

SPECIFICATION NO. A-0

FOR

GENERAL ARCHITECTURAL WORK

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**SPECIFICATION NO. A-0
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1.00.00 INTRODUCTION

This specification covers design, preparation of necessary drawings for approval and construction of all Architectural work associated with 1x100 MW NAMRUP REPLACEMENT POWER PROJECT (PHASE-1), Assam State Electricity Board. The scope of work covers complete Architectural Work including supply of all materials, labour, tools and plants as required for successful execution of the turnkey Contract.

The architectural work & services shall cover wall Cladding and finishing work of Gas Turbine & Steam Turbine Building including other auxiliary plant buildings & structures like Air compressor building Electrical and control building, C.W Pump house & chlorination building, D.M. plant building with control room and chemical laboratory, Chemical house, Gas Booster compressor building, Raw water pump house, Clarified cum fire water pump house, BFP building, Switchyard Relay room but not limited to these buildings.

Architectural cladding and finishing work are Anti termite treatment work of the foundation, ground and other required surface area, brick work for external walls and partition walls, Damp proof treatment, pre coated metal cladding work and work for roof protection, finishing of walls, painting, flooring & ceiling, false ceiling, false floor as required, doors, windows, ventilators and louvers, potable water supply system, sanitary, plumbing, landscaping and all other related work required for completion of the buildings and surrounding area in all respect to render the premises acceptable to the satisfaction of the owner.

2.00.00 MAIN PLANT STRUCTURES/COMPONENTS

The general description of some of the major structures/components covered under this Contract have been given else where in this specification.

2.01.00 All buildings, structures shall be designed to meet its structural & functional requirements as stated in the relevant section of this specification. Besides all technical requirements stipulated in specification no. C-0, various architectural design criteria shall be as per the following clause. For workmanship, material & construction methods for each item of architectural work, stipulation of relevant technical specification shall be complied with.

3.00.00 DESIGN REQUIREMENTS

3.01.00 The indicative layout of S.T. and G.T buildings have been shown in the tender drawings. The contractor shall develop the final architectural drawings of all the buildings including those indicated in the tender drawings as per the final approved equipment layout and considering other related layout indicated elsewhere in this specification. All drawings shall need the approval of the

owner before construction. The contractor shall also have to submit coloured perspective view of the plant. Obtain approval from statutory authorities, e.g. Factories Inspector, Explosives Inspector, Tariff Advisory Committee or any other bodies as required shall be the responsibility of the contractor without any obligation to the owner.

3.02.00 Architectural concepts of the buildings shall offer its own identity and will be aesthetically blended with the surroundings to give pleasing appearance keeping an eye to the functional needs of each building. Special attention shall be given to architectural treatment of power houses and other important buildings.

3.03.00 Contractor shall comply with all applicable statutory rules for

- a) Factories Act of the State.
- b) Fire safety rules of TAC.
- c) Act of the Pollution Control Board of the State.
- d) All other statutory rules not mentioned but are to be observed for implementation of the project.
- e) Laws/acts concerning control of Industrial effluents, Waste disposal and gaseous emissions.

3.03.01 Generally flat R.C.C. roof or RCC roof over metal deck in steel/RCC frame structure shall be provided for plant buildings. Cladding shall be either with brickwork with cement, sand mortar or pre coated cladding over partly masonry wall up to a certain height as indicated below.

External Wall Cladding and roofing for the buildings shall be as follow:

Sl. No.	Name of the Building	External wall cladding	Roof
1.	Gas turbine & Steam turbine building	Brick wall up to 2.1 M from finish floor level above that pre colour coated galvalume (0.55mm total coated thickness) steel sheet with super polyester or Silicon polyester or Fluoro polymer (PVF2) coated single sheet cladding of approved brand.	RCC roof over pre coated metal deck with Roof water proofing treatment and necessary roof drainage slope
2.	Electrical Control Building	-Do-	RCC roof with Roof water proofing treatment and necessary roof drainage slope
3.	Clarified cum Fire water pump house	-DO- Masonry wall height will be 2.1 m	-DO-
4.	C.W. Pump house	-DO-	-DO-

Sl. No.	Name of the Building	External wall cladding	Roof
5.	Air compressor & D.G building	-DO-	-DO-
6.	Raw water pump house	-DO-	-DO-
7.	D.M Plant building	Brick wall up to full height.	RCC Roof with Roof water proofing treatment and necessary roof drainage slope
8.	Switch yard Relay room	-DO-	-DO-
9.	C.W. Chlorination Building	-DO-	-DO-
10.	Chemical House	-DO-	-DO-
11.	Gas booster Compressor house	-DO-	-DO-

External brick wall for all buildings shall be one full brick thick wall except for fire wall. Fire wall shall be either one and half brick thick wall or RCC wall as approved by the owner and shall be provided where required to protect the building from fire hazards. cladding shall be permanently pre coated metal cladding (single sheet) trough profile or as approved by the owner including its colour, shade.

- 3.03.02 Windows, ventilators and louver shall be in general as per the requirements of National Building code for natural light penetration and air flow. This may vary as per functional requirements. The sill height for low level windows shall be approximately 1000 mm above finish floor level.
- 3.03.03 Stairs & platforms shall be provided as required for maximum utility & safety and as per statutory requirements and relevant code of practice.
- 3.03.04 Damp proof course
- 50 thick DPC shall be provided at ground floor level.
- 3.03.05 Plinth protection
- 100 mm thick PCC Plinth protection with top smooth finish shall be provided all along the periphery of buildings with surface drain. Minimum 750 mm wide plinth protection shall be provided. For G.T and STG building RCC Pavement of required width with surface drain shall be provided.
- 3.03.06 Miscellaneous Metal railing:
- Railing shall be provided as required from safety point of view and shall as specified else where in the document.

