relevant services indicated in the enclosed specifications. However, suppose the vendor cannot supply Piping / Tubing conforming to these Specifications. In that case, the vendor may be allowed for deviations,



provided the vendor's deviated specification is superior to that specified, and the owner and consultant approve all such variations.

**B. TECHNICAL SPECIFICATIONS**

**1. BRIEF SPECIFICATIONS FOR SS TUBING**

Specification	SA-213 Gr. TP 316 / 316L
Make / Vendor	<b>Sandvik / Parker / Tubacex</b>
Material	SS 316/316L (ASTM A-269)
Hardness	Rb 80
Finish	Fully annealed
Rating	It shall be suitable for more than 275 bar-g (working pressure.)

Tubing shall be suitable for bending, flaring and cold finish. Finishing shall be scratch-free and bright polished. Batch / make / traceability marking should be placed on every tube, and a test certificate shall be made available before installation.

**2. BRIEF SPECIFICATIONS FOR FITTINGS**

Make / Vendor	<b>Swagelok / Parker</b>
Material	SS 316/316L (ASTM A-269)
Rating	It shall be suitable for more than 275 bar-g (working pressure.)

- All fittings shall be designed for a Minimum 5000 PSIG working pressure.
- The fittings shall be flare-less and consist of four primary components, i.e. Body, Nut, Front Ferrule and Back Ferrule. All the Parts should be interchangeable for only the same make of Ferrules.
- All fittings shall be suitable for the tubes as per ASTM A-269. The tolerance and hardness of the Tubes will be Rb 80.
- The primary material for the fittings shall be SS 316, bar stock as per ASME SA-479, and forging shall be ASME A-182.
- Fittings shall be suitable to operate at high temperature and pressure combinations.
- NPT thread shall be as per ANSI B1.20.1 standard. Male threads must be made by the Cold rolling method and protected by plastic caps.
- Heat Code Traceability numbers will be roll marked on the Body and Nut Ferrules.
- The nut shall be silver-plated inside to reduce torque and prevent galling.
- Fitting body, Nut and Ferrules shall be electro-polished.
- Front Ferrule, which is a wet part, shall not be hardened by Heat treatment.
- The rear ferrule, which grips the tubing and is not typically a wet part, shall be significantly hardened than the tubing up to RC 60 hardness.
- Heat Treatment shall not harden the rear ferrule.
- For hardening of the back ferrule, multiple processes shall not be used.
- The sealing cone of the body where the front ferrule seats shall be burnished to remove tool marks and to give an extra smooth surface for proper sealing.
- Fittings shall be designed for a minimum of 50 - 60 remakes.
- Fittings shall be gauge able. Gauges shall be provided.

a. **FABRICATION, INSTALLATION / INSPECTION & TESTING FOR TUBING AND FITTINGS**

The following test shall apply to the entire job in various stages but not limited to the next and shall be executed per the best engineering practice. The certificate mentioned below parameter must be submitted as a part of the test certificate along with the invoice.

- Visual Examination
- Pneumatic Pressure Test
- Material and Performance Test certification shall be offered, witnessed & performed/submitted.
- Generic test certificates from NABL-accredited test labs shall be submitted.

b. **FABRICATION & INSTALLATION SPECIFICATIONS – STAINLESS STEEL & FITTINGS**

Cutting, Fit-up and laying out

- The template shall be used for laying out headers, laterals and other irregular details to ensure accurate cutting and proper fit-up.
- The pipes/tubes shall be aligned correctly within the existing tolerance on the diameter, wall thickness and out-of-roundness.
- Rigid support clamps / heavy-duty brackets for clamping SS Tubes shall be provided at minimum distances, i.e. 1 meter and near all joints as per the standard engineering practice.
- For fit-up, the maximum recommended torque shall be given for tightening it.
- Rubber gaskets shall isolate MS Angle and U-clamps or brackets.

Bending

- Completed bends/elbows shall have a smooth surface free of flat spots and corrugations.
- Hot bending is not permitted.
- The bends shall be free of buckles, cracks, wrinkles, bulges, and other visible defects.
- The tolerance on bending shall be maintained.
- Cold bends to a radius of three (3) times the nominal pipe diameter or greater may be made without subsequent stress relieving. For good quality bends three (3) times the nominal pipe diameter. Bends shall be made subject to the approval of the Engineer-In-Charge or its representative.
- The flattening at any cross section shall not exceed 8% and 3% of the nominal outside diameter for internal and external pressure, respectively. Similarly, reduction in wall thickness as measured by the difference between nominal and minimum thickness shall not exceed 10% of nominal pipe thickness.

c. **INSTALLATION, INSPECTION, TESTING & COMMISSIONING, REPORTS / DOCUMENTATIONS**

- All equipment shall be installed conforming to good general engineering practice and particularly to NFPA Code, OISD Norms, ASTM A-269, ASME 31.8, Gas Cylinder Rules, CCOE / PESO



Guidelines, NZS 5425.

- The bidder shall arrange all the necessary erection tools, tackles, testing and measuring equipment for testing and commissioning of the job.
- Test certificates for routine tests on individual items or equipment shall be provided. Tests shall be listed in the relevant specifications and, at minimum, in the applicable Indian Standard specifications.
- The bidder shall submit all relevant test certificates to GASONET or its representative, and the necessary witness shall be made by them at the site for mechanical works as per standard practice.
- Gasonet, its representative, shall inspect the erection, witness the testing and commissioning of the equipment at the site and approve the test certificate. Their certification shall be attached to the invoice for the payments.
- Bidder shall do necessary painting & marking as per BIS wherever required. The bidder shall provide station-wise as-built Drawings for the entire installation work before commissioning, along with the invoice or as per the EIC instructions.
- The bidder has to provide the necessary tag marking on the tubing as Low, Medium & High Bank at both ends of the high-pressure tubing installation. Further, painting of “Emergency valve” and “Low”, “Medium”, and “High” on the MS Plate located at the isolation valve of the dispenser so that outsiders can visualize in case of emergency.
- Bidder shall provide wire mesh screen in SS tubing trench at the bottom side of dispenser base frame for protection against rat bite on cables & other accessories of the dispenser. Specification of Wire Mesh Screen: - Material - SS304, Diameter of Wire – 1mm, Mesh/Inch – 1, Type – Square Mesh.
- If any inspected or tested services / Goods fail to conform to the specifications, Gasonet may reject them, and the bidder shall either replace the rejected Goods or make all alterations necessary to meet specification requirements, free of cost to Gasonet.
- Final measurements shall be taken jointly by GASONET EIC, Bidder, or its representatives at the site to be certified by both for their correctness for billing and payments.
- Gasonet or its representatives shall carry out material inspection.
- Bidder shall carry out necessary hook-up & interconnecting tubing with CNG Dispenser (to be supplied by Gasonet as free issue material) and further successful commissioning, including supply of material, fabrication, erection/installation, testing, etc.
- Bidder shall carry out necessary hook-up & interconnecting tubing leak test with Air Compressor (if available) for pneumatic air supply (to be supplied by Gasonet or OMC as free issue material) and further successful commissioning, including collection of material, fabrication, erection/installation, etc.
- Material reconciliation shall be done jointly after the completion of work at each of the stations.
- Bidder shall furnish the reports, such as Inspection & Testing Report, Material Test Certificates, and Final As-built drawing in Soft & Hard copies duly certified as per EIC instruction.
- Bidder shall decide to display a hard copy (in the form of a rigid board) of the mechanical layout of the CNG station duly approved & authorized by EIC of Gasonet.
- Bidder shall provide header arrangement including tubing piece, ball valve & required fittings in storage cascade to facilitate/enable CNG filling or unloading. However, this is an optional case, and it may be performed with prior concern from the EIC of Gasonet.



**d. WARRANTY / GUARANTEE / DEFECT LIABILITY**

Bidder shall replace the material against defect & workmanship, etc., if any, The defect liability of material workmanship shall be one year from the date of completion of the entire job of each CNG Daughter station and acceptance by Gasonet. A necessary deduction shall be made from the final bill or recovered from CPBG if any non-conformance is found.

**e. EXCLUSION**

- GASONET EIC shall arrange the required work permit or site clearance for the job; Contractors shall take the Work Permit before execution of the job.
- GASONET or its representative shall inspect & witness the entire job.
- Before dispatching at the site, GASONET or its representative shall approve the sample quality of material, color, make, etc.
- GASONET shall arrange the approval of authority if required. Necessary marking for the same shall be made jointly, if any.
- GASONET shall provide an Electrical LT power supply at the station if needed.
- Gasonet shall arrange assistance in the installation, testing & commissioning of the compressor and dispenser from the respective OEM (Vendor).
- GASONET shall arrange the installation, testing & commissioning of Air compressors for operating pneumatic valves (if required) through the OEM vendor. However, the bidder shall provide the connectivity from the Dispensers to the Air Compressor & anywhere if needed.
- Gasonet shall arrange all the required permissions/approvals related to the CNG station.

**f. OTHER TERMS & CONDITIONS**

- The bidder shall provide a first aid box at the place of work for minor injuries to his staff. It is pertinent to state that the Gasonet, as referred above, shall be in no way responsible for any medical claims/reimbursement/premium of any medical or pertaining insurances to the bidder staff.
- The bidder shall be responsible for his employees observing all security and safety rules set by Gasonet & may issue regulations and instructions occasionally. In case the Gasonet suffers any losses, etc., of whatsoever in nature on account of the bidder's employees not following the security/safety norms, the bidder shall be liable to make good all such losses as may be determined by the Gasonet and the Gasonet shall have the right to recover all such losses, etc., from the dues payable to the bidder. The bidder shall provide details of each person engaged at the site and must fill in a prescribed Performa of all the employees for records. Any staff shall be hired after the approval of the Gasonet only.
- The bidder shall ensure disciplined behavior amongst his staff/workers at the place of working. If any Bidder employee violates the norms of discipline and good conduct, the bidder shall be liable to take disciplinary actions.
- The bidder shall mobilize at a site within the stipulated time as indicated in the Work Order unless otherwise specified elsewhere in the Work Order to mobilize early on necessities of the requirement of Gasonet. The bidder shall mobilize the materials and resources per EIC's written instructions.
- The work shall be performed during day hours only; if required to be carried out in the night hours,



permission shall be obtained from Gasonet in advance. If necessary, adequate illumination has to be provided by the bidder at their cost.

### **3. SPECIFICATION FOR SS TUBE LAYING & TESTING**

#### **a. Laying of SS Tube:**

Supply, laying, testing and commissioning of SS tubes and fittings, complete with all supports. The contractor shall procure and install the MS Angle, Bracket and U-clamps (galvanized) / other fixing arrangement. Payment shall be at the rate for the work set out in the agreed Schedule of Rates. The contractor shall engage any sub-contractor for this specialized work after confirmation/permission of Gasonet. Also, the contractor shall submit all documents like experience certificates “Similar Works” of manpower deployed at a site for Electrical and Mechanical Works.

#### **b. Scope of Works: For Laying, Testing and commissioning of SS Tubing**

Generally, the following shall constitute the contractor’s scope of work but not be limited to as given herein:

- SS tubes shall be clamped to the MS Angle at every 1000 mm using U-clamps (galvanized)/ Bracket (Box Clamp – Heavy Duty)/ P-clamps of Standard make / SS– 308 clamps with EPDM cushion.
- The practice of flattening tubes for clamping purposes shall not be permitted.
- MS Angle and U-clamps (galvanized) shall be procured from approved manufacturers and through a QAP, including stage inspection and pre-dispatch inspection of the materials by Gasonet. (To be isolated by rubber gaskets). Tubes shall be bent using tube benders only, and any hot bending will be rejected. Tubes shall be cut using a cutting device.
- Hot cutting is not allowed.
- Carrying out pneumatic testing and purging with nitrogen as per approved procedures; providing all tools, tackles, instruments, manpower and other related accessories for testing tubes.
- Start-up and commissioning assistance.
- Handing over the completed works to Gasonet or their operation use purposes.
- Any other work not specifically mentioned herein but required for satisfactory completion/ operation/ safety/ statutory/ maintenance shall also be covered under the scope of work and must be completed by the contractor within the specified schedule at no extra cost to Gasonet.

#### **c. INSTALLATION PROCEDURE**

- Cut the ends square with a tube cutter. Tube cutters are satisfactory for most tube materials but tend to work to harden stainless steel. Proper care shall be exercised while cutting the SS tubes to avoid hardening.
- Burrs must be removed inside and outside for proper entry into the fitting to prevent contamination and/or restricted flow.
- Remove all fittings, chips, and grit before attachment of fittings.
- Depth marking tool shall be used before installation of Tubes & fitting.
- Assembly
- Tube line fabrication must be accurate so that the tube end quickly enters the fitting in proper alignment. Do not force an improperly fitted tube line into the fittings.
- Never permit the fitting body to rotate during tube end make-up; use two wrenches. Assemble port



connectors to components first and hold with a wrench while making up the tube joint. All union bodies must be maintained while each tube end is made up.

- Never attempt to make up by torque.
- Always turn the nut to the prescribed amount regardless of the torque required. Fitting end plugs only needed 1- ¼ turn from finger-tight makeup in all sizes.

**d. Remake of Fittings**

A disassembled joint can be remade by retightening the nut to the position of the original make-up; for a maximum number of remakes, mark the fitting and nut before disassembly. Before retightening, ensure the assembly has been inserted into the fitting until the ferrule(s) seats in the fitting. Retightened the nut by hand. Rotate the nut with a wrench to the original position as indicated by the previous marks lining up. (A noticeable increase in mechanical resistance will be felt, showing the ferrule is being re-sprung into the sealing position.) Then, snug the nut 1/12 turn (1/2 hex flat) past the original place.

**e. Reference Specification, Codes and Standards**

The contractor shall work following this specification, Gasonet Engineering Standards, ASME B 31.8 - Gas Transmission and Distribution Piping Systems, Oil Industry Safety Directorate (OISD) norms.

Should the contractor find any discrepancy, ambiguity or conflict in or between the Standards and the contract documents, this should be promptly referred to the GA head for his decision, which shall be considered binding on the contractor.

**f. Scope of Supply**

**Supplied by The Contractor at his Own Cost as Part of This Specification:**

The procurement and supply of MS Angle with U-clamps at the appropriate time of all the materials and consumables, except for the materials specifically enlisted under the owner's scope of supply, shall be entirely the contractor's responsibility, and its rates of execution shall be inclusive for all these items, as follows but not limited to these:

- Bolts and nuts for supports, U-bolts with nuts, clamps for tubes, and anchor bolts of various sizes for fixing concrete structures.
- Bitumen paints primer and solvents.
- All material for minor civil works like grouting, etc.
- Minor structural steel for fabrication of tube/ tray supports like MS plates, GI plates, flats, pipe, etc.
- Pumps, compressor, Corrosion Inhibitor for water used for hydrostatic testing, including water for testing, inert gas for purging.
- All items not expressly mentioned in the contract but necessary for the work contract's satisfactory completion and performance.