3.03.07 All floors generally shall be of RCC with hatch-ways as required with 50 thick floor finish except for false floor.

3.03.08 Painting

Exterior masonry surfaces shall be painted with water proof cement paint in general. For GT and STG building, Electrical and control building shall be painted with exterior grade Acrylic emulsion paint over plaster.

Exterior steel work shall be painted with synthetic enamel paint as specified in the document. Refer CL no-7.07.08 in this document.

3.03.09 Miscellaneous Work

- a) Counter tops in kitchen, washbasin ,pantry & similar areas shall be polished granite
- b) Pavement and walk ways unless otherwise specified else where in the document shall be with 50 mm thick interlocking concrete pavers.
- c) M.S grill in windows shall be provided as required from security point of view as per approved design.
- d) Suitable arrangement of floor drains with trap shall be provided in floor where spillage of water may occur.
- e) Covered car parking with RCC pavement for 10 no of cars and one shed for 20 no of two wheelers shall be provided. Structure shall be tubular vault structure with translucent PVC sheet similar to ONDEX bi-stretched PVC sheet.
- f) All roofs shall be accessible from grade level by staircase and for single storied buildings steel cage ladders shall be provided.
- g) All external doors, windows, ventilators and rolling shutters shall be provided with sun and rain control device either by projecting RCC chajja or by recessing the windows, ventilators at least 400 mm from external surface. Minimum 750 mm projection from external surface shall be provided for Doors and rolling shutters. For windows projection shall be minimum 500 mm. Continuous chajja shall be provided where doors and windows are provided side by side.
- h) Chain link fencing shall be provided as required from safety point of view.
- i) Fencing shall be 3.0m high. Refer Cl. No. 8.01.00 in this document.

3.04.00 **Roof Insulation and Ventilation**

The RCC roof of all buildings shall be insulated with foam concrete or expanded high density polystyrene block. For roof ventilation relevant section of the specification shall be referred

3.05.00 **Roof Waterproofing**

Generally all RCC roofs shall be provided with water proofing treatment comprising of concrete screed in slope not less than 1:100. Top of Screed shall be provided with water proof treatment comprising of one coat approved water

proof chemicals of rubberized modified bituminous emulsion similar to EMUFAL TE of TEXSA or approved equivalent and 1.5 mm thick Self adhesive water proof membrane similar to Texself H.D of TEXSA or approved equivalent over chemical treatment.. Top of water proof membrane shall be covered with foam concrete insulation as per HVAC requirement. Top of foam concrete shall be plastered with 12 mm thick cement sand plaster 1:4. Walk way required over roof surface for maintenance purpose shall be finished with 20 mm thick pressed precast concrete tiles on 15 mm thick Cement: Sand (1:4) mortar.

3.06.00 Partition Wall

Generally full brick thick partition wall in 1:6 cement, sand mortar shall be used except for toilet internal walls which shall be half brick thick in 1:4 cement sand mortar. H.B. wire netting shall be provided at every third layer. Full Glazed partition in anodized aluminium frame shall be provided for control room area so that clear view of the operating equipment and turbine hall is available from control room and various ancillary rooms in control room area.

3.07.00 Plastering

Exterior masonry wall m concrete surfaces and internal masonry and concrete surfaces and rough side of brick wall shall be plastered with cement sand mortar Clause no 7.04.00 shall be referred for details.

3.08.00 False Ceiling

Control room shall be designed with special architectural features with domical Suspended ceiling and indirect illumination system.

Material shall be Gypsum board fixed to G.I. framework (snap grid system) as per manufacturer's details and suspended from steel/ R.C. beams or slabs. Suspended ceiling shall be provided in air conditioned spaces. The illumination and duct grills in these areas shall match the overall aesthetics. Other Areas of the control area shall have flat suspended ceiling with Gypsum board.

Suspended ceiling shall take care of all illumination system, fire detection and fighting system HVAC diffusers and other service system. Refer Cl. No. 7.07.05 for details.

3.09.00 Special Finish

The main entrance of power house, control room, and other important areas along with main stairs, lift lobby, entrance lobbies etc. shall be specially considered for layout and finishes

3.10.00 Doors

- a) Generally hollow metal (steel) flush doors with pressed steel frame shall be provided for plant and utility areas.
- b) Rolling steel shutters shall be used where frequent use is not envisaged and large openings are required.
- c) Special areas like control rooms shall be provided with aluminium glazed partitions and double doors with air lock i.e., two sets of doors with an

air space In between two doors.

- d) Aluminium single leaf or double leaf fully glazed doors.
- e) Fire proof doors with panic bar devices shall be provided in cable spreader rooms and other areas having fire hazard and shall be provided as per TAC requirements.
- f) Doors shall be provided at appropriate location to prevent dust ingress from outside. Weather strip shall be provided to all external doors as well as in all air conditioned area.
- g) Solid core wooden flash doors in approved timber frame shall be provided with both side lamination for toilets and office internal doors as per owners requirements.
- h) Specially fabricated sliding or double leaf side hung steel door shall be provided in mono rail portion.

3.11.00 **Windows & Ventilators**

Generally for all plant buildings Aluminium casement windows and ventilators with 4mm to 6mm thick clear float glass depending upon the glass panel size and glass manufacturer requirement both for openable portion as well as for fixed portion shall be provided. Aluminium casement windows shall be of Hindalco 40 series and shall have 15 micron thick anodisation.

6mm thick clear wired glass shall be provided as required from safety point of view.

Windows in Control room area shall be double glazed fixed windows hermetically sealed similar to glazed partition below.

3.12.00 **Glazing and Glazed Partition**

Glazing between A.C and non A.C areas shall be Insulating glass consisting of two 6mm thick clear float glass with a separating gap of 12 mm for thermal insulation. Both the glasses shall be hermetically sealed. Glazing between two A.C area shall be with 6mm thick glass. All glazed partition shall be in aluminium 15 micron thick anodized frame. Refer also Cl. No. 7.07.04.

3.13.0 **Sealant**

Silicon sealant shall be provided in all joints around exterior doors, windows, ventilators with masonry and concrete surfaces. Expansion joints shall be sealed with polysulphide sealant with backer rod.

3.14.00 **Landscaping**

Both soft and hard landscaping shall be developed for a pleasing environment.

Generally the natural contour shall be retained except where modifications needed for drainage or other technical reasons. Trees shrubs, hedges, earth mound, grass lawn shall be provided to suit the climate. Necessary irrigation system shall be provided for watering of the landscape area.

3.15.00 **Facilities in Buildings**

Facilities in each building shall be developed on the basis of requirements. Circulations and safety will be considered in each case.

Adequate toilet and drinking water facilities shall be provided for personnel working in each building. Each building and each manned floor shall have toilet facilities according to occupancy requirement as per NBC.

Ladies toilet shall be provided in each building as per requirements of the female occupancy in that building.

3.16.00 **Potable Water System and Plumbing**

3.16.01 This system for various buildings shall be connected to the drinking water and service water system, the schemes for which are indicated elsewhere in this specification.

3.16.02 Water outlets shall be provided for an instantaneous flow rate of approximately 7 Cu.M/Hr. (25 GPM).

3.16.03 System will satisfy the state and local plumbing codes and regulations.

3.16.04 Following I.S. Codes for the system shall be followed :

- a) IS-2065 : Code of Practice for water supply in buildings.
- b) IS-1172 : Code of basic requirements for water supply, drainage and sanitation.
- c) IS-1200 : Laying of water and sewer lines (Pt.XVI) including appurtenant items.
- d) IS-1239 : Specification for mild steel tubes and mild steel tubulars and other wrought steel pipe fittings (10 mm to 15 mm nominal diameter).
- e) IS-3589 : Specification for electrically welded steel pipes for water, gas and sewage (220 mm to 2000 mm nominal diameter).

3.16.05 Potable water shall be supplied to basins, water closets, urinals, sinks, water coolers, showers and other plumbing fixtures. Soil and waste piping shall drain through traps to the yard sanitary sewer system.

3.17.00 **Roof Drainage Systems**

3.17.01 The system shall be provided for removal of water from roof surface to avoid damage to the roof structure of all buildings and shall consist of the following :

- a) Roof Drain Heads
- b) Rain Water Down pipes
- c) Fixtures

IS-1742: Code of practice for building drainage shall be followed for this purpose.

Multiple drains (min.2) shall be provided for all roof areas. System will be designed to handle rainfall at a rate of 150 mm per hour and in accordance with stipulations of IS-1742.

Roof drains will dispose rain water to storm water drain. Rain water pipes generally be run unexposed.

Any roof more than 8.0 metres height from grade shall be provided with access for maintenance of the roof drains. Cl. No. 7.07.07 shall also be referred for more details.

3.18.00 Finish Schedule

Sl. No.	Building/Area	Floor/Skirting/Dado	Wall	Ceiling
1.	All Turbine hall floors, (except operating floor of ST building and floors of control building), AC plant, AHU room, Unloading bays, maintenance and workshop area, pump house and similar other areas of GT, STG Contro, and other buildings.	Heavy duty floor finish with non metallic hardener with suitable aluminium dividing strips.	Plastered and painted with acrylic washable distemper	RCC ceiling plastered and white washed.
2.	Operating floor of steam turbine building.	20 mm thick Kota stone flooring over 1:4 mortar and required concrete under bed 1:2:4.	Plastered and painted with acrylic washable distemper	Metal deck ceiling.
3.	General circulation areas. lift entrance lobby and corridors in important areas.	20 mm thick Kota stone flooring over 1:4 cement sand mortar and required concrete under bed.	Plastered and painted with acrylic emulsion paint Over POP. Lift front shall be finished with 20 mm thick mirror polished pink granite slab	RCC ceiling plastered and painted with acrylic emulsion over POP.
4.	Cable vault, cable spreader and similar other areas.	Heavy duty floor finish with non metallic hardener and suitable aluminium dividing strips	Plastered and white washed.	RCC ceiling plastered and white washed
5.	RCC stair case in electrical control building, STG	20 mm thick mirror polished Kota stone treads and risers in 1:4 mortar and required	Plastered and painted with acrylic emulsion	RCC ceiling plastered and painted with