Note: Gasonet must approve samples of all the consumables items/test certificates.

**g. TESTING PROCEDURE:**

Hydrotest SS316:

1. When filling the line with test fluid, keeping all the vents and other connections used as vents open to remove air is essential. Temporary isolating valves should be provided for pressurizing and depressurizing the system if valves, vents, or drains do not exist.
2. Pressure shall be applied only after the system/line is ready and approved by the Gasonet Site-In-Charge.
3. A suitable test pump or other pressure source must be used to apply pressure for testing. It is essential to isolate the pressure source from the system as soon as the desired test pressure is reached and stabilized within the system.
4. A pressure gauge shall be provided at the pump discharge to guide the system to the required pressure.
5. The pump shall be attended constantly during the test by an authorized person.
6. The pump shall be isolated from the system wherever the pump is to be left unattended.
7. Test pressure shall be gradually increased at 70 Bar for enough time to permit thorough inspection of all joints for leakage or signs of failure. Any joint found leaking during a pressure test shall be re- tested to the specified pressure after repair.
8. During a pressure test, the test pressure should be gradually increased from 70 to 150 Bar over a sufficient period to allow for a thorough inspection of all joints for leakage or signs of failure. If any joint leaks during the pressure test, it must be re-tested to the specified pressure after being repaired.
9. Test pressure shall be gradually increased from 150 to 380 Bar and maintained for enough time to permit thorough inspection of all joints for leakage or signs of failure. Any joint found leaking during a pressure test shall be re-tested to the specified pressure after repair. The test period shall be maintained for a minimum of 4 hours.
10. The pump and the piping system to be tested must be provided with separate pressure-indicating test gauges. The gauges are to be checked by the standard test gauge before each pressure test.
11. Care shall be taken to avoid increased pressure due to atmospheric variation during the test.

**h. INSPECTION ACTIVITY FOR SS 316**

1. This specification covers the general requirements for piping system inspection, flushing and testing. However, testing of steam lines falling under IBR shall also be governed.
2. Gasonet Engineer-in-Charge shall witness the flushing and testing of all piping systems.
3. During various stages and after completion of fabrication and erection, the piping system shall be inspected by the engineer- in - Charge to ensure that:
  - Proper piping material has been used.
  - Piping has been erected as per drawings and the instruction of the Engineer-in-charge.
4. All support has been installed correctly.
5. Test preparations mentioned in this specification have been carried out.
6. Test Certificates and all the concerned certificates shall be checked before the start of testing.

**i. FLUSHING**

1. Flushing of all lines shall be done before pressure testing. Flushing shall be done by freshwater or dry compressed air, wherever water flushing is undesirable, to clean the pipe of all dirt, debris or loose foreign materials.
2. Required water pressure flushing shall meet the fire hydrant or utility water pressure. The system will be pressurized by compressed air at the required pressure of 50 psi maximum for air flushing the line.
3. The pressure shall then be released by quickly opening a valve in the line. This procedure shall be repeated as often as required until the pipe's inside is thoroughly cleaned.

#### **4. TECHNICAL SPECIFICATION FOR ELECTRICAL WORKS**

This specification intends to define the requirements for the supply of equipment and materials (as required), erection, testing and commissioning of the electrical power distribution system.

The work shall be carried out in the best workmanship-like manner, in conformity with these specifications, approved drawings and the instructions of the Engineer-in-charge from time to time. The contract shall include clearing of temporary construction, waste materials and loose earth, which might get collected in and near the work site consequential to the execution of work under this contract.

##### **a. STANDARDS:**

The Electrical equipment and system design, manufacture, testing, installation, site testing, and commissioning shall comply with the applicable latest revision of Bureau of India Standards and OISD standards.

- BIS -3043 Code of practice for earthing
- BIS-2309 Protection of building and allied structures against lightning-code of practice BIS -7098 Part -1 Cross-linked polyethylene insulated PVC sheathed
- OISD 137 Inspection of Electrical Equipment
- OISD 147 Inspection and safe practice during electrical installations NFPA 72 National fire alarm code OISD 163 Control room safety.

In case of any conflict, the stipulations under this specification shall govern. In addition to the above, the Electrical installation, testing and commissioning shall also conform to the requirements of the following rules/regulations as amended up to date:

- The Indian Electricity Rules and Act
- The Indian Electricity Act
- Central Electricity Authority regulations 2010.
- The rules laid down by the Chief Electrical Inspector of the state government / Central Electricity Authority (CEA).
- PNGRB Regulation
- The Indian Electricity Supply Act.
- The Indian Factories Act,
- The Petroleum Rules
- CCE/CCOE/PESO

##### **b. GUARANTEE**

The contractor shall guarantee the installation against any defects of workmanship and materials (supplied by the contractor) for 12 months from the date of issue of the completion certificate. Any damage or defects connected with the erection of materials, equipment or fittings supplied by the contractor that may be undiscovered at the time of issue of the completion certificate or may arise or come to light after that shall be rectified or replaced by the contractor at his own expense as deemed necessary and as per the instruction of the Engineer-in-charge within the time limit specified by the Engineer-in-charge. The above guarantee shall be applicable for the quality of work executed and for the equipment/cable/fittings/ other material supplied by the contractor.

c. **SITE CONDITIONS**

The equipment and installation shall be suitable for continuous operation under the following site conditions.

Max. / Min temperature : 50 Degrees/5 Degrees  
Max. Relative humidity : 90 %  
Altitude : Less than 1000 m above MSL  
Atmosphere : To withstand site conditions (Dry, dust storms during summer, Humid and heavy Rainfall during Monsoon)

d. **POWER SUPPLY PARAMETERS:**

For Daughter Booster station at IOCL, BPCL, and HPCL RO & Other equivalent:

NORMAL POWER : 415V AC, 3 Phase & Neutral  
LIGHTING DISTRIBUTION (Normal) : 230 V AC, 1 Phase  
INSTRUMENTATION (UPS) : 230 V AC, 1 Phase

e. **SCOPE**

i. **SCOPE OF DESIGN & ENGINEERING:**

- Submission of electrical equipment drawings for review, preparation of site engineering drawings and details for installation works wherever applicable or required by the Engineer-in-charge, and request to the Engineer-in-charge for review.
- Correction, updating and submission of all Owners' drawings for as-built status.

ii. **SCOPE OF SUPPLY**

The following electrical equipment and materials are in the contractor's scope of supply in this tender.

- MV power and control cable (XLPE – insulated armoured Al/Cu conductor 3 core cables).
- GI pipes, GI Cable-trays and accessories, cable markers, identifier tags, GI saddles and all other associated accessories for cable laying.
- FLP-type double-compression nickel-plated brass cable glands, tinned-copper lugs, clamping material, etc. for cable termination.
- The earthing system includes earthing pits, earth electrodes, earthing strips, grounding conductors of various sizes, Cu strips for flange jumpers, Cu earth plates, etc.
- Safety equipment in the stations/terminals, like shock treatment charts, caution boards, first aid equipment, rubber mats, portable fire extinguishers, sand buckets, etc.
- UPS system inbuilt Battery Bank & interconnecting cables as per specification.
- Fabrication and supply of MS frames support canopies and brackets for miscellaneous electrical equipment, including welding, collection of bolts, nuts, etc., for mounting and other necessary supplies, all-inclusive of paint as specified.

iii. **SCOPE OF INSTALLATION, TESTING & COMMISSIONING**

- Laying & termination of all power and control cables laid in concrete-lined trenches, buried cable trenches, pipes, road crossings, pipe racks, etc.
- Installation testing & commissioning of 125 Amp switchboards/PDBs/LDBs.
- Installation of earthing system material & testing and commissioning of the complete system.

iv. **OTHER MISCELLANEOUS WORKS**

- Preparation of buried cable trenches, including backfilling, compacting, providing brick protection with second-class bricks, and spreading fine river sand, including all supplies.
- The job includes repairing all civil works damaged during the installation of electrical facilities.
- The scope of work under this contract shall include breaking walls and floors and chipping concrete foundations necessary for installing equipment materials and making good of the same.
- Minor modifications, wherever required, are to be done in the bidder-supplied equipment/ devices to enable cable entry, termination, etc.
- Use acceptable practices and standards to seal openings in the walls/floors for cable trays, cables, bus ducts, etc.
- Supply and installation of all other accessories not explicitly mentioned herein, but never the less necessary for completion of the job.

v. **AREA CLASSIFICATION**

Hydrocarbon handling areas have been generally classified as zone 1, gas group IIA/IIB as per IS: 5572, API RP-500, OISD - 113 and IP Rules. All equipment installed in these areas shall be suitable for the area classification with temperature class T3 (2000C), CMRI testing and approved by CCOE, DGFAS and having a BIS license.

vi. **STATUTORY APPROVAL OF WORKS**

The contractor shall obtain the necessary clearance from the electrical inspector/competent authority for equipment supplied and installed. All essential drawings, calculations, test certificates, etc., as required by the Electrical Inspector / DGMS /competent authority shall be furnished. Any modification/rectification as required by them shall be carried out free of cost. The owner shall bear the necessary fees to be paid to the state electrical Inspector/statutory authority for inspection upon producing documentary evidence. The contractor shall arrange the actual Liaison work, and necessary coordination and liaison work shall be the contractor's responsibility.

vii. **JOB SPECIFICATIONS**

Various electrical works covered under this contract, like equipment erection, cabling and grounding assignments, etc., shall be performed following the specifications attached to this tender. (Certain clauses of specifications applicable to equipment or systems not covered under this contract shall not be relevant). Erection and commissioning of specific special equipment shall follow the supplier's instructions and directions of the Engineer-in-charge under supervision by the equipment supplier/s.



The types of equipment/materials to be supplied by the contractor shall conform to the requirements of the applicable specifications enclosed in the tender document.

**viii. MAKES OF EQUIPMENT AND MATERIALS**

All equipment/ materials supplied by the contractor shall be per the list of approved makes enclosed with this document, subject to submission of certification and approvals.

For any other item(s) for which the vendor list is not provided, bidders can supply those item(s) from vendors/ suppliers who have earlier given the exact item(s) for the intended Services in earlier projects, and the item(s) offered is in their regular manufacturing/ supply range. The bidder is not required to enclose documentary shreds of evidence (PO copies, Inspection Certificate, etc.) along with their offer; however, in case of a successful bidder, these documents shall be required to be submitted by them within 07 days from the date of Placement of Order for approval. Bidder shall take prior permission of the make/model no of the offered item, which shall be from the list above. However, additional vendors will be considered in exceptional cases, provided they have supplied similar applications to reputed gas transmission/distribution companies, in quantities at least half the numbers provided for this tender, and working satisfactorily for a minimum of 6 months. Documentary evidence substantiating the above shall be submitted for approval.

**ix. PRESERVATION AND STORAGE**

Equipment and materials shall be protected to withstand extended storage periods at the job site for at least 03 months. Equipment shall be protected to safeguard against all adverse environments, such as humidity, moisture, rain, dust, dirt, sand, mud, salt, air, etc. The VENDOR shall supply instructions for transport, storage, erection and maintenance of the equipment as an integral part of the order.

**x. COMMUNICATION**

For effective communication with the owner, related facility installation & piping laying and other contractors, landowners, local authorities, sub-contractors, etc., the contractor shall establish a detailed project communication procedure in consultation with the Engineer-in-Charge, that will include, as a minimum, an organization chart and details of communications structure.

**xi. INSPECTION, TESTING & COMMISSIONING**

- All the equipment supplied and installed by the contractor shall be tested and commissioned as required, and no separate payments shall be made. Any damage or defect in equipment shall be brought to the notice of the engineer- in-charge. The contractor shall implement procedures and Inspection and Test Plans (ITPs) and, following the vendor documentation, shall complete Site Acceptance Testing (SAT).
- Any work not conforming to the execution drawings, specifications, or codes shall be rejected immediately, and the contractor shall rectify it at his own cost.
- The contractor shall carry out all the tests enumerated in the technical specifications and per applicable codes and standards.
- Before the electrical system is made live, the electrical contractor shall carry out suitable tests to

establish to the satisfaction of the engineer-in-charge that the installation of equipment, wiring and connections have been correctly done and are in good working condition and that it will operate as intended.

- All the tests shall be conducted in the presence of the Owner/ Engineer-in-charge or his authorized representative unless he waives this requirement in writing. The contractor shall arrange all testing equipment necessary to carry out the test. The tests shall be recorded on approved Performa, and certified records of the tests shall be submitted to the Owner/ Engineer-in-charge.
- After the completion of all tests and rectification of all defects pointed out during the final inspection, plant start-up trials would be commenced. During the start-up trials, the contractor shall provide skilled/unskilled personnel and supervision round the clock at his cost. The number and category of workers and duration, up to which required, will be decided by the Engineer-in-charge. Any defects noticed during the start-up trial relating to the equipment supplied and work carried out by the contractor will be rectified by the contractor at his own cost.
- The engineer-in-charge shall have the right to get these defects at the risk and cost of the contractor if he fails to attend to these defects immediately as desired.
- If the operating conditions are fully achieved in the plant, and the other requirements as stated in the General Conditions of Contract are fulfilled, the contractor would be eligible to apply for a completion certificate.
- The equipment/materials to be supplied by the contractor shall conform to the requirements of the applicable specifications and standards. The installation of equipment/material shall conform to the installation standards/norms and IE rules.
- When read with specifications, the drawings accompanying the tender documents shall depict the Terminal's electrical system. These indicate the nature of work and are issued for tendering purposes only. These drawings aim to enable the tenderer to make an offer in line with the owner's requirements. Construction shall be as per drawings/specifications issued/approved by the Engineer- in-charge during the execution of work.
- Conduit layout drawing with wall, wherever required, is to be prepared by the contractor and shall be submitted for approval.
- After the job completion, the contractor shall prepare AS-BUILT drawings and documents and submit to the Owner AS BUILT drawings catalogues/manuals (O&M) of major brought-out items like lighting fixtures, etc.
- Final certified as-built drawings, documents, manuals, etc. shall be submitted by the contractor to the owner in bound volume with one soft copy (CD) set plus five sets of prints.

**xii. SAFETY**

The contractor shall be responsible for implementing a project-specific Safety and Health Management Plan immediately after the work award, in line with statutory requirements. The contractor shall be liable for the safety of all sites, including all travel to the sites and any remote offices. The safety plan shall comply with all local and government safety requirements, approvals and standards and the owner's safety manual. The contractor shall depute experienced and sufficiently trained safety personnel at the site throughout the project phase.