Sl. No.	Building/Area	Floor/Skirting/Dado	Wall	Ceiling
	building and other buildings.	concrete under bed.	paint Over POP	acrylic emul-sion over POP.
6.	Control room and other areas where false floors are required.	False floor min. 600 high from base slab removable type over 35 mm thick 600x600 fire resistant ply wood with aluminium sheet backing top finished with 2mm thick PVC topping. Whole system shall be mounted on detachable steel pedestal and grid system.	Plastered and painted with acrylic emulsion paint Over POP	False ceiling with gypsum board and painted with acrylic emulsion paint.
7.	All air conditioned areas other than control room where false floor not reqd., MCC room, office areas conference room shift in charge room, Engineers' room and other similar areas	10 mm thick 600x600 vitrified tiles over 1:3 mortar and concrete under bed as required.	Plastered and painted with acrylic emulsion paint Over POP	False ceiling with gypsum board and painted with acrylic emulsion paint.
8.	Battery & battery Charger room and Acid prone similar areas.	Minimum 20 mm thick acid alkali resistant tiles set in and jointed in Silica based epoxy mortar. 1500 high Dado of similar tiles.	Chemical resistant paint over remaining wall surfaces.	Chemical resistant paint.
9.	Toilet, pantry and other similar wet areas,	Mat finish coloured designed ceramic tiles in 1: 3 cement sand mortar tile size 300x300x7.2 mm. Glazed coloured designed ceramic wall tiles dado 300x200x6mm thick up to 2250 height.	Plastered and painted with acrylic emulsion paint over POP	Plastered and painted with acrylic emulsion paint over POP
10.	All sunken floor in toilets	Sub floor painted with EMUFAL T.E of TEXSA or eqv. & one layer of Water proof 1.5 mm thick self adhesive water proof membrane of TEXSA or Eqv. Including 50 mm thick PCC 1:2:4 protection layer (Treatment similar to roof water proofing)	Side walls of sunken floor similar to floor treatment.	-
11	Floors and RCC stair in areas prone to slippage	Antiskid finish with neat cement with chequered finish	-	-

Skirting in all floors shall be 150 mm high and shall be of similar material. 2 mm thick POP (Plaster of paris) finish shall be provided where Acrylic Emulsion paint indicated.

All internal metal components, doors both wooden and steel shall be painted with two coats of synthetic enamel paint over a coat of zinc chromate primer.

Fire door shall be painted with Post office red shade.

False flooring area shall be provided with Sunken slab to get floor finish same as adjacent floor. Sunken floor below false floor shall be given two coats of synthetic enamel paint over one coat primer.

3.18.01 During execution of the contract, the contractor shall take approval from the owner of all building materials and finish items (e.g. various tiles, doors, and windows, paints etc.) to be used for the contract by submitting samples and/or product literature as appropriate.

4.00.00 **WORKMANSHIP**

Workmanship for architectural works shall be of the best possible quality and all work shall be carried out by skilled workmen except for those which normally required unskilled persons. Welding shall be done by experienced and certified welders in proper sequence using necessary jigs and fixtures. In addition to the requirement specified above, if the bylaws of the local Govt., Municipal or other authorities require the employment of licensed or registered workmen for various trades, the Contractor shall arrange to have the work done by such registered or licensed personnel. In case of manufactured materials, the Contractor shall have, with no additional cost to the Owner, the services of the representative of the manufacturers to ensure that the work is being done according to the manufacturer's specifications and details.

5.00.00 **DOCUMENT SUBMISSION**

Design and Construction documents including architectural drawings & finish schedule pertaining to all Architectural work shall be required to be submitted to Owner/Owner's Consultant for their approval. Approval of these documents by the Owner/Consultant shall not relieve the Contractor of his responsibility for any errors and fulfillment of Contract requirements.

5.01.00 **As Built Drawings**

"As-built" drawings shall be prepared by the Contractor after completion of construction/erection incorporating all the changes, if any, done on Engineer's instruction/approval. The number of prints and film based reproducible transparency to be submitted for Design, Construction documents and As-Built drawings mentioned elsewhere in the specification, stipulations made in Section G-0 shall prevail.

6.00.00 **CODES AND STANDARDS**

Following is a general list of Codes and Standards to be used in the design of the Plant. Specifically applicable codes and standards shall be identified in System Design Descriptions/Technical Specifications as appropriate. The latest editions/revision of following codes and standards alongwith addendums/ amendments, if any, shall be followed.

6.01.00 **General**

- a) Internationally accepted design Codes and Standards which are equivalent or more stringent than corresponding Indian Standards.
- b) National Building Codes of India.
- c) "Accepted Standards" and "Good Practice" listed in the appendix to National Building Code of India.
- d) IS-1200 : Method of measurement of Building and Civil Engineering Works.
- e) IS-1256 : Code of Practice for Building Bylaws.

6.01.01 **Masonry**

- a) IS-712 : Building limes.
- b) IS-1077 : Common Burnt Clay Building Bricks.
- c) IS-1127 : Recommendations for dimensions and workmanship of natural building stones for masonry work.
- d) IS-1528 : Methods of sampling and physical tests for refractory materials.
- e) IS-1597 : Code of practice for construction of stone masonry (all parts).
- f) IS-2212 : Code of practice for brickwork.
- g) IS-2116 : Sand for masonry mortars.
- h) IS-2185 : Concrete masonry units. (all parts - Hollow and Solid concrete blocks).
- i) IS-2250 : Code of practice for preparation and use of masonry mortars.
- j) IS-2572 : Code of practice for construction of hollow concrete block masonry.
- k) IS-2691 : Burnt clay facing bricks.

- l) IS-3414 : Code of practice for design and installation of joints in buildings.
- m) IS-3495 : Methods of tests of burnt clay building bricks.
- n) IS-4441 : Code of practice for use of Silicate type chemical resistant mortars.
- o) IS-4860 : Acid Resistant Bricks.

6.01.02 **Doors, Windows and Ventilators**

- a) IS-399 : Classification of commercial timbers and their zonal distribution.
- b) IS-883 : Code of practice for design of structural timber in building.
- c) IS-1003 : Timber panelled and glazed shutters (all parts).
- d) IS-1038 : Steel doors, windows and ventilators.
- e) IS-1081 : Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators.
- f) IS-1361 : Steel windows for industrial buildings.
- g) IS-2835 : Transparent sheet glass for glazing and framing purposes.
- h) IS-1948 : Aluminium doors windows and ventilators.
- i) IS-1949 : Aluminium windows for industrial building.
- j) IS-2191 : Wooden flush door shutters (Cellular and hollow core type).
- k) IS-2202 : Wooden flush door shutters solid core type).
- l) IS-3103 : Code of practice for Industrial ventilation.
- m) IS-3548 : Code of practice for glazing in buildings.
- n) IS-3614 : Fire check doors.
- o) IS-4021 : Timber door, windows and ventilator frames.
- p) IS-4351 : Steel door frames.
- q) IS-6248 : Metal rolling shutters and rolling grills.

6.01.03

Roof and Flooring

- a) IS-2204 : Code of practice for construction of reinforced concrete shell roof.
- b) IS-3201 : Criteria for the design and construction of precast concrete trusses.
- c) IS-2210 : Criteria for Design of R.C. shell structures and folded plates.
- d) IS-809 : Rubber flooring materials for general purposes.
- e) IS-1195 : Bitumen mastic for flooring.
- f) IS-1196 : Code of practice for laying bitumen mastic flooring.
- g) IS-1198 : Code of practice for laying, fixing and maintenance of linoleum floors.
- h) IS-1237 : Cement concrete flooring tiles.
- i) IS-1443 : Code of practice for laying and finishing of cement concrete flooring tiles.
- j) IS-2114 : Code of practice for laying in situ terrazzo floor finish.
- k) IS-2571 : Code of practice for laying in situ cement concrete flooring.
- l) IS-5491 : Code of practice for laying in situ granolithic concrete floor topping.
- m) IS-5766 : Code of practice for laying burnt clay brick flooring.
- n) IS-1197 : Code of practice for laying of rubber floors.
- o) IS-2441 : Code of practice for fixing ceiling coverings.

6.01.04

Waterproofing

- a) IS-1322 : Bitumen felts for waterproofing and damp proofing.
- b) IS-1346 : Code of practice for waterproofing of roofs with bitumen felts.
- c) IS-1609 : Code of practice for laying damp proof treatment using bituminous felts.

- d) IS-3036 : Code of practice for laying lime concrete for a waterproofed roof finish.
- e) IS-3037 : Bitumen mastic for use in waterproofing of roofs.
- f) IS-3067 : Code of practice for general design, details and preparatory work for damp proofing and water proofing of buildings.
- g) IS-3384 : Bitumen primer for use in water proofing and damp proofing.
- h) IS-4365 : Code of practice for application of bitumen mastic for waterproofing of roofs.

6.01.05 **Water Supply, Drainage and Sewerage**

- a) IS-404 : Lead pipes.
- b) IS-458 : Concrete pipes.
- c) IS-651 : Salt glazed stoneware pipes and fittings.
- d) IS-771 : Glazed fire-clay sanitary appliances (all parts).
- e) IS-774 : Flushing cisterns for water closets and urinals other than plastic cisterns.
- f) IS-783 : Code of practice for laying of concrete pipes.
- g) IS-1172 : Code of basic requirements for water supply, drainage and sanitation.
- h) IS-1626 : Asbestos cement building pipes, gutters and fittings (all parts).
- i) IS-1742 : Code of practice for building drainage.
- j) IS-2064 : Code of practice for selection, installation and maintenance of sanitary appliances.
- k) IS-2065 : Code of practice for water supply in buildings.
- l) IS-2470 : Code of practice for installation of septic tanks (all parts).
- m) IS-3114 : Code of practice for laying of Cast Iron pipes.
- n) IS-4127 : Code of practice for laying of glazed stoneware pipes.
- o) IS-12251 : Code of practice for Drainage of Building Basement.

- p) IS-1200 : Method of measurement : Laying of [Part XVI] water and sewer lines including appurtenant items.
- q) IS-1536 : Centrifugally cast (spun) iron pressure pipes for water, gas and sewage.
- r) IS-1537 : Vertically cast iron pressure pipe for water, gas and sewage.
- s) IS-3486 : Cast iron spigot and socket drain pipes.
- t) IS-5329 : Code of practice for sanitary pipe work above ground for buildings.
- u) IS-3076 : Low density polyethylene pipes for potable water supplies.
- v) IS-1230 : Cast iron fittings for pressure pipes for water, gas and sewage.
- w) IS-1230 : Cast iron rainwater pipes and fittings.
- x) IS-1729 : Sand cast iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.
- y) IS-784 : Prestressed concrete pipes.
- z) IS-1726 : Cast iron manhole covers and frames.
- aa) IS-5961 : Cast iron grating for drainage purposes.
- bb) IS-5219 : "P" and "S" traps.
[Part-I]
- cc) IS-772 : General requirements for enamelled cast iron sanitary appliances.
- dd) IS-775 : Cast iron brackets and supports for wash basins and sinks.
- ee) IS-777 : Glazed earthenware wall tiles.
- ff) IS-2548 : Plastic water closet seats and covers (all parts).
- gg) IS-2527 : Code of practice for fixing rainwater gutters and downpipes for roof drainage.

6.01.06 **Painting**

- a) IS-348 : Specification for French Polish.