**xiii. MEASUREMENT AND TEST EQUIPMENT:**

The contractor shall furnish a list of measurement and test equipment in his procedure and demonstrate that sufficient equipment will be allocated for all concurrent tasks. All measurement and testing equipment shall be calibrated. The contractor shall furnish a calibration test certificate by a recognized independent certified testing house.

**xiv. COORDINATION WITH OTHER CONTRACTORS**

The owner shall engage other contractors/agencies for additional civil and pipeline work. It shall be the responsibility of the contractor to communicate, co-operate, co-ordinate and provide assistance to such agencies and sort out all interface issues in consultation with the engineer-in-charge for carrying out the scope of work of the system. The contractor shall appoint a representative to meet weekly with other contractor representatives in the owner's presence. The contractor in the meeting shall provide the locations to determine programming for construction and commissioning activities such that one contractor's actions do not disadvantage the owner's needs for coordination with other contractors. The contractor shall plan his activities requiring interfacing with other contractors/agencies well in advance and provide details to the other contractors/agencies at least one month in advance so that all interface issues can be resolved before the actual execution of the work. All delays due to interface problems arising from the contractor's non-co-operation / lack of coordination shall be to the contractor's invoice.

**xv. VENDOR LIST FOR MAJOR EQUIPMENT**

Equipment / Item	Make
SS tube – SS316	Sandvik / Parker / Tubacex
SS Fitting – SS316	Swagelok / Parker / DK-Lok
Hoses	Eaton / Parker
Mass Flow Meter	Micro motion - Emerson
Cable	<ul style="list-style-type: none"> <li>• Cords Cable Industries Ltd.</li> <li>• Universal Cable Ltd.</li> <li>• KEI Industries Ltd.</li> <li>• Havells.</li> <li>• Delton</li> <li>• Finolex Cable</li> <li>• Polycab</li> </ul>

All equipment/ materials supplied by the contractor shall be per the list of approved makes enclosed with this document, subject to submission of certification and approvals.

For any other item(s) for which the vendor list is not provided, bidders can supply those item(s) from vendors/ suppliers who have earlier given the exact item(s) for the intended Services in earlier projects, and the item(s) offered is in their regular manufacturing/ supply range.

The bidder is not required to enclose documentary shreds of evidence (PO copies, Inspection Certificate, etc.) along with their offer; however, in case of a successful bidder, these documents shall be required to be submitted by them within 07 days from the date of Placement of Order for approval.

The bidder shall take prior permission of the make/model no of the offered item, which shall be from the list above. However, additional vendors will be considered in exceptional cases, provided they have supplied similar applications to reputed gas transmission/distribution companies, in quantities at least half the numbers provided for this tender, and working satisfactorily for a minimum of 6 months. Documentary evidence substantiating the above shall be submitted for approval.



**INSPECTION AND TEST PLAN  
FOR  
INSULATING JOINTS**

**1.0 SCOPE:**

This Inspection and Test Plan covers the minimum testing requirements of Insulating Joints.

**2.0 REFERENCE DOCUMENTS:**

PO / PR / Standards referred there in / Job specifications / Approved documents.

**3.0 INSPECTION AND TEST REQUIREMENTS:**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
<b>1.0</b>	<b>Procedure</b>						
1.1	Hydrostatic Test, NDT and other procedures	Documented Procedures	100%	Procedure Documents	-	H	R
1.2	WPS/ PQR /WPQ	Documented procedures	100%	Procedure Documents	-	H	R-Existing W-New
<b>2.0</b>	<b>Material Inspection</b>						



**INSPECTION AND TEST PLAN  
FOR  
INSULATING JOINTS**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
2.1	1) Forging 2) Pup Piece	Chemical / Mechanical Properties, NDT, HT and other requirement as per purchase specification.	100%	MTC & Inspection Record	H	W	W
2.2	Gasket, Insulating Ring, Filling Material, etc.	As per material spec./code	100%	MTC & Inspection Record	H	H	R
<b>3.0</b>	<b>In Process Inspection</b>						
3.1	Welding	Welding Parameters, NDT (as applicable)	100%	NDT Records/RT films	-	W	R
<b>4.0</b>	<b>Final Inspection</b>						
4.1	Hydro Testing, Air Leak test, Vacuum test (As applicable)	Leak Check	100%	Test Report	-	H	H



**INSPECTION AND TEST PLAN  
FOR  
INSULATING JOINTS**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
4.2	Visual and Dimension Check	Visual and Dimension Check	100%	Inspection Report	-	H	RW
4.3	Dielectric Test	Insulating Resistance	100%	Inspection Report	-	W	W
<b>5.0</b>	<b>Painting</b>						
5.1	Final painting (as applicable)	Paint Scheme, Visual & Paint thickness check	100%	Inspection Report	-	H	R
<b>6.0</b>	<b>Documentation &amp; IC</b>						
6.1	Stamping and review of inspection documents, issue of IC	Review of documents for compliance as per PR.	100%	IC	-	-	H



INSPECTION AND TEST PLAN  
FOR  
INSULATING JOINTS

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
7.0	Review of final documentation	Compilation of documents as per VDR attached with PR records for submission to the customer	100%	Dossier/Completion Certificate (EN 10204 Type 3.2)	-	H	H

**NOTES (As applicable):**

1. Items shall be EN 10204 Type 3.2 Certified.
2. ITP shall be submitted including but not limited to the item/activity covered above. Any item/activity identified and required for the completeness shall also be covered in the ITP submitted by the manufacturer



**INSPECTION AND TEST PLAN  
FOR  
INSULATING JOINTS**

<b>ABBREVIATIONS:</b>			
CE	Carbon Equivalent	NDT	Non-Destructive Testing
DCN	Dispatch Clearance Note	PO	Purchase Order
DFT	Dry Film Thickness	PQR	Procedure Qualification Record
DPT	Dye Penetrant Testing	PR	Purchase Requisition
HT	Heat Treatment	RT	Radiography Testing
ITP	Inspection and Test Plan	TC	Test Certificate
IC	Inspection Certificate	TPI or TPIA	Third Party Inspection Agency
IGC	Inter Granular Corrosion	UT	Ultrasonic Testing
IR	Inspection Report	VDR	Vendor Data Requirement
IRC	Inspection Release Certificate	WPQ	Welders Performance Qualification
MPT / MT	Magnetic Particle Testing	WPS	Welding Procedure Specification
MTC	Material Test Certificate		
<b>LEGENDS:</b>			
<b>H</b> - Hold (Do not proceed without approval)			
<b>W</b> – Witness (Give due notice, work may proceed after scheduled date)			
<b>P</b> - Perform			
<b>R</b> - Review			
<b>RW</b> - Random Witness [As specified or 10% (min. 1 no. of each size and type of Bulk items)]			



**INSPECTION AND TEST PLAN  
FOR  
INSULATING JOINTS**

**1.0 SCOPE:**

This Inspection and Test Plan covers the minimum testing requirements of Ball Valves.

**2.0 REFERENCE DOCUMENTS:**

PO / PR / Standards referred there in / Job specifications / Approved documents.

**3.0 INSPECTION AND TEST REQUIREMENTS:**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS / METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUB VENDOR	VENDOR	TPIA
<b>1.0</b>	<b>PROCEDURES</b>							
1.1	Hydrostatic Test, NDT and Other Procedures	Documented Procedures	100%		Procedure Documents	-	H	R
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%		WPS, PQR & WPQ	-	H	W- New R- Existing
1.3	Pre-Qualification Tests	Fire safe, Cryogenic & Other Test as applicable	As per PR/Purchase Specification		Acceptance Report	-	H	H (If new)
<b>2.0</b>	<b>RAW MATERIAL</b>							
2.1	Forging / Casting:	Visual & Dimension	100%	Material & Technical Specification	Inspection Report	H	H	-
	1) Body							
	2) End Piece	Chemical: Chemical Analysis IGC (For SS component)	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
	3) Ball	Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	W (Note-1)
	4) Seat Ring							
	5) Pup Piece (as applicable)							



**INSPECTION AND TEST PLAN  
FOR  
INSULATING JOINTS**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS / METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUB VENDOR	VENDOR	TPIA
		Impact Test (@ - 29°C): for CS Impact Test (@ - 45°C): for LTCS	All Heats	Material & Technical Specification / ASME B 16.34	Test Report	H	R	W (Note-1)
		Non-Destructive Examination (NDT): Radiography (100% Critical Area)	100%	Material & Technical Specification /ASME B 16.34	RT Report	H	R (RT-Film review)	R (RT-Film review)
		Non-Destructive Examination (NDT): Magnetic Particle Examination (100% exterior & accessible interior)	100%	Material & Technical Specification /ASME B 16.34	MPI Report	H	R	R
		ENP (For Ball): Visual, Thickness & Hardness	100%	25 microns (min) & 50 HRC (min)	Vendor Test Certificate	H	R	R
<b>3.0</b>	<b>INCOMING / BOF ITEMS</b>							
3.1	Stem	Chemical: Chemical Analysis	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
		Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
3.2	Fasteners	Chemical: Chemical Analysis	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
		Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
		Impact Test (@ - 29°C): for CS Impact Test (@ - 45°C): for LTCS	All Heats	Material & Technical Specification /ASME B 16.34	Test Report	H	R	R
3.3	Gaskets, Gear units, Gland, Packings, etc.	Physical / Chemical Properties	100%	Material & Technical Specification	Test Certificates & Lab Report	H	R	R



**INSPECTION AND TEST PLAN  
FOR  
INSULATING JOINTS**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS / METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUB VENDOR	VENDOR	TPIA
<b>4.0</b>	<b>MACHINED COMPONENTS</b>							
4.1	Body, Connector, Ball & Seat Ring	Surface examination & Dimension Inspection: Visual & Measurement	100%	Manufacturer's Drawing	Inspection Reports	100%	R	R
<b>5.0</b>	<b>IN-PROCESS</b>							
5.1	Body & Connector joint welding	Non-Destructive Examination (NDT): Magnetic Particle Examination (MPI)	100%	ASME Sec VIII - Appendix V & VI	MPI Report	100%	R	R
5.2	Valve & Pup Piece Bevel Ends joint welding	Non-Destructive Examination (NDT): Radiography (100% on weld joint)	100%	ASME B16.34	RT Report	100%	R (RT-Film review)	R (RT-Film review)
<b>6.0</b>	<b>FINAL INSPECTION</b>							
6.1	Finished Valve Assembly: Pressure Test & Final Inspection	Shell Test: Hydrostatic	100%	Testing Procedure as per Code	Test Record	-	H	RW
6.2		Seat Test: Hydrostatic				-	H	RW
6.3		Seat Test: Pneumatic				-	H	RW
6.4		Functional Test - Actuated Valve @ Atm. Pressure & Max. Diff. Pressure: Operation- Open / Close				-	H	RW
6.5		Double Block & Bleed: Hydrostatic				-	H	RW
6.6		Final Inspection: Visual, Dimension, TC Verification, Special Requirements & Marking as per sale order	100%	Approved GA Drawing (if applicable)	Test Report	-	H	RW
6.7		Anti-Static Test	100%	API 6D & Technical Specification	Test Record	-	H	RW



**INSPECTION AND TEST PLAN  
FOR  
INSULATING JOINTS**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS / METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUB VENDOR	VENDOR	TPIA
6.8		Fire Safe Test	100%	API-6FA / ISO-10497	Fire safe type test report	-	H	R
6.9	Final Stamping	Stamping Of Accepted Valves	Stamping of Valves which are witnessed by VCS/TPIA	As per Tender Specification	Inspection Report	-	H	H
6.10	Strip Test	Component integrity, PMI of BOM	One per size per rating	-	Test report	H	H	H
<b>7.0</b>	<b>PAINTING &amp; PACKING</b>	Surface examination & DFT Inspection: Visual & Measurement	100%	As per Tender Specification	Painting Record	-	H	R
<b>8.0</b>	<b>DOCUMENTATION &amp; INSPECTION CERTIFICATE(IC)</b>	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	As per Tender Specification	Vendor TC & IC	-	H	H
<b>9.0</b>	<b>FINAL DOCUMENTATION &amp; SUBMISSION OF REPORTS</b>	Compilation of IR/IRC/DCN/MTC/DRGS./VDR	100%	EN 10204 type 3.2/3.1 certification as specified in valve datasheet (Note-1)	Compliance Certificate	-	H	-

**NOTES (As applicable):**

1. If the certification is specified as EN 10204 Type 3.1 in Data sheet / Material Requisition, then **W** 'may be replaced with **R** 'with Material Traceability.
2. ITP shall be submitted including but not limited to the item/activity covered above. Any item/activity identified and required for the completeness shall also be covered in the ITP submitted by the manufacturers.



**INSPECTION AND TEST PLAN  
FOR SEAMLESS LINE PIPES**

<b>ABBREVIATIONS:</b>			
CE	Carbon Equivalent	MTC	Material Test Certificate
HT	Heat Treatment	NDT	Non-Destructive Testing
IC	Inspection Certificate	PO	Purchase Order
IGC	Inter Granular Corrosion	PMI	Positive Material Identification
ITP	Inspection and Test Plan	TC	Test Certificate
MPT/MT	Magnetic Particle Testing	TPI or TPIA	Third Party Inspection Agency
MPS	Manufacturing Specification	Process UT	Ultrasonic Testing
MR	Material Requisition	VDR	Vendor Data Requirement
<b>LEGENDS:</b>			
<b>H</b> - Hold (Do not proceed without approval)			
<b>W</b> - Witness (Give due notice, work may proceed after scheduled date)			
<b>P</b> - Perform			
<b>R</b> - Review			
<b>RW</b> - Random Witness (As specified or 10% [min.1 no. of each size and type of Bulk item])			



**INSPECTION AND TEST PLAN  
FOR SEAMLESS LINE PIPES**

**1.0 SCOPE:**

This Inspection and Test Plan covers the minimum testing requirements of Seamless Pipes up to 16" (Including 16")

**2.0 REFERENCE DOCUMENTS:**

PO/PR/ Standards referred there in/ Job specifications /Approved documents.