- b) IS-427 : Specification for Distemper, dry colour as required.
- c) IS-428 : Specification for Distemper, oil emulsion, colour as required.
- d) IS-1477 : Code of practice for painting of ferrous metal in buildings.
- e) IS-2328 : Code of practice for finishing of [I & II]wood and wood based materials.
- f) IS-2339 : Specification for Aluminium Paints for general purposes in dual containers.
- g) IS-2395 : Code of practice for painting concrete, masonry and plaster surface.
- h) IS-2932 : Specification for enamel, synthetic, exterior:
 - i) Undercoating
 - ii) Finishing
- i) IS-2933 : Specification for enamel, exterior :
 - i) Undercoating
 - ii) Finishing
- j) IS-5410 : Specification for cement paint.

Any other code which is not indicated above but may be required in course of design, construction, and review shall also be referred.

7.00.00 **BRIEF SPECIFICATION OF ARCHITECTURAL WORK**

- 7.01.00 Antitermite Treatment : Antitermite treatment with chlorypyriphos emulsifiable concentrate 20% with 1% concentration.
- 7.02.00 Brick work - : 230 mm thick brick wall with 1:6 Cement : Sand mortar. Class designation of brick shall be of best quality available in the locality.
- 7.02.01 Half brick thick walls for toilets' internal walls : 1:4 Cement & Sand Mortar with H.B. wire netting at every 3rd course.
- 7.03.00 Damp proof course : 50 mm thick 1:1.5:3 concrete with a minimum of 2% admixture of water proofing compound and shall be provided at plinth level. Plinth level of all buildings shall be minimum 500 mm above finished grade level or as approved.

7.04.00	Plaster :	
7.04.01	Internal	: 12 mm thick 1:6 Cement Sand plaster. 15 mm thick 1:6 cement sand plaster for rough side of half brick thick wall.
7.04.02	External	: 18 mm thick cement sand plaster to be laid in two layers. Bottom layer with 1:5 cement sand mortar with coarse sand and top layer 6mm thick with 1:6 cement sand mortar with fine sand. 18 mm thick external plaster with richer mix cement sand plaster shall be provided where specially required as per manufacturer's specification for any special decorative finish.
7.04.03	Ceiling	: 6 mm thick 1:4 Ceiling plaster over concrete surfaces except in cable vault area.
	Punning over plaster	: 2 mm thick plaster of paris punning over plaster areas punning to be provided over plaster for all airconditioned room, entrance and lobbie and as indicated in finish schedule.
7.05.00	Cladding forGT, S.T. & control building	a) Exterior walls shall be of 230mm thick brick wall upto 3000 mm height from finish floor level or height as per statutory code or TAC rule for particular equipment particularly in trans-former yard. Other three sides unless required by any specific rule or codes height of Brick wall shall be upto 3000 height from finished floor level. The upper part of the external wall above brick wall single sheet metal cladding (profiled) shall be provided. Metal cladding shall be permanently precoated with Fluro polymer (PVF-2) over zinc aluminium high tensile (550MPA) steel profiled sheet of minimum 0.55 mm TCT thick (total coated thickness)
7.06.00	Filler wall	: a) 150 high curb of half brick thick shall be provided between edge of floor slab and initial cladding. curb wall if required shall be provided up to window sill. b) control room, control equipment room and other rooms in this operating floor, shall be provided with half brick thick curb wall up to window sill. Remaining surfaces up to false

ceiling/structural slab shall be provided with Double layer 12.5 mm thick Gypsum board over Gyp steel channel, if functionally or aesthetically required. In toilet brick wall shall be up to 2250 height. Battery room, battery charger room shall have brick wall up to dado height.

7.07.00 Doors & Windows

7.07.01 Doors

- : a) Doors shall be steel doors consisting of double plated hollow flush door shutters with pressed steel door frame and shall be provided for plant and utility areas. Doors shall be minimum 1200 wide and 2100mm height.
- b) Large door in monorail location shall be specially fabricated and provided where required.
- c) Fire proof doors shall be provided on division walls of cable spreader rooms and at all fire exit points as per recommendation of Tariff Advisory Committee. These shall be as per IS:3614. Fire resistance grade of the doors shall be as per TAC requirements. However, min. fire resistance grade shall be for 2 (two) hours.
- d) Doors of control room, control equipment room, computer room, and other important rooms and entrance doors. shall be aluminium glazed doors. Doors shall be of double swing type with floor spring. For control room, control equipment room, etc. glazed wall panels with aluminium frame shall be provided between air-conditioned and non-air-conditioned areas and on the side of control room facing the operating floor to have a clear view. Glazed panel with aluminium frame work shall be provided as partition between two air-conditioned areas where clear view is necessary. All aluminium frame shall be 15 mic. thick anodizing coating. Main entrance door to control room and control equipment room shall be with air locked lobby.
- e) Internal Doors of W.C. and showers

- shall be wooden flash door with sal wood frame. Refer CL-3.10.00.
- 7.07.02 Windows
- a) All windows and ventilators shall be aluminium casement glazed windows and ventilators. Aluminium sections shall be of INDAL 40 series of 15 micron thk. anodizing coating.
 - b) Fixed M.S. grill shall be provided in all windows in MCC room in ground floor.
 - c) P.S. louvre shall be provided as per requirement of HVAC.
- 7.07.03 Rolling shutters : Rolling shutters with suitable operating arrangement (manual, mechanical and/or electric) according to size shall be provided in buildings to facilitate handling & transportation of equipment.
- 7.07.04 Glazing and glazed partition :
 - a) Thickness of glazing shall be 4mm to 6 mm thick clear float glass according to panel size shall be provided in all windows which are within 2500 height from finish floor level. All other fixed windows at upper level shall be provide with 6 mm thick clear wired glass.
 - b) All external windows in control room at operating floor shall be double glazed hermetically sealed with 12mm gap. Both glass shall be 6mm thick clear toughened float glass.
 - c) FIXED glazed window between A/C and non A/C area shall be double glazed aluminium case-ment windows. With 6 mm thick clear float toughened glass.
 - d) Glazing in control room between two AC areas shall be with single glazed wall panels with 6 mm thick toughened clear glass with aluminium frame.
 - e) 4 mm thick ground glass shall be provided for toilets.
 - f) 6.0 mm thick float glass shall be provided for doors. For control room door clear float toughened glass 6.0 mm thick shall be provided.
- 7.07.05 False Ceiling for air- : a) Control room and other air-