**3.0 INSPECTION AND TEST REQUIREMENTS:**

SL. NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
<b>1.0</b>	<b>Procedure</b>						
1.1	MPS	Documented Procedures	100%	Procedure Documents	-	H	R
<b>2.0</b>	<b>Raw Material Procurement</b>						
2.1	Raw Material Inspection	Chemical & Mechanical Properties, Method of manufacturing, Heat Treatment Condition etc.	100%	Mill Test Certificates (EN 10204-3.2)	H	H (Note-3)	R (Note-3)



**INSPECTION AND TEST PLAN  
FOR SEAMLESS LINE PIPES**

SL. NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
<b>3.0</b>	<b>In Process Inspection</b>						
3.1	First Day Production test	All testing requirement as per PR/ MPS	As per PR/ MPS	Test Report	-	H	H
3.2	Raw material Inspection	Marking & Correlations with Test Certificates	100%	Inspection Reports	-	H	-
3.3	Heat Treatment	Heat Treatment time and temperature	100%	HT Graph / Record	-	H	R
<b>4.0</b>	<b>Final Inspection</b>						
4.1	Hydrostatic Testing	Leak & pressure Drop, Calibration of Gauges/ Recorder	100%	Inspection Report	-	H	RW (Min.5%)



**INSPECTION AND TEST PLAN  
FOR SEAMLESS LINE PIPES**

SL. NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
4.2	Calibration of UT system	Run with calibration pipe	1) Beginning of each shift 2) After Breakdown /Maintenance	Inspection Report	-	H	W
4.3	Pipe UT	Lamination & other defects	100%	Inspection Report	-	H	RW (Min.5%)
4.4	Pipe End UT MPT as applicable	Lamination & other defects	100%	Inspection Report	-	W	RW (Min.1%)
4.5	Final visual and dimension	1. Visual Examination 2. Dimensional Check Surface Condition, Straightness, End Finish, Bevel Angle, Root Face, Outer Dia., Thickness, Length, End Finish, Marking etc.	100%	Inspection Report	-	H	RW (Min.5%)
4.6	Lot Testing	1. Chemical Analysis 2. Tensile Tests 3. Macro & Hardness Tests 4. Impact Tests and other applicable test	As per MPS/API 5L/Spec.	Inspection Report	-	H	W



**INSPECTION AND TEST PLAN  
FOR SEAMLESS LINE PIPES**

SL. NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
4.7	Non-conforming product/stage	Repair / Retest /Reject	100%	Inspection Report	-	H	W
4.8	Marking/Stencilling	Pipe No, Acceptance No., Heat. No., Size, Weight, Grade, Thickness, Colour Code etc as per MPS	100%	Inspection Report	-	H	RW (Min.5%)
<b>5.0</b>	<b>PAINTING</b>						
5.1	Rust Preventive Coating & Colour Coding	Visual & Colour Coding as applicable	100%	Inspection Report	-	H	-
<b>6.0</b>	<b>Documentation &amp; IC</b>						
6.1	Documentation & Inspection Certificate (IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Manufacturer TC & IC (Note-4)	-	H	H



SL. NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
6.2	Final documents as per PR/MR	Verification & compilation of inspection & test records for submission to customer	100%	Final dossier (Note-4)	-	H	H

**NOTES (As applicable):**

1. ITP shall be submitted including but not limited to the item/activity covered above. Any item/activity identified and required for the completeness shall also be covered in the ITP submitted by the manufacturers.
2. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in /Job Specification /Approved Documents.
3. Raw Material shall be inspected at Mills (Sub vendors works) by TPIA appointed by Vendor.
4. Items shall be EN 10204 Type 3.2 Certified based on this ITP/MR/PR for the Pipe (Final product).



**INSPECTION AND TEST PLAN  
FOR  
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

<b>ABBREVIATIONS:</b>			
CE	Carbon Equivalent	PMI	Positive Material Identification
DCN	Dispatch Clearance Note	PO	Purchase Order
DFT	Dry Film Thickness	PQR	Procedure Qualification Record
DPT	Dye Penetrant Testing	PR	Purchase Requisition
HT	Heat Treatment	RT	Radiography Testing
IC	Inspection Certificate	TC	Test Certificate
IR	Inspection Report	TPI or TPIA	Third Party Inspection Agency
IRC	Inspection Release Certificate	UT	Ultrasonic Testing
ITP	Inspection and Test Plan	VDR	Vendor Data Requirement
MPT/MT	Magnetic Particle Testing	WPQ	Welders Performance Qualification
MTC	Material Test Certificate	WPS	Welding Procedure Specification
NDT	Non-Destructive Testing		
<b>LEGENDS:</b>			
<b>H-</b> Hold (Do not proceed without approval)			
<b>W-</b> Witness (Give due notice, work may proceed after scheduled date)			
<b>P-</b> Perform			
<b>R-</b> Review			
<b>RW-</b> Random Witness [As specified or 10% (min. 1 no. of each size and type of Bulk item)]			



**INSPECTION AND TEST PLAN  
FOR  
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

**1.0 SCOPE:**

This Inspection and Test Plan covers the minimum testing requirements of Forged, Seamless & Welded Fittings.

**2.0 REFERENCE DOCUMENTS:**

PO / PR / Standards referred there in / Job specifications / Approved documents.

**3.0 INSPECTION AND TEST REQUIREMENTS:**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
<b>1.0</b>	<b>Procedure</b>						
1.1	Heat Treatment / NDT	Documented Procedures	100%	Procedure Documents	-	H	R
1.2	WPS, PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	-	H	W- New R- Existing
<b>2.0</b>	<b>Material Inspection</b>						
2.1	Raw Material Identification (Billets, Rounds, Pipes, Coil, Plates, etc.)	Chemical and Mechanical Properties, Size & Steel making practice etc	100%	Mill test certificate, Vendor's Inspection Report	-	H	R



**INSPECTION AND TEST PLAN  
FOR  
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
<b>3.0</b>	<b>In Process Inspection</b>						
3.1	Welding	Welding Parameters as per WPS / PQR	100%	Inspection Reports	-	H	-
3.2	Heat Treatment	Stress Relieving, Normalising, Tempering, Solution Annealing, Stabilization Heat Treatment etc. as applicable	100%	HT chart	-	H	R
3.3	RT For Fittings As Applicable	Weld defects	PR / Purchase Specification	RT films & Reports	-	H	R (RT film review)
3.4	Identification of Test Samples	Product Chemical, Mechanical, Impact, Hardness and other test as applicable	One/Heat/Lot	Test Reports	-	H	H



**INSPECTION AND TEST PLAN  
FOR  
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
3.5	Product Analysis	Chemical Composition	PR/ Purchase Specification	Test Reports	-	H	R
3.6	Destructive Testing	Mechanical, Impact, Hardness and Other test as applicable	One/Heat/Lot	Test Reports	-	H	H
3.7	MPT/LPT	Surface & Internal Imperfections	PR/ Purchase Specification	NDT Reports	-	H	R
<b>4.0</b>	<b>Final Inspection</b>						
4.1	Visual and Dimensional Inspection (VDI)	Surface finish, Dimensions, Marking etc	100%	Inspection report	-	H	RW
4.2	PMI Check	Chemical Check	As Per Spec./Code	Inspection report	-	H	RW



**INSPECTION AND TEST PLAN  
FOR  
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
4.3	Final Stamping	Stamping of accepted Items	100%	Inspection report	-	H	H
<b>5.0</b>	<b>Painting</b>						
5.1	Rust Preventive Coating & Colour Coding	Visual Inspection & Colour Coding	100%	Inspection report	-	H	-
<b>6.0</b>	<b>Documentation &amp; IC</b>						
6.1	Documentation & Inspection Certificate (IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Vendor TC & IC	-	H	H
<b>7.0</b>	<b>Final Documentation and Submission of Reports</b>	Compilation of IR/IRC/DCN/MTC/DRGS. /VDR	100%	Compliance Certificate (Note-1)	-	H	-



**INSPECTION AND TEST PLAN  
FOR  
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

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**NOTES (As applicable):**

1. If the certification is specified as EN 10204 Type 3.1 in Datasheet / Material Requisition, then **W** may be replaced with **R** with Material Traceability.
  2. ITP shall be submitted including but not limited to the item/activity covered above. Any item/activity identified and required for the completeness shall also be covered in the ITP submitted by the manufacturers.
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**INSPECTION AND TEST PLAN FOR  
LONG RADIUS BENDS FOR ONSHORE PIPELINES**

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<b>ABBREVIATIONS:</b>			
CE	Carbon Equivalent	PR	Purchase Requisition
IC	Inspection Certificate	RT	Radiography Testing
ITP	Inspection and Test Plan	TC	Test Certificate
MPT/MT	Magnetic Particle Testing	TPI or TPIA	Third Party Inspection Agency
MTC	Material Test Certificate	UT	Ultrasonic Testing
NDT	Non-Destructive Testing	VDR	Vendor Data Requirement
PO	Purchase Order		
<b>LEGENDS:</b>			
<b>H</b> - Hold (Do not proceed without approval)			
<b>W</b> - Witness (Give due notice, work may proceed after scheduled date)			
<b>P</b> - Perform			
<b>R</b> - Review			
<b>RW</b> - Random Witness [As specified or 10% (min.1 no. of each size and type of Bulk items)]			

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**INSPECTION AND TEST PLAN FOR  
LONG RADIUS BENDS FOR ONSHORE PIPELINES**

**1.0 SCOPE:**

This Inspection and Test Plan covers the minimum testing requirements of long radius Bends for onshore Pipelines.

**2.0 REFERENCE DOCUMENTS:**

PO / PR / Standards referred there in / Job specifications / Approved documents.

**3.0 INSPECTION AND TEST REQUIREMENTS:**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
<b>1.0</b>	<b>Procedure</b>						
1.1	Hydro Test, NDT, Bend Manufacturing, Heat treatment and Other Procedures	Documented Procedures	100%	Procedure Documents	-	H	R
<b>2.0</b>	<b>Material Inspection</b>						
2.1	Raw Material Inspection	Chemical, mechanical properties, method of manufacturing, Heat Treatment Condition, etc	100%	Mill Test Certificates (EN 10204 Type 3.2 certificate)	H	R	R



**INSPECTION AND TEST PLAN FOR  
LONG RADIUS BENDS FOR ONSHORE PIPELINES**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
<b>3.0</b>	<b>In Process Inspection</b>						
3.1	Material Identification (In case of EN 10204 Type 3.1 certificate)	Review of Test Certificates, Markings, Visual and Dimensional inspection, identity correlation & Transfer of identification marks	One/Heat	Material Clearance Record (3.2 certificate or check test [mechanical, chemical, impact, hardness])	-	H	H
3.2	Bend Manufacturing Procedure Qualification	Bend forming parameters, Mechanical, Impact, Micro and Hardness	100%	Test Report	-	H	H
3.3	Induction Bending (Production bends)	Bending temp Bending rate Power input As per qualified procedure of test bend	100%	Inspection Report	-	H	M



**INSPECTION AND TEST PLAN FOR  
LONG RADIUS BENDS FOR ONSHORE PIPELINES**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
3.4	Heat Treatment (If Applicable)	Time / temp record	100%	HT Graph	-	H	R
<b>4.0</b>	<b>Final Inspection</b>						
4.1	NDT-RT, UT & MPT as applicable	Defects	100%	Films/Test Reports	-	H	R
4.2	Hydrostatic Test	Soundness / Leak check	100%	Test Report	-	H	W
4.3	Final visual and dimension	Visual and Dimension	100%	Inspection Report	-	H	W
4.4	Gauging Pig Passing (95% of ID)	Verification of ID / Profile	100%	Inspection Report	-	H	W
<b>5.0</b>	<b>Documentation &amp; IC</b>						
5.1	Documentation & Inspection Certificate (IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Vendor TC & IC	-	H	H



INSPECTION AND TEST PLAN FOR  
LONG RADIUS BENDS FOR ONSHORE PIPELINES

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SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
5.2	Final documents as applicable	Verification & compilation of inspection & test records for submission to customer	100%	Final dossier	-	H	H

**NOTES (As applicable):**

1. ITP shall be submitted including but not limited to the item/activity covered above. Any item/activity identified and required for the completeness shall also be covered in the ITP submitted by the manufacturers.

  
**INSPECTION AND TEST PLAN FOR  
 FLANGES & SPECTACLE BLINDS**

<b>ABBREVIATIONS:</b>			
CE	Carbon Equivalent	NDT	Non-Destructive Testing
DCN	Dispatch Clearance Note	PO	Purchase Order
HT	Heat Treatment	PR	Purchase Requisition
IC	Inspection Certificate	RT	Radiography Testing
IR	Inspection Report	TC	Test Certificate
IRC	Inspection Release Certificate	TPI or TPIA	Third Party Inspection Agency
ITP	Inspection and Test Plan	UT	Ultrasonic Testing
MPT/MT	Magnetic Particle Testing	VDR	Vendor Data Requirement
MTC	Material Test Certificate		
<b>LEGENDS:</b>			
<b>H</b> - Hold (Do not proceed without approval)			
<b>W</b> - Witness (Give due notice, work may proceed after scheduled date)			
<b>P</b> - Perform			
<b>R</b> - Review			
<b>RW</b> - Random Witness [As specified or 10% (min.1 no. of each size and type of Bulk items)]			

  
**INSPECTION AND TEST PLAN FOR  
 FLANGES & SPECTACLE BLINDS**

**1.0 SCOPE:**

This Inspection and Test Plan covers the minimum testing requirements of Flanges, Spectacle Blinds & Drip Rings.

**2.0 REFERENCE DOCUMENTS:**

PO / PR / Standards referred there in / Job specifications / Approved documents.

**3.0 INSPECTION AND TEST REQUIREMENTS:**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
<b>1.0</b>	<b>Procedure</b>						
1.1	Heat Treatment, NDT and Other Procedures	Documented Procedures	100%	Procedure Documents	-	H	R
<b>2.0</b>	<b>Material Inspection</b>						
2.1.	Raw Material Inspection	Chemical, Mechanical, Properties	100%	Test Certificates	-	H	R
<b>3.0</b>	<b>In Process Inspection</b>						

**Gasnet**  
INSPECTION AND TEST PLAN FOR  
FLANGES & SPECTACLE BLINDS

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
3.1	Heat Treatment	Stress Relieving, Normalising, Tempering, Solution Annealing, Stabilization Heat Treatment etc. as applicable	100%	HT Chart	-	H	R
3.2	Identification of Test Samples	Product Chemical, Mechanical, Impact and Other test as applicable	One/Heat/Lot	Test Report	-	H	H
3.4	Product Analysis (As applicable)	Chemical Composition	As per PR/Purchase Specification	Test Reports	-	H	R
3.5	Destructive Testing	Mechanical, Impact and Other tests as applicable	One/Heat/Lot	Test Reports	-	H	H
3.6	MPI	Surface & Internal Imperfections	As per PR/Purchase Specification	NDT Reports	-	H	R
<b>4.0</b>	<b>Final Inspection</b>						
4.1	Final Inspection	1. Visual 2 Dimensions 3. Hardness 4. Marking etc	100%	Inspection Report	-	H	W

  
**INSPECTION AND TEST PLAN FOR  
 FLANGES & SPECTACLE BLINDS**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
4.2	PMI Check	Chemical	As per Spec.	Inspection Report	-	H	RW
4.3	Final Stamping	Stamping Of Accepted Flanges & Spectacle Blinds	Stamping of Valves which are witnessed by TPIA.	Inspection Report	-	H	H
<b>5.0</b>	<b>Painting</b>						
5.1	Rust Preventive Coating & Colour Coding	Visual & Colour Coding as applicable	100%	Inspection Report	-	H	-
<b>6.0</b>	<b>Documentation &amp; IC</b>						
6.1	Documentation & Inspection Certificate (IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Vendor TC & IC	-	H	H
<b>7.0</b>	<b>Final Documentation &amp; Submission of Reports</b>	Compilation of IR/IRC/DCN/MTC/DRGS. /VDR	100%	Compliance Certificate (Note-1)	-	H	-

**NOTES (As applicable):**

1. If the certification is specified as EN 10204 Type 3.1 in Datasheet / Material Requisition, then 'W' may be replaced with R with Material Traceability.
2. ITP shall be submitted including but not limited to the item/activity covered above. Any item/activity identified and required for the completeness shall also be covered in the ITP submitted by the manufacturers.



**APPROVED VENDOR LIST FOR CONSUMABLE AND OTHER MATERIAL USED IN PIPELINE LAYING WORK**

**TOTAL SHEETS**

**20**

**APPROVED VENDOR LIST FOR CONSUMABLE AND OTHER MATERIAL USED IN PIPELINE LAYING WORK**

**I. LIST OF VENDORS OF MECHANICAL & FIRE FIGHTING EQUIPMENT**

**A. MAINLINE & MECHANICAL**

SL. No.	Items / Name of Products	Make / Brand / Manufactures
1	Pipe Carbon Steel to Indian Standards	1. Welspun Corp. Limited (Dahej) 2. Surya Roshni Ltd. 3. Asian Mills Pvt. Ltd. 4. Essar Steel Limited (Er Hazira Pipes Mill) 5. Jindal Industries Ltd 6. Jindal Pipes Ltd. 7. Jindal Saw Ltd (Kosi Works) 8. Maharashtra Seamless Ltd. 9. Man Industries (India) Ltd. – Pithampur 10. Ratnamani Metals and Tubes Ltd.

<p style="text-align: center;"><b>2</b></p>	<p style="text-align: center;"><b>Pipe &amp; Tubulars To A.P.I. Standards</b></p>	<ol style="list-style-type: none"> <li>1. Arcelor mittal Tubular Products Roman Sa, Romania</li> <li>2. Bhel (Trichy), India</li> <li>3. Dalmine Spa (Enquiry to Tenaris), UAE</li> <li>4. Eewkorea Co. Ltd (Germany), Korea</li> <li>5. Eew Korea Co. Ltd. (Korea), Korea</li> <li>6. Eisenbau Kramer Gmbh, Germany</li> <li>7. Hyundai Rb Co. Ltd. South Korea</li> <li>8. Ilva Lamiere E Tubi Srl (Enq to Ilva Spa, Italy)</li> <li>9. Inox Tech. Spa, Italy</li> <li>10. Jindal Pipes Ltd., India</li> <li>11. Jindal Saw Ltd. (Kosi Works), India</li> <li>12. Jindal Saw Ltd. (Nashik Works), India</li> <li>13. Maharashtra Seamless Ltd., India</li> <li>14. Man Industries (I) Ltd. (Pithampur), India</li> <li>15. Ratnamani Metals and Tubes Ltd., India</li> <li>16. Siderca S.A.I.C (Enquiry Totenaris), Uae</li> <li>17. Surya Roshni Ltd., India</li> <li>18. Swastik Pipes Ltd, India</li> <li>19. Tata Steel Uk Limited (Formerly C702)</li> <li>20. Tubos De Acero De Mexico Sa (Enq. Tenaris), Uae</li> <li>21. Tubos Reunidos Sa Spain</li> <li>22. Umran Steel Pipe Inc. (Turkey), Turkey</li> <li>23. Valcovny Trub Chomutov, Czech Republic</li> <li>24. Vallourec and Mannesmann Tubes, France</li> <li>25. Welspun Corp Limited (Dahej), India</li> </ol>
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3	<p align="center"><b>Pipe/Tube CS (Seamless) To ASTM Stds</b></p>	<ol style="list-style-type: none"> <li>1. Arcelor mittal Tubular Products Roman Sa, Romania</li> <li>2. Bhel (Trichy), India</li> <li>3. Dalmine Spa (Enquiry to Tenaris, Uae</li> <li>4. Jfe Steel Corporation, UAE</li> <li>5. Jindal Saw Ltd (Nashik Works) India</li> <li>6. Maharashtra Seamless Ltd, India</li> <li>7. Products Tubulares S.A.U, Spain</li> <li>8. Tubos Reunidos Sa Spain</li> <li>9. Valcovny Trub Chomutov, Czech Republic</li> <li>10. Vallourec Andmannesmann Tubes France</li> <li>11. Yangzhou Chengde Steel Pipe Co. Ltd Dubai (UAE)</li> <li>12. Astec Tubes</li> </ol>
4	<p align="center"><b>Pipe Carbon Steel (Welded) To ASTM Stds.</b></p>	<ol style="list-style-type: none"> <li>1. Eew Korea Co. Ltd. (Germany), Korea</li> <li>2. Eew Korea Co. Ltd. (Korea), Korea</li> <li>3. Eisenbau Kramer Gmbh, Germany</li> <li>4. Hyundai Rb Co. Ltd., South Korea</li> <li>5. Inox Tech. Spa, Italy</li> <li>6. Jindal Saw Ltd (Kosi Works), India</li> <li>7. Lalit Pipes and Pipes Ltd., India</li> <li>8. Man Industries (I) Ltd. (Pithampur), India</li> <li>9. Man Industries (India) Ltd. Anjar, India</li> <li>10. Ratnamani Metals and Tubes Ltd., India</li> <li>11. Tata Steel Uk Limited.</li> </ol>
<b>B. VALVES, FITTINGS &amp; FLANGES</b>		
1	<p align="center"><b>Globe Valves</b></p>	<ol style="list-style-type: none"> <li>1. M/S KSB Pumps (New Delhi)</li> <li>2. M/S L&amp;T (New Delhi)</li> <li>3. M/S Neco Schuber &amp; Salzer Ltd. (New Delhi)</li> <li>4. BHEL (Trichy), India</li> <li>5. Econo Valves Pvt Ltd, India</li> <li>6. Leader Valves Ltd, India</li> <li>7. NSSL Ltd. (Neco Schubert &amp; Salzer ltd.)</li> <li>8. Oswal Industries Ltd, India</li> <li>9. Petrochemical Engineering Enterprises, India</li> <li>10. Sakhi Engineers Pvt Ltd</li> <li>11. Steel Strong Valves India Pvt Ltd, India</li> <li>12. Petro Valves Pvt. Limited, Ahmedabad</li> <li>13. Hawa Engineers Ltd.,Ahmedabad</li> <li>14. Zed Valves Co. Pvt. Ltd.,Ahmedabad</li> </ol>
2	<p align="center"><b>Check Valves</b></p>	<ol style="list-style-type: none"> <li>1. M/s Advance Valves Pvt. Ltd., Noida</li> <li>2. M/s Larsen &amp; Toubro Limited (M/s Audco India Limited, Chennai)</li> <li>3. M/s BDK engineering India Ltd., Hubli</li> <li>4. M/s BHEL, OFE&amp;OE Group, New Delhi</li> <li>5. M/s Datre Corporation Limited, Calcutta</li> <li>6. M/s Leader Valves Ltd., Jalandhar</li> <li>7. M/s Neco schubert &amp; Salzer Ltd., New Delhi</li> <li>8. M/s Precision Engg. Co., Mumbai</li> <li>9. KSB Pumps Ltd (Coimbatore), India</li> <li>10. NSSL Ltd. (Neco Schubert &amp; SalzerLtd)</li> <li>11. Oswal Industries Ltd, India</li> <li>12. Petrochemical Engineering Enterprises, India</li> <li>13. Sakhi Engineers Pvt Ltd</li> <li>14. Steel Strong Valves India Pvt Ltd, India</li> </ol>

<b>3</b>	<b>Plug Valves</b>	<ol style="list-style-type: none"> <li>1. M/s Breda Energia Sesto Industria Spa, Italy</li> <li>2. M/s Fisher Sanmar Ltd., Chennai</li> <li>3. M/s Larsen &amp; Toubro Ltd., New Delhi</li> <li>4. M/s Nordstrom Valves, USA</li> <li>5. M/s Serck Audco Valves, UK</li> <li>6. M/s Z Corporation, Korea</li> <li>7. M/s Hawa Valves (India) Pvt. Ltd., Mumbai</li> <li>8. M/s Steel Strong Valves India Pvt. Ltd., Navi Mumbai</li> <li>9. M/s ZED Valves</li> </ol>
<b>4</b>	<b>Ball Valves</b>	<ol style="list-style-type: none"> <li>1. M/s Hawa Valves (India) Pvt. Ltd, Navi Mumbai</li> <li>2. M/s Larsen &amp; Toubro, Delhi</li> <li>3. M/s Microfinish Valves Pvt. Ltd., Noida</li> <li>4. M/s Oswal Industries Ltd., Gandhi nagar</li> <li>5. M/s Virgo Engineers Ltd., Delhi</li> <li>6. M/s Cameron (Malaysia) SDN BHD, Malaysia</li> <li>7. M/s Dafram S.P.A., Italy</li> <li>8. M/s Franz Schuck GmbH, Germany</li> <li>9. O.M.S. Saleri (Italy)</li> <li>10. Pibi Viesse S.P.A (Italy)</li> <li>11. Nuovo Pignone (Italy)</li> <li>12. Perar S.P.A (Italy)</li> <li>13. Pietro Fiorentini (Italy)</li> <li>14. Cooper Cameron Valve Italy SRL-FRM, Italy</li> <li>15. Petrol Valves SRL</li> <li>16. Petro Valves Pvt. Limited, Ahmedabad</li> <li>17. Tormene Gas Technology S.P.A (VALVITALIA)</li> <li>18. Flowchem Industries, Ahmedabad</li> <li>19. Hawa Engineer Ltd., Ahmedabad</li> <li>20. Zed Valves Co. Pvt. Ltd., Ahmedabad</li> </ol>
<b>5</b>	<b>Flow Tee</b>	<ol style="list-style-type: none"> <li>1. M/s Coprosider SPA, Italy</li> <li>2. M/s GEA Energy System India Limited, Chennai</li> <li>3. M/s Multitex Filtration</li> <li>4. M/s Pipeline Engineering, (U.K.)</li> <li>5. M/s Scomark Engg. Limited (U.K.)</li> <li>6. M/s Skeltonhall Limited, England (U.K.)</li> <li>7. M/s Technospecial SPA, Italy</li> <li>8. M/s Tectubi SPA, Italy</li> <li>9. M/s RMA Germany</li> <li>10. M/s Pipefit Engineers Pvt. Ltd.</li> <li>11. M/s PSN Energy Systems (up to 24" NB, 600#)</li> <li>12. United Forge Industry, Vadodara</li> <li>13. Vival Forged Pvt. Ltd.</li> </ol>
<b>6</b>	<b>Split Tee</b>	<ol style="list-style-type: none"> <li>1. M/s T D Williamson India Private Limited, India</li> <li>2. M/s Furmanite International Ltd., USA</li> <li>3. M/s Huwelco Inc., South Houston</li> <li>4. M/s Plant-Tech Power Technical Services Pvt. Ltd., India</li> <li>5. M/s VKVC, India</li> <li>6. Teemans, UK</li> </ol>
<b>7</b>	<b>Flanges</b>	<ol style="list-style-type: none"> <li>1. M/s Aditya Forge Ltd., Vadodara</li> <li>2. M/s Echjay Industries Ltd., Rajkot</li> <li>3. M/s Metal Forgings Pvt. Ltd., Mumbai</li> <li>4. M/s Perfect Marketings Pvt. Ltd., New Delhi</li> <li>5. M/s Sky Forge, Faridabad</li> <li>6. Sawan Engineers, Baroda</li> <li>7. Stewarts &amp; Lloyds of India Ltd., Kolkata</li> <li>8. Engineering Services Enterprises</li> <li>9. Pipefit Engineers Pvt. Ltd.</li> <li>10. Vival Forged Pvt. Ltd.</li> <li>11. United Forge Industry, Vadodara</li> </ol>