	conditioned areas	<p>conditioned areas shall have gypsum board ceiling (snap grid system) suspended from steel members or RCC slab/beam with anchor fastener by concealed suspending system as per manufacturer's detail. Filler vertical panel with double layer gyp board shall be provided to hide the metal cladding member of control room and its allied areas. Profile of control room interior shall be as indicated in the attached schematic drawing attached to this document.</p> <p>b) Suitable MS channel grid walk-way shall be provided over false ceiling for maintenance purpose. The minimum channel section shall be ISMC 75 at a spacing 1.5m c/c (max.) both ways.</p> <p>c) Resin Bonded glass wool insulation minimum 25 mm thick in aluminium foil backing shall be provided over false ceiling for thermal and acoustical insulation. The density of glass wool shall be 32 kg/cu.m (minimum) and shall conform to IS 8183. Maximum value shall be 1.0 W/sq.m/deg.C</p> <p>d) Underdeck insulation as per HVAC requirement minimum 50 mm thick bonded mineral wool blankets with suitable protecting membrane like aluminium sheet/ foils shall be provided.</p>
7.07.06	Floor finish	<p>a) Floor finish shall be in general 50mm thick and generally finish will be heavy duty concrete floor with metallic hardener with suitable aluminium strip divider. For floor finish details refer finish schedule CL no- 3.18.00</p>
7.07.07	Roof	<p>: All roofs shall be provided with water proofing treatment as indicated in CL no-3.05.00.</p> <p>The slope shall be 1:100 for quick disposal of rainwater. Grading under bed 1:2:4 & 1:3 cement sand plaster shall be provided where structural slopes are not provided. 1:3 plaster at end slope shall only be provided if required at end slope.</p> <p>The contractor shall give guarantee in writing for all work executed under this specification</p>

supplemented by a separate and unilateral guarantee from the specified agency for the roof water proofing treatment work. The guarantee shall be for materials and workmanship for twenty (20) years. The mode of execution of the guarantee shall have to be acceptable to the owner.

In general Cast iron rain water down comers conforming to IS:1230 with water tight lead joints and medium class galvanized mild steel pipes conforming to IS:1239/IS:3589 shall be provided particularly to drain off rain water from the roof. The numbers and size of down comers shall be governed by IS:1742 & IS:2527. Galvanized rain water down comer shall only be provided in ST Control Building.

- | | | | |
|---------|----------|---|---|
| 7.07.08 | Painting | : | <ul style="list-style-type: none"> a) External masonry surfaces of all buildings shall have water proof cement paint except in S.T. GT Bldg. and Electrical control building external masonry surfaces of these buildings shall be finished with min. 2 coats of exterior grade acrylic emulsion paint. b) Internal surfaces shall be finished as per finish schedule CL no 3.18.00. c) Oil resistant paint shall be pro-vided in oil equipment room, oil canal, fuel oil pump house, etc. d) Fire-proof putty in cable penetration on walls of cable spreader rooms shall be provided. |
| 7.07.09 | Stairs | : | <ul style="list-style-type: none"> a) All RCC stairs shall have not more than fourteen (14) risers in one flight. Height of risers and width of treads shall be 150 mm (max) and 300 mm respectively. Minimum width of stairs shall be 1500 mm for RCC Main stair-case. For other emergency/fire escape staircase maximum steps in each flight shall be 13 nos. Tread 250mm and riser 180 max width of staircase 1200 clear. b) Aluminium angle nosing shall be provide for edge protection of RCC stairs. c) Hand railing minimum 1.0 meter high shall be provided around all floor/roof |

openings, projections / balconies, walkways platforms and steel stairs. All hand rail shall be 32mm nominal bore MS pipe (medium class) and shall be galvanized as per relevant IS code and shall not be less than 450g/m². All rungs for ladder shall be min. 16 dia. and galvanized with 650gm/ zinc/sq.m.

- d) For all RCC stairs 20 mm square MS bar balustrades with 30x6 mm thick MS flats and aluminium handrail of INDAL SECTION NO. 5116 shall be provided and fixed to MS flat.

7.07.10 Draining out water from : For all buildings, suitable arrangement for floors floors draining out water collected from equipment, blow down, leakages, floor washings, fire fighting etc. shall be provided for each floor, complete up to station sewers.

8.00.00 **WORK**

8.01.00 **Fencing**

Minimum 3.0 metre high fencing above toe wall shall be provided around switch yard, transformer yard, building transformer area, and other areas where fencing is necessary due to statutory requirements. Fencing shall comprise 2.4 metre high PVC coated galvanized chain link fencing of minimum 12 gauge (including PVC coating) of mesh size 75 mm and galvanized concertina for switchyard/transformer yard.

Galvanized barbed wires of a height of 0.6 metre shall be provided above the chain link fence. The diameter of steel wire for chain link fencing excluding PVC coating shall not be less than 12 gauge. Steel entry gate shall be provided for all fenced areas. Top of toe wall shall be minimum 200 mm above the formation level.