<b>8</b>	<b>Fittings</b>	<ol style="list-style-type: none"> <li>1. M/s Gujarat Infra Pipes Pvt. Ltd., Vadodara</li> <li>2. M/s Stewarts &amp; Lloyds of India Ltd., Kolkata</li> <li>3. M/s Teekay Tubes Pvt. Ltd., Mumbai</li> <li>4. M/s Pipe Fit, Baroda</li> <li>5. M/s Sky Forge, Faridabad</li> <li>6. M/s Sawan Engineers, Baroda</li> <li>7. Eby Fasteners, India</li> <li>8. Leader Valves Ltd, India</li> <li>9. Sawan Engg - Vadodara</li> <li>10. Fittech Industries Pvt Ltd (Thane)</li> <li>11. Gujrat Infrapipes Pvt Ltd ,Vadodara</li> <li>12. Teekay Tubes Pvt Ltd (New Mumbai)</li> <li>13. Petro Chem. Industries, Vadodara</li> <li>14. Vival Forged Pvt. Ltd.</li> <li>15. United Forge Industry, Vadodara</li> </ol>
<b>9</b>	<b>Insulating Joint (IJ)</b>	<ol style="list-style-type: none"> <li>1. IGP Eng. Pvt. Ltd.</li> <li>2. Advance Electronics Pvt. Ltd.</li> <li>3. Vee Kay Vikram &amp; Company LLP</li> <li>4. Nupros Inc., Vadodara</li> </ol>
<b>10</b>	<b>Gaskets</b>	<ol style="list-style-type: none"> <li>1. IGP Engineers (P) Ltd., Madras</li> <li>2. Madras Industrial Products, Madras</li> <li>3. Dikson &amp; Company, Bombay</li> <li>4. Banco Products (P) Ltd., Vadodara</li> <li>5. Goodrich Gaskets Pvt Ltd</li> <li>6. Starflex Sealing India Pvt Ltd, India</li> <li>7. Teekay Meta Flex Pvt Ltd</li> <li>8. UNIKLINGER Ltd</li> <li>9. HEM Engg. Corp.</li> <li>10. Unique Industrial Packing Pvt. Ltd.</li> <li>11. Neoseal Engineering Pvt. Ltd., Gujrat</li> </ol>
<b>11</b>	<b>Fasteners</b>	<ol style="list-style-type: none"> <li>1. Nireka Engg. Co. (P) Ltd., Calcutta</li> <li>2. Precision Taps &amp; Dies, Bombay</li> <li>3. AEP Company, Vithal Udyoug Nagar</li> <li>4. Fix Fit Fasteners, Calcutta</li> <li>5. Precision Engg. Industries, Baroda</li> <li>6. Echjay Forgings Pvt. Ltd., Bombay</li> <li>7. Capital Industries, Bombay</li> <li>8. Boltmaster India Pvt Ltd, India</li> <li>9. Deepak Fasteners Limited, India</li> <li>10. Fasteners &amp; Allied Products Pvt Ltd, India</li> <li>11. Hardwin Fasteners Pvt Ltd, India</li> <li>12. J.J. Industries, India</li> <li>13. Multi Fasteners Pvt Ltd, India</li> <li>14. Nexo Industries, India</li> <li>15. Pacific Forging &amp; Fasteners Pvt Ltd, India</li> <li>16. Pioneer Nuts &amp; Bolts Pvt Ltd, India</li> <li>17. Precision Auto Engineers, India</li> <li>18. President Engineering Works, India</li> <li>19. Sandeep Engineering Works, India</li> <li>20. Syndicate Engineering Industries, India</li> <li>21. Udehra Mechanical Work, Ludhiana</li> </ol>
<b>12</b>	<b>Welding Electrodes</b>	<ol style="list-style-type: none"> <li>1. For Mainline (All Passes) – Lincoln make</li> <li>2. For Terminal – For root pass - Lincon Make and other passes – Lincoln, D&amp;H, or equivalent make</li> </ol>
<b>13</b>	<b>Strainer (Y-Type)</b>	<ol style="list-style-type: none"> <li>1. Bombay Chemical Equipment.</li> <li>2. Gujraat Otofilt.</li> <li>3. Grand Prix Engineering Pvt. Ltd.</li> <li>4. Multitex filtration engineers Pvt. Ltd., New Delhi</li> <li>5. Rak din engineers, New Delhi</li> <li>6. Petromar engineered solution Pvt. Ltd.</li> </ol>
<b>14</b>	<b>Rain Cap</b>	<ol style="list-style-type: none"> <li>1. M/s Nupros Inc, Gujarat</li> </ol>

<b>C. (TEMPORARY CATHODIC PROTECTION)</b>		
<b>1</b>	<b>CP Agencies/CP Contractor</b>	<ol style="list-style-type: none"> <li>1. Universal Corrosion Prevention india</li> <li>2. Cathodic Control Company Pvt. Ltd</li> <li>3. Corrttech International Pvt Ltd.</li> <li>4. JG Corrosion Solution.</li> <li>5. Underground Pipeline &amp; NDTs Pvt. Ltd.</li> <li>6. UNDTs Corrosion Services (P) Ltd.</li> <li>7. Cortigo, Ahemdabad</li> <li>8. Corr experts, Noida</li> <li>9. Silverline integrity services, Guwahati</li> <li>10. SARK EPC projects</li> <li>11. BSS tech , Mumbai</li> <li>12. CTS, Mumbai</li> <li>13. MTech engineers.</li> <li>14. Mercury CP services</li> </ol>
<b>2</b>	<b>Cable</b>	<ol style="list-style-type: none"> <li>1. KEI</li> <li>2. Gemscab Cables</li> <li>3. Universal cables</li> <li>4. EC International Cables (RPG Cables)</li> <li>5. NETCO, New Delhi</li> <li>6. Polycab</li> <li>7. Icon Cable</li> <li>8. Suyog Cable</li> <li>9. Gloster Cables Limited, Gujarat</li> <li>10. Cables Corporation of India Ltd., Maharastra.</li> <li>11. Rashi Cables Pvt. Ltd.</li> <li>12. Tecshol Engineers</li> <li>13. Polycab</li> <li>14. Microtech</li> <li>15. Finolex</li> </ol>
<b>3</b>	<b>Test Station (Flame Proof)</b>	<ol style="list-style-type: none"> <li>1. Flame proof Equipments Private Limited, Mumbai</li> <li>2. FCG Flameproof Control Gears Pvt. Ltd., Mumbai</li> <li>3. Baliga Lighting Equipments Pvt. Ltd., Tamil Nadu</li> </ol>
<b>4</b>	<b>ANODE JUNCTION BOX/ CATHODE JUNCTION BOX/ Test stations (Non-Flame proof)</b>	<ol style="list-style-type: none"> <li>1. Advance Electronic Systems, Vadodra</li> <li>2. Corrpro Asia Pte Ltd., Singapore</li> <li>3. Control Plus Oil &amp; Gas solutions Pvt. Ltd., Ahmedabad</li> <li>4. Underground Pipeline &amp; NDTs Pvt. Ltd.</li> <li>5. Shakti Enterprises, Ahmedabad</li> <li>6. Corrttech International Pvt Ltd.</li> <li>7. Cortigo, Ahemdabad</li> <li>8. Corr experts, Noida</li> <li>9. Silverline integrity services, Guwahati</li> <li>10. SARK EPC projects</li> <li>11. BSS Tech , Mumbai</li> <li>12. CTS, Mumbai</li> </ol>
<b>5</b>	<b>REFERENCE ELECTRODE - Cu/CuSO4</b>	<ol style="list-style-type: none"> <li>1. MC Miller, USA</li> <li>2. Electrochemical Device Inc.- USA</li> <li>3. Tinker &amp; Rasor, USA</li> </ol>
<b>6</b>	<b>Pin Brazing Kit&amp; Accessories</b>	<ol style="list-style-type: none"> <li>1. Safetrack Baavhammar AB, Sweden</li> <li>2. BAC Corrosion Control Ltd.- United Kingdom</li> </ol>
<b>7</b>	<b>Thermit Weld Connection Kit</b>	<ol style="list-style-type: none"> <li>1. ERICO</li> <li>2. Thermoweld</li> </ol>
	<b>EDB COMPONENTS</b>	<ol style="list-style-type: none"> <li>1. Tecshol Engineer</li> <li>2. Switch Gear</li> <li>3. L&amp; T</li> <li>4. ABP</li> </ol>
<b>8</b>	<b>Zinc Anode</b>	<ol style="list-style-type: none"> <li>1. Scientific Metal &amp; Engineers Pvt. Ltd - Karaikudi</li> <li>2. Sargam Metals - Chennai</li> <li>3. Shakti Enterprises, Ahmedabad</li> <li>4. Electro Protection Service India Private Limited</li> <li>5. Protech Anodes &amp; Alloy Engineers, Karaikudi</li> <li>6. Control Plus Oil &amp; Gas solutions Pvt. Ltd. Ahmedabad</li> <li>7. Vijay Corrosion Technology</li> </ol>

9	<b>Magnesium Anode</b>	<ol style="list-style-type: none"> <li>1. Scientific Metal &amp; Engineers Pvt. Ltd – Karaikudi</li> <li>2. Shakti Enterprises, Ahmedabad</li> <li>3. Sargam Metals, Chennai</li> <li>4. Electro Protection Service India Private Limited</li> <li>5. Protech Anodes &amp; Alloy Engineers, Karaikudi</li> <li>6. Control Plus Oil &amp; Gas solutions Pvt. Ltd. Ahmedabad</li> <li>7. Vijay Corrosion Technology</li> </ol>
10	<b>ZINC GROUNDING CELL</b>	<ol style="list-style-type: none"> <li>1. Electro Protection Service India Private Limited</li> <li>2. Shakti Enterprises Ahmedabad</li> <li>3. Protech Anodes &amp; Alloy Engineers, Karaikudi</li> <li>4. Scientific Metal &amp; Engineers Pvt. Ltd – Karaikudi</li> <li>5. Control Plus Oil &amp; Gas solutions Pvt. Ltd. Ahmedabad</li> </ol>
11	<b>SOLID STATE DC DECOUPLER/POLARIZATION CELL</b>	<ol style="list-style-type: none"> <li>1. Dairy land Electrical Industries,- USA</li> <li>2. Interprovincial Corrosion Control Co.- Canada</li> <li>3. Dehn,Germany</li> <li>4. Kristron, India</li> <li>5. ELK Engineering Associates Inc.- USA</li> </ol>
12	<b>Surge Diverter</b>	<ol style="list-style-type: none"> <li>1. Dehn- Germany</li> <li>2. Dairyland Electrical Industries – USA</li> <li>3. Interprovincial Corrosion Control Company Ltd.- Canada</li> <li>4. OBO BETTERMAN- GERMANY</li> </ol>
13	<b>Coupon</b>	<ol style="list-style-type: none"> <li>1. MC-Miller, USA</li> <li>2. SAP Enpro Con</li> </ol>
14	<b>Corrosion Inhibitors for Hydrotest.</b>	<ol style="list-style-type: none"> <li>1. Maxwell Additives Pvt Ltd (earlier Manhar Specialities)</li> <li>2. Imperial Oilfield Chemicals Private Limited, Gujarat</li> </ol>
15	<b>Earthing electrode &amp; GI Strip</b>	<ol style="list-style-type: none"> <li>1. Rukmani Electrical &amp; Components Pvt Ltd.</li> <li>2. Indiana Grating Pvt Ltd.</li> <li>3. Jef Techno Solutions Pvt Ltd</li> <li>4. Stealite Engg .co</li> <li>5. Sadhana Engineering Corporation</li> <li>6. Metallite Industries</li> <li>7. Bhartia Exports</li> <li>8. Jayant Metal Mfg. Co</li> <li>9. National Power Industries</li> <li>10. Techno Power</li> <li>11. Powertrac Industries</li> <li>12. JSR Earthing Solution</li> </ol>
16	<b>Air Condotioner</b>	<ol style="list-style-type: none"> <li>1. O General</li> <li>2. Daikin</li> <li>3. Hitachi</li> </ol>
17	<b>Batteries(Lead Acid)</b>	<ol style="list-style-type: none"> <li>1. Amco Batteries Ltd.</li> <li>2. Exide Industries Ltd</li> <li>3. HBLNIFE Power System Ltd.</li> <li>4. Amara Raja Batteries Ltd.</li> </ol>
18	<b>Batteries(Nickel Cadmium)</b>	<ol style="list-style-type: none"> <li>1. Amco Batteries Ltd</li> <li>2. HBLNIFE POWER SYSTEM LTD</li> </ol>
19	<b>Batteries charges/DC-DC Converter</b>	<ol style="list-style-type: none"> <li>1. Amara Raja Power System(P) Ltd.</li> <li>2. BCH</li> <li>3. Chhabi Electrical Pvt. Ltd</li> <li>4. Calldyne Automatics Limited</li> <li>5. Dubas</li> <li>6. HBL Nife Power System Ltd</li> <li>7. Universal Industries Products</li> <li>8. Universal Instrument Mfg Co Pvt Ltd</li> </ol>

20	<b>Cable- Fire Alarm &amp; Communication Cables</b>	<ol style="list-style-type: none"> <li>1. Cords Cable Industries Ltd.</li> <li>2. CMI</li> <li>3. Delton cables Ltd</li> <li>4. Elkay Telelinks</li> <li>5. KEI Industries Ltd.</li> <li>6. Reliance Engineers Ltd.</li> </ol>
21	<b>Cable- HT (XLPE)</b>	<ol style="list-style-type: none"> <li>1. Universal cable Ltd.</li> <li>2. KEI Industries Ltd.</li> <li>3. Industrial Cables</li> <li>4. NICCO Corporation Ltd.</li> <li>5. Uniflex</li> <li>6. Polycab</li> <li>7. Torrent cables Ltd</li> </ol>
22	<b>Cable- LT Power and control</b>	<ol style="list-style-type: none"> <li>1. Cords cable Industries Ltd</li> <li>2. Universal Cable Ltd.</li> <li>3. KEI Industries Ltd.</li> <li>4. HAVELLS</li> <li>5. DELTON</li> <li>6. Elkay Telelinks</li> <li>7. Evershine Electricals</li> <li>8. ECKO</li> <li>9. Ravin</li> <li>10. Rallison</li> <li>11. Suyog</li> <li>12. Netco</li> <li>13. Uniflex</li> <li>14. Paramount</li> <li>15. Gloster</li> <li>16. Associated cables Pvt ltd</li> <li>17. CMI</li> <li>18. Gemscab</li> <li>19. Industrial cables</li> <li>20. NICCO</li> <li>21. Polycab</li> <li>22. Torrents</li> </ol>
23	<b>Cable-Gland</b>	<ol style="list-style-type: none"> <li>1. Balinga</li> <li>2. Comet</li> <li>3. Flexpro</li> <li>4. Flameproof</li> <li>5. FCG</li> <li>6. Electro Werke</li> <li>7. Dowel</li> <li>8. CCI</li> </ol>
24	<b>CABLE-LUNG</b>	<ol style="list-style-type: none"> <li>1. Dowels</li> <li>2. Jainson</li> <li>3. Ismal</li> </ol>
25	<b>Cable Tray</b>	<ol style="list-style-type: none"> <li>1. Ercon Comopsites</li> <li>2. Yamuna Power &amp; Infrastructure Ltd.</li> </ol>
26	<b>Cable Termination and joining Kit</b>	<ol style="list-style-type: none"> <li>1. CCI</li> <li>2. Raychem</li> <li>3. M-seal</li> </ol>
27	<b>Ceiling /Exhaust/Pedestal Fan &amp; Circulators</b>	<ol style="list-style-type: none"> <li>1. Bajaj Electricals Ltd</li> <li>2. Crompton Greaves Ltd.</li> <li>3. Khaitan Electricals Ltd</li> <li>4. Havells</li> </ol>

28	<b>Contractors -AC Power</b>	<ol style="list-style-type: none"> <li>1. Andrew Yule</li> <li>2. ABB</li> <li>3. BHEL</li> <li>4. C&amp;S</li> <li>5. Havells</li> <li>6. L&amp;T</li> <li>7. Schneider</li> <li>8. Siemens Ltd</li> <li>9. Telemecanique</li> </ol>
29	<b>Control Transformer</b>	<ol style="list-style-type: none"> <li>1. AE</li> <li>2. Indushree</li> <li>3. Intra Vidyut</li> <li>4. Kalpa Elektrikals</li> <li>5. Transpower Industries Ltd.</li> <li>6. Siemens</li> </ol>
30	<b>DG Set</b>	<ol style="list-style-type: none"> <li>1. Sterling and Wilson</li> <li>2. GD ankalesaria</li> <li>3. Deev Genset</li> <li>4. Jackson</li> <li>5. Sudheer Gensets</li> <li>6. Power Engineerings (India) Pvt. Ltd</li> </ol>
31	<b>Earthing Materials</b>	<ol style="list-style-type: none"> <li>1. Rukmani Electrical &amp; Components Pvt. Ltd</li> <li>2. Indiana Grating Pvt. Ltd</li> <li>3. Jef Techno Solution Pvt Ltd</li> </ol>
32	<b>Flame-proof LDB/JB/Controls stations/ switches</b>	<ol style="list-style-type: none"> <li>1. FCG</li> <li>2. Sudhir</li> <li>3. Prompt Engineering Works</li> <li>4. Flame Proof Equipments Pvt. Ltd</li> <li>5. Baliga Lighting Equipment Pvt. Ltd</li> <li>6. Flexo Electrical Pvt. Ltd.</li> </ol>
33	<b>High Mast</b>	<ol style="list-style-type: none"> <li>1. Bajaj Electricals Limited</li> <li>2. Crompton Greaves Ltd</li> <li>3. Philips India Ltd</li> <li>4. Surya Roshani</li> </ol>
34	<b>High Voltage PCC/MCC Panels</b>	<ol style="list-style-type: none"> <li>1. BHEL</li> <li>2. Control and Switchgear</li> <li>3. Siemens</li> <li>4. Tricolite Electrical Industries</li> <li>5. Schneider</li> <li>6. CGL</li> <li>7. L&amp;T</li> </ol>
35	<b>Indicating Lamp</b>	<ol style="list-style-type: none"> <li>1. Alstom Ltd</li> <li>2. BCH</li> <li>3. L&amp;T Ltd</li> <li>4. Siemns Ltd</li> <li>5. Vaishno Electricals</li> </ol>
36	<b>Indicating Meters</b>	<ol style="list-style-type: none"> <li>1. ABB</li> <li>2. AMCO</li> <li>3. AE</li> <li>4. Alstom Ltd.(EE)</li> <li>5. Conzerv/ Schneider</li> <li>6. Elecon Measurement PVT. Ltd.</li> <li>7. HPL Electrical &amp; power Pvt. ltd</li> <li>8. MECO Instruments Ltd.</li> <li>9. Minilec</li> <li>10. Rishabh Instruments Pvt. Ltd</li> <li>11. Trinity energy system</li> <li>12. Kaycee</li> <li>13. Salzer</li> </ol>

37	<b>Lighting Fixtures</b>	<ol style="list-style-type: none"> <li>1. GE Lighting Pvt. Ltd</li> <li>2. Bajaj Electrical Ltd</li> <li>3. Crompton Greaves Ltd</li> <li>4. Philips India Ltd</li> </ol>
38	<b>Lighting Fixture- Flameproof</b>	<ol style="list-style-type: none"> <li>1. Bajaj Electricals Ltd</li> <li>2. Baliga Lighting Equipment Pvt. Ltd.</li> <li>3. Crompton Greaves Ltd</li> <li>4. CEAG Flame proof controlgear Pvt. Ltd</li> <li>5. Flexopro Electricals Pvt. Ltd</li> <li>6. Philips India Ltd.</li> <li>7. Pyrotech Electronics Pvt. Ltd</li> <li>8. Risha Control Engineers Pvt. Ltd</li> <li>9. Siemens</li> <li>10. Tricolite Electrical Industries</li> <li>11. Unilec Engineer Ltd</li> <li>12. Vidyut Control India Pvt. Ltd.</li> <li>13. Control and Schematic</li> <li>14. Zenith Engineering</li> </ol>
39	<b>UPS System and Inverter</b>	<ol style="list-style-type: none"> <li>1. DB Power</li> <li>2. APLAB</li> <li>3. KELTRON</li> <li>4. HI-REL</li> <li>5. DUBAS</li> <li>6. TOSHIBA Corporation</li> <li>7. Fuzi Electrical Co Ltd</li> <li>8. Synergy System</li> </ol>
40	<b>GI- Octogonal Pole</b>	<ol style="list-style-type: none"> <li>1. Bajaj</li> <li>2. Transraii</li> <li>3. Wipro</li> </ol>
41	<b>Solar Module</b>	<ol style="list-style-type: none"> <li>1. Tata BP Solar (I) Ltd</li> <li>2. REIL, Jaipur</li> <li>3. CEIL , Sahibabad</li> <li>4. HBL pOWER</li> </ol>
42	<b>Solar Street Lighting</b>	<ol style="list-style-type: none"> <li>1. Tata BP Solar (I) Ltd</li> <li>2. REIL, Jaipur</li> <li>3. CEIL , Sahibabad</li> <li>4. HBL Power</li> </ol>
43	<b>Terminals Blocks</b>	<ol style="list-style-type: none"> <li>1. Connectwell</li> <li>2. Controls &amp; Switchgear co. Ltd</li> <li>3. Elmex Controls Pvt. Ltd</li> <li>4. Essen Engineering Co. Pvt. Ltd.</li> </ol>
44	<b>Transformers</b>	<ol style="list-style-type: none"> <li>1. ABB</li> <li>2. Andrew Yule</li> <li>3. Areva</li> <li>4. BHEL</li> <li>5. Bharat Bijlee</li> <li>6. Crompton Greaves</li> <li>7. EMCO Ltd</li> <li>8. Intra Vidyut</li> <li>9. Indushree</li> <li>10. Indcoil</li> <li>11. Kirloskar</li> <li>12. Skippers Electricals</li> <li>13. Transformer &amp; Rectifiers (I) Ltd</li> <li>14. Voltamp</li> </ol>

45	<b>PUSH Button</b>	<ol style="list-style-type: none"> <li>BCH</li> <li>Alstom Ltd.</li> <li>L&amp;T</li> <li>Siemens Ltd</li> <li>Telemenchanique &amp; controls ( India) Ltd</li> <li>Vaishno Electricals</li> </ol>
46	<b>Switch- Controls</b>	<ol style="list-style-type: none"> <li>BCH</li> <li>Easum Reyroll Relays &amp; Devices Ltd.</li> <li>Alstom</li> <li>Kaycee Industries Ltd</li> <li>L&amp;T</li> <li>Siemens Ltd.</li> </ol>
47	<b>Switches-5/15A Piano/Plate, Switch Socket</b>	<ol style="list-style-type: none"> <li>Anchor Electronics &amp; Electricals Pvt. Ltd</li> <li>Kingal Electricals Pvt. Ltd.</li> <li>North-WEST Switchgear Ltd.</li> </ol>
48	<b>Switch Socket Outlets ( Industrials)</b>	<ol style="list-style-type: none"> <li>Alstom Ltd.</li> <li>Best &amp; Crompton Engineering Ltd.</li> <li>BCH</li> <li>Crompton Greaves Ltd.</li> <li>Sudhir Switchgears Pvt. Ltd.</li> <li>FCG</li> </ol>
49	<b>Miniature Circuit Breakers (MCBS) and Lighting DB</b>	<ol style="list-style-type: none"> <li>ABB</li> <li>Hagger</li> <li>Havells India Ltd</li> <li>Indo Asian Fusegear Ltd</li> <li>Legrand</li> <li>MDS Switchgear Ltd.</li> <li>Schneider</li> <li>Siemens Ltd.</li> <li>HPL</li> </ol>
50	<b>Moulded Case Circuit Breaker (MCCBs)</b>	<ol style="list-style-type: none"> <li>ABB</li> <li>Andrew yule</li> <li>L&amp;T</li> <li>Schneider</li> <li>Siemens</li> <li>Control and Switchgear</li> </ol>
51	<b>Protection Relays- Thermal</b>	<ol style="list-style-type: none"> <li>BCH</li> <li>L&amp;T Ltd.</li> <li>Siemens Ltd.</li> <li>Telemenchanique &amp; controls (India) Ltd</li> </ol>
52	<b>Low Voltage Power Control center (PCC)/(MCC)/PDB)(MLDB)/(LDB)</b>	<ol style="list-style-type: none"> <li>ABB</li> <li>BCH</li> <li>C&amp;S</li> <li>Elecmeh Switchgear &amp; Instrumentation</li> <li>KMG ATOZ</li> <li>L&amp;T</li> </ol>
<b>D. FIRE FIGHTING EQUIPMENT'S</b>		
1	<b>Fire Extinguishers</b>	<ol style="list-style-type: none"> <li>Avon Services (Production &amp; Agencies) Pvt. Ltd., Bombay</li> <li>Kooverji Devshi &amp; Co., Bombay</li> <li>Zenith Fire Services, Bombay</li> <li>Safex Fire Services, Bombay</li> <li>Reliable (Fire Protection) India Ltd., Bombay</li> <li>Brij Basi Hi</li> <li>tech Udyog</li> <li>Bharat Engg Works, India</li> <li>Gunnebo India Ltd</li> <li>Nitin Fire Protection Industries Ltd, India</li> <li>Supremex Equipments, India</li> <li>Vimal Fire Controls Pvt Ltd., India</li> <li>Tecshol Engineers Bangalore</li> </ol>

		<ul style="list-style-type: none"> <li>14. Nitin Fire Protection Pvt. Ltd.</li> <li>15. Safex Fire Services</li> <li>16. HD Fire Protect Co.</li> <li>17. Zenith Fire Services</li> <li>18. Steelage Industries</li> <li>19. Atlas Firetech Pvt. Ltd.</li> <li>20. Techshol Engineer</li> <li>21. Nitin Fire Protection Pvt. Ltd.</li> <li>22. Safex Fire Services</li> <li>23. Fire Safety Services</li> <li>24. HD Fire Protect Co.</li> <li>25. Zenith Fire Services</li> <li>26. Steelage Industries</li> <li>27. Atlas Firetech Pvt. Ltd.</li> </ul>
<b>2</b>	<b>Fire Hydrants, Monitors, Deluge Valve, Nozzles</b>	<ul style="list-style-type: none"> <li>1. Zenith</li> <li>2. Minimax</li> <li>3. Newage</li> <li>4. HD Fire</li> <li>5. Vijay Fire</li> <li>6. Asco Strumech Pvt Ltd, India</li> <li>7. Brij Basi Hi</li> <li>8. tech Udyog</li> <li>9. Gunnebo India Ltd</li> <li>10. Nitin Fire Protection Pvt Ltd</li> <li>11. Shah Bhogilal Jethamal &amp; Brothers</li> <li>12. Venus Pumps &amp; Engineering Works</li> </ul>

<b>3</b>	<b>RRL Hose</b>	<ol style="list-style-type: none"> <li>1. Jayshree</li> <li>2. Newage</li> </ol>
<b>4</b>	<b>Hoses</b>	<ol style="list-style-type: none"> <li>1. Ashit Sales Corporation, Bombay</li> <li>2. Royal India Corporation, Bombay</li> <li>3. Gayatri Industrial Corporation</li> <li>4. Simplex Rubber Products Ltd., Ahmedabad</li> <li>5. Zaverchand Marketing Pvt. Ltd., Baroda</li> <li>6. Presidency Rubber Mill, Calcutta</li> <li>7. The Cosmopolite, Calcutta</li> <li>8. Simplex Rubber Products, Thane</li> </ol>
<b>5</b>	<b>Hose Delivery</b>	<ol style="list-style-type: none"> <li>1. Chhatarya Rubber &amp; Chemical Industries,</li> <li>2. Nitin Fire Protection Industries Ltd, India</li> </ol>
<b>6</b>	<b>Fire Hose Accessories</b>	<ol style="list-style-type: none"> <li>1. Asco Strumech Pvt Ltd</li> <li>2. Brij Basi Hi-tech Udyog</li> <li>3. Gunnebo India Ltd</li> <li>4. Shah Bhogilal Jethamal &amp; Brothers</li> <li>5. Vimal Fire Controls Pvt Ltd., India</li> </ol>
<b>7</b>	<b>Heat Shrinkable Sleeves</b>	<ol style="list-style-type: none"> <li>1. Covalence Raychem (Berry Plastics Corporation)</li> <li>2. Canussa – CPS</li> </ol>
<b>8</b>	<b>Cold Applied Tapes</b>	<ol style="list-style-type: none"> <li>1. Denso GmbH</li> <li>2. Polyken (Berry Plastics Corporation)</li> </ol>
<b>9</b>	<b>PUR Coating</b>	<ol style="list-style-type: none"> <li>1. Powercrete (Berry Plastics Corporation)</li> </ol>
<b>10</b>	<b>Casing End Closure</b>	<ol style="list-style-type: none"> <li>1. Raci, Italy</li> <li>2. Raychem RPG Limited</li> </ol>
<b>11</b>	<b>Rockshield</b>	<ol style="list-style-type: none"> <li>1. Raychem RPG Limited</li> </ol>
<b>12</b>	<b>Warning Mat / Mesh</b>	<ol style="list-style-type: none"> <li>1. Sparco Multiplast Pvt. Ltd., Ahmedabad</li> <li>2. M/s Raychem RPG Limited</li> <li>3. Singhal Industries Private Limited</li> <li>4. Vijay Plast Tech.</li> <li>5. Polycan Extrusion Pvt. Ltd.</li> </ol>
<b>13</b>	<b>High Build Epoxy Coating</b>	<ol style="list-style-type: none"> <li>1. Berry Plastics – Powercrete</li> <li>2. Specialty Polymer Canada</li> <li>3. Denso Protal, Canada</li> </ol>
<b>14</b>	<b>Casing Insulators</b>	<ol style="list-style-type: none"> <li>1. Raci, Italy</li> <li>2. Raychem RPG Limited</li> <li>3. Veekay Vikram</li> </ol>
<b>15</b>	<b>DRY GAS FILTER &amp; FILTER SEPERATOR</b>	<ol style="list-style-type: none"> <li>1. Grand Prix Fab (Pvt.) Ltd. (New Delhi)</li> <li>2. Perry Equipment, USA</li> <li>3. Faudi Filter, Germany</li> <li>4. Forain S.r.l., Italy</li> <li>5. ABB, Faridabad</li> <li>6. Burgess Manning, USA</li> <li>7. Multitex Filtration Engineers India</li> <li>8. Triveni Plenty Engg. Ltd. (New Delhi)</li> <li>9. Siirtec International Contractor S.P.A (Italy)</li> <li>10. Flashpoint, Pune india</li> <li>11. Filtration Engineers (I) Pvt Ltd, India</li> <li>12. Gujarat Otofilt, India</li> <li>13. Tormene Gas Technology</li> <li>14. Ultrafilter (India) Pvt Ltd, India</li> <li>15. Ravi Techno Systems Pvt Ltd, India</li> <li>16. Siirtec Nigi S.P.A</li> <li>17. Filtan Filter Anlagenbau Gmbh</li> <li>18. Fairley Arlon BV</li> <li>19. PECO Facet</li> <li>20. EPE Epenstenner GMBH</li> <li>21. Filtrex srl</li> <li>22. Petromar Engineered Soln</li> <li>23. Plenty Filter</li> <li>24. Eurofiltec</li> <li>25. PTI Technologies Inc</li> </ol>