The fence around switchyard area shall comprise of 12 gauge G.I. PVC coated chain link fencing of mesh size 75 mm to a height of 2.4 m above the toe wall with a 600 mm high galvanized concertina at the top such that total fence height of 3.0 m above toe wall level is achieved. Toe wall shall be minimum 200 mm above the formation level.

The chain link will be stretched and attached by 'C' clips at 0.5 m intervals to 3 strands of high tensile spring steel wire (HTSSW) of 12 gauge interwoven in chain link wire mesh and kept under tension which in turn are attached to the fence post with security nuts and bolts. On every fourth post a clamping strip will be threaded through the links of chain link and bolted to the fence post with the help of security nuts and bolts.

Above the chain link a 600 mm high Tensile Serrated Wire (HTSW) galvanised

Concertina will be stretched to 6 m and attached to 2 strands HTSS wire by means of 'C' clips at 1 m intervals. The 2 HTSS wire strands will be attached to angle iron posts with 1/2" security fasteners.

All fence posts shall be 65 x 65 x 6 MS angles spaced at 2.5 m C/C distance. All straining posts i.e., end posts shall be 65 x 65 x 6 MS angles. All corner posts will have two stay posts and every tenth post will have a transverse stay post. Suitable concrete foundations for the angle iron posts and stays shall be provided based on the prevailing soil conditions. Toe walls either of brick masonry with bricks of minimum 50 kg/cm² compressive strength shall be provided between the fence posts all along the run of the fence with suitable foundation. Toe wall shall be minimum 200 mm above the switchyard grade formation level with PCC coping (1:2:4). All gates shall be of hot dipped galvanized structural steel as per specification.

All structural steel work for the fencing shall be painted with synthetic enamel paint over a suitable primer.

8.02.00 Galvanising

Steel works specifically require galvanization for corrosion protection shall be provided with hot dip galvanized after fabrication in accordance with relevant Indian Standard Codes.

Zinc required for galvanising will have to be arranged for by the Contractor. Purity of zinc to used for galvanising shall be 99.5% as per IS:209.

The weight of the zinc coating shall be at least 0.615 kg/sq.m unless noted otherwise. Stub members, anchor bolts shall be having heavier zinc coating not less than 0.80 kg/m².

Fasteners, bolts, washers etc. shall have zinc coating as per relevant IS Code.

9.00.00 WATER SUPPLY AND SANITARY WORK

- 9.01.00 Water Supply and Sanitary : a) Roof water tank of adequate capacity depending on the number of users for 8 hours storage shall be provided for each building.
- b) Galvanised MS pipe of medium class shall be used for internal piping work for potable water supply.
- c) Heavy cast iron pipes with lead joints shall be used for sanitary work below ground.
- d) Sand cast iron pipes with lead joints shall be used for sanitary work above ground level.
- e) 100 mm thick plinth protection with plain cement concrete 1:2:4 with top

smooth finish over an under bed of 75 mm thick (nominal) over 40 mm (nominal) dry brick ballast well compacted & grouted with sand.

- f) Brick/RCC surface drain shall be provided all around the building with slope 1:250 to 300 and connected to area drain. 40 thk. M.S. gratings/RCC slab shall be provided over surface drain at the location of entry, vehicular crossing etc. Size of drain shall be as per quantity of rain water to be disposed off and shall not be less than 300 wide x 300 depth.

9.02.00 Toilets

Minimum one toilet shall be provided in each building. The no. of WC, wash hand basin, urinals etc. shall be as per the no. of users. Toilet blocks in control room building shall have arrangement for both Gents & Ladies toilet.

For toilet block with two or more W.C.S at least one toilet shall be of Indian type.

For multilevel toilet block & toilet in upper floor ventilation shaft/pipe duct shall be provided. An eye & face fountain conforming to IS-10592 shall be provided in battery room.

Each toilet shall contain following minimum fittings :

- Raised type 1 No. W.C. (Western pattern)
- Squatting type W.C. 1 No. (Incase of two or more WCS) (Orissa type)
- Urinals 2 Nos. (430x280x350)
- Wash Basin 2 Nos. (550x440)
- Shower 1 No. for chlorination building.
- Bathroom mirror 2 Nos. (600x450x5.5MM)
- Glass Shelves 2 Nos. (610mm x 127 mm x 6mm thk.)
- Towel rail 1 No. 600x20mm dia. CP Brass
- Liquid Soap Holder (stainless steel) 1 No.

- Toilet paper holder 1 No.
- Janitor 1 No.
- Water cooler 1 No.
- Septic tank including all accessories and laying of 150 mm or as per required dia. heavy cast iron soil lines.
- Effluent shall be treated through up flow filter system from septic tank and will pass through chlorination chamber before disposal to nearest area drain.

10.00.00 **RULES AND BYE LAWS**

- 10.01.00 Statutory rules :
- a) Vendor shall comply with all applicable statutory rules pertaining to Factories Act as applicable for Assam, Rules of Tariff Advisory Committee (TAC), Water Act for pollution control, Building by laws, Factory rules etc.
 - b) Provision of safety, health and welfare according to Factories Act shall be complied with. These shall include provision of continuous walkway, minimum 600 mm wide, along the crane girder at crane girder level on both sides, comfortable approach to EOT crane cabin, fire escape, locker room for workmen, pantry, toilets, rest rooms etc.
 - c) Provision for fire proof doors, number of staircases, fire separation walls, encasing of structural members (in fire prone areas) etc. shall be made according to the recommendation of Tariff