<p><b>16</b></p>	<p><b>QUICK OPENING END CLOSURE (QOEC)</b></p>	<ol style="list-style-type: none"> <li>1. Forain S.R.L.</li> <li>2. GD Engineering</li> <li>3. Pipeline Engineering, UK</li> <li>4. Siirtec Nigi S.P.A</li> <li>5. TD Williamson</li> <li>6. Peerless</li> <li>7. Grinelli</li> <li>8. Huber Yale</li> <li>9. Tube Turn (U.S.A.)</li> <li>10. Pipeline Technologies, France</li> <li>11. M/s Grand Prix Engineering Pvt. Ltd.</li> <li>12. M/s VKVC LLP</li> <li>13. M/s Multitex Filtration Engineers Ltd</li> </ol>
<p><b>17</b></p>	<p><b>FILTER ELEMENT</b></p>	<ol style="list-style-type: none"> <li>1. Peco – Facet</li> <li>2. Velcon</li> <li>3. Pall – Filterite</li> <li>4. Burgress Manning</li> </ol>
<p><b>18</b></p>	<p><b>NDT Agency</b></p>	<ol style="list-style-type: none"> <li>1. NDT Services, Ahmedabad</li> <li>2. GEECY Industrial Services Pvt. Ltd., Mumbai</li> <li>3. Corrosion Control Services, Mumbai</li> <li>4. Perfect Metal Testing &amp; Inspection Agency, Calcutta</li> <li>5. Inter Ocean Shipping Co., New Delhi</li> <li>6. RTD, Mumbai</li> <li>7. Sievert, Mumbai</li> <li>8. X-Tech, Vizag</li> <li>9. Sigma NDT services.</li> <li>10. Universal NDT services</li> <li>11. Sai Heatreaters &amp; Non-Destructive Testing PVT LTD.</li> <li>12. Aditya NDT services, Uttar Pradesh</li> <li>13. Krishna NDT Engineers, Gujarat</li> <li>14. Smart Technocrats and consultancy services, Maharashtra.</li> <li>15. OPI services (India) pvt. ltd., Pune</li> <li>16. Offshore testing &amp; inspection services (i) pvt. ltd., Navi Mumbai</li> <li>17. Calcutta test house pvt. ltd., new Delhi</li> <li>18. RST NDT INSPECTION Co.</li> </ol>
<p><b>19</b></p>	<p><b>Bends</b></p>	<ol style="list-style-type: none"> <li>1. M/s Sawan</li> <li>2. M/s Gujarat Infra</li> <li>3. M/s P K Tubes</li> <li>4. M/s Dee Development Engineers Ltd</li> <li>5. Pipefit Engineers Pvt. Ltd.</li> <li>6. Vival Forged Pvt. Ltd.</li> <li>7. United forging Pvt. Ltd.</li> </ol>

20	<b>PIG LAUNCHERS/ RECEIVERS/ PIG SIGNALERS</b>	<ol style="list-style-type: none"> <li>1. Bassi Luigi Fittings B.V., Holland</li> <li>2. BRAUN STAHL PIPE TEC, GERMANY</li> <li>3. FORAIN, ITALY</li> <li>4. Fluidel SRL, ITALY</li> <li>5. RMA Maschinen- und, GERMANY</li> <li>6. Siirtec Nigi, Italy</li> <li>7. SCHUCK ARMATUREN, GERMANY</li> <li>8. T.D. Williamson Inc., USA</li> <li>9. Tectubi SPA, Italy</li> <li>10. Taylor Forge Engineering System INC, USA</li> <li>11. Tormene Americana S.A. (Argentina)</li> <li>12. Tormene Gas Technology S.p.A., Italy</li> <li>13. PIPELINE ENGINEERING, UNITED KINGDOM</li> <li>14. Krohne, Oil &amp; Gas BV, Drive Houston,</li> <li>15. Multitex Filtration Engrs. Ltd, New Delhi</li> <li>16. BGR ENERGY SYSTEMS LIMITED New Delhi</li> <li>17. Glapwell Contracting Services Ltd. UK</li> <li>18. FULGOSI GIOVANNI S.n.c di Corrado &amp; C, ITALY</li> <li>19. VEEKAY VIKRAM &amp; CO, GUJRAT</li> <li>20. GBM S.R.L, ITALY</li> <li>21. Multitex Filtration Engineers Ltd., India</li> <li>22. Cardew Ltd., Alexeander</li> <li>23. Forain S.R.L.</li> <li>24. GD Engineering, India</li> <li>25. Pipeline Engineering, UK</li> <li>26. Siirtec Nigi SPA</li> </ol>
21	<b>Pressure Gauge</b>	<ol style="list-style-type: none"> <li>1. AN Instruments Pvt Ltd.</li> <li>2. Badotherm Process Instruments B.V.</li> <li>3. Baumer Bourdon Haenni S.A.S</li> <li>4. British Rototherm Co Ltd.</li> <li>5. Budenberg Gauge Co Ltd.</li> <li>6. Dresser Inc.</li> <li>7. Forbes Marshall (Hyd) Pvt Ltd.</li> <li>8. General Instrument Consortium</li> <li>9. Guru Instruments (South India) Pvt Ltd.</li> <li>10. Manometer (India) Pvt. Ltd.</li> <li>11. Nagano Keiki Seisakusho Ltd</li> <li>12. Hirlekar Precision, India</li> <li>13. Waaree Instruments Ltd</li> <li>14. Walchandnagar Industries Ltd (Tiwac Divn)</li> <li>15. Wika Alexander Wiegand &amp; Co GmbH</li> <li>16. Wika Instruments India Pvt Ltd.</li> <li>17. Ashcroft India Pvt Ltd.</li> </ol>
<b>II. LIST OF APPROVED VENDORS</b>		
<b>Sr. No.</b>	<b>Item</b>	<b>Name of Vendor</b>
1	<b>PE ELECTROFUSION FITTING</b>	<ol style="list-style-type: none"> <li>1. Georg Fischer Piping System</li> <li>2. Kimplas Piping Systems Ltd.</li> <li>3. Innogaz &amp; Frialen of Aliaxis Utilities &amp; Industry Pvt. Ltd.</li> <li>4. Glynwed Pipe Systems</li> <li>5. Tega Muhendislik (represented by Sangir Plastics)</li> </ol>
2	<b>DOUBLE PURGE VALVE WITH EXTENDED STEM</b>	<ol style="list-style-type: none"> <li>1. Tega Muhendislik (represented by Sangir Plastics)</li> <li>2. Polytec, Korea (represented by Autometers Energitec Limited)</li> <li>3. Daeyoun, Korea (represented by Rhino services)</li> <li>4. AVK Valves India Pvt. Ltd.</li> </ol>

3	<b>HDPE PIPES</b>	<ol style="list-style-type: none"> <li>1. Climax Synthetics (P) Ltd.</li> <li>2. Himalayan Pipes</li> <li>3. Duraline India</li> <li>4. Jain Irrigation Systems Ltd.</li> <li>5. Kriti Industries (India) Ltd.</li> <li>6. Oriplast Limited</li> <li>7. Sangir Plastics (P) Ltd.</li> <li>8. Veekay Plast</li> <li>9. Kisan Irrigation</li> <li>10. Dutron Polymers Ltd.</li> <li>11. Mangalam Pipes Pvt. Ltd.</li> <li>12. Shand Pipe industry Pvt. Ltd.</li> <li>13. Varun Pipes Pvt. Ltd.</li> </ol>
4	<b>APPROVED MAKES FOR ELECTRO- FUSION MACHINES</b>	<ol style="list-style-type: none"> <li>1. Georg Fischer Piping System</li> <li>2. Hurner</li> <li>3. Friatec</li> <li>4. Rothenberger</li> <li>5. Ritmo</li> <li>6. Kimplas Piping Systems Ltd.</li> </ol>
5	<b>MDPE Fittings &amp; MDPE Valves</b>	<ol style="list-style-type: none"> <li>1. AliAxis,</li> <li>2. Geroge Fischer,</li> <li>3. Al-Aziz,</li> <li>4. Kimplas,</li> <li>5. Banides,</li> <li>6. Agru,</li> <li>7. Friatech,</li> <li>8. Plasson</li> </ol>
6	<b>Brass Valves</b>	<ol style="list-style-type: none"> <li>1. Universal srl, Italy</li> <li>2. Tiemme Raccorderie Sede, Italy</li> <li>4. Enolgas Bonimu s.a.s., Italy</li> <li>5. Fratelli Fortis s.r.l, Italy</li> <li>6. Giacomo Climbrio, Italy</li> <li>7. Parker Hannifin S.P.A., USA</li> <li>8. Singapore Valve &amp; Amp; Fittings Pte Limited, Singapore /Bengaluru</li> <li>9. Rubinetteria Utensilerie Bonomi (RUB), Italy</li> <li>10. Zhejiang Valogin Technology Co. Ltd., China,</li> <li>11. Ningbo Zhiqing Industrial Co. Ltd., China,</li> <li>12. Zhejiang Dunan Valve Co. Ltd.,</li> <li>13. Ningbo Huaping, China</li> </ol>
7	<b>GI Pipe</b>	<ol style="list-style-type: none"> <li>1. Swastik Pipe Ltd. (Authorised Distributor M/s Hareesh Steel &amp; Pipe)</li> <li>2. Jindal Industries Ltd.</li> <li>3. Vishal Pipes Ltd.</li> <li>4. Indus Tubes Ltd. (Authorised Distributor M/s Hareesh Steel &amp; Pipe)</li> <li>5. Advance Steel Tubes Ltd.</li> <li>6. Good Luck Tubes Ltd.</li> <li>7. Surya Roshni Limited</li> <li>8. APL Apollo Tubes Limited</li> <li>9. Jindal Pipes Limited</li> </ol>
8	<b>Casting GI Fittings</b>	<ol style="list-style-type: none"> <li>1. Sarin Industries Ltd.</li> <li>2. Jupiter Metal Industries Ltd.</li> <li>3. Jainsons Industries Ltd.</li> <li>4. Jinan Meide Casting Co. Ltd.</li> <li>5. Green Malleable Pvt. Ltd.</li> <li>6. Unique Pipe Fittings Company.</li> </ol>

9	<b>Forged GI Fittings (for High Rise Segment)</b>	1. Jainsons Industries Ltd. 2. B.M. Meters Pvt. Ltd.
10	<b>Copper Tubes</b>	1. Jay Banas 2. Mehta Tubes Limited- Trade Mark "MEXFLOW" 3. Rajco Metal (Tubes & Fittings) 4. Paras Industries 5. Mercure Metal & Alloys Pvt. Ltd. (Authorised Distributors: M/s Shills alloys Pvt. Ltd & Hreesh Steel & pipes)
11	<b>Brass Fittings</b>	1. Chandan Enterprises 2. Paras Industries Ltd. 3. Chokhawala Distributors- Brass Adaptor 4. Saumya Electricals Industries 5. Umesh Enterprises
12	<b>Steel Re-inforced Rubber Hose (Type-4)</b>	1. Super Seal Flexible Hose Ltd. 2. Suraksha Products Pvt. Ltd. 3. Vansh Industries 4. T & L Gases
13	<b>Corrugated Flexible Metal Hoses (Anaconda)</b>	1. KPC Flex Tubes 2. Vestas Hose Division 3. Alpha Flexi Tubes 4. Chandan Enterprises

### III. LIST OF RECOMMENDED MANUFACTURERS

#### A. SHOP & FIELD PAINTING

Sl. No.	Items/Name of	Makes/Brands/Manufactures
1	<b>Indian Vendors</b>	1. Asian Paints (I) Ltd. Berger Paints Ltd. 2. Goodlass Nerlolac Paints Ltd. 3. Jenson And Nicholson Paint Ltd & choku Gu Jenson & Nicholson Ltd. 4. Shalimar Paints Ltd. 5. Sigma Coating, Mumbai 6. CDC Carboline Ltd. 7. Premier Products Ltd. 8. Coromandel Paints & Chemicals Ltd. 9. Anupam Enterprises 10. Grand Polycoats 11. Bombay Paints Ltd. 12. Vanaprabha Esters & Glycer, Mumbai 13. Sunil Paints and Varnishes Pvt. Ltd. 14. Courtaulds Coating & Sealants India (Pvt.) Ltd. 15. Mark-chem Incorporated, Mumbai (for phosphating chemicals only) 16. VCM Polyurethane Paint (for polyurethane Paint only)
2	<b>Foreign Vendors For Overseas Products</b>	1. Sigma Coating, Singapore 2. Ameron, USA 3. Kansai Paint, Japan 4. Hempel Paint, USA 5. Valspar Corporation, USA 6. Courtaulds Coating, UK



**NOTES:**

1. Bidders to adhere strictly to the vendor list. No deviation shall be accepted without prior approval from Owner.
2. The details of Recommended Vendors indicated in this list are based on the information available with Owner & Owner's representative. Contractor shall verify capabilities of each vendor for producing the required quantity with vendor. Owner & Owner's representative does not guarantee any responsibility on the performance of the Vendor; it is the contractor responsibility to verify the correct status of vendor and quality control of each vendor and to expedite the material availability at site without delay execution work.
3. The vender which are not mentioned in the list, can approach GSL/ SIPI BENIN for approval, GSL will incorporate the vender in approved vender list after evaluation process (as per COMPANY GUIDELINES).
4. This is the preferred vender list, However, CLIENT/GSL can add or delete any vender after the evaluation process.
5. Additional vendors will be considered in exceptional cases with the following condition: -

Apart from the above given vendors detailed/items with no vendor list, the contractor may propose any other vendors having credentials for supply of respective items (for the same or higher size as well as pressure rating) in the last 3 years in natural gas service (i.e., City gas / cross country distribution project). In such cases the bidder is to submit supply record as below.

- A. Copy of PO/Work Order
  - B. Inspection Reports,
  - C. Inspection Release note,
  - D. Past Track Record (PTR)
  - E. Catalog, if any
  - F. Experience Details.
  - G. Certification related to quality and management/manufacturing of the same item.
6. GSL / CLIENT reserves to right for acceptance/rejection of the new proposed vendor.

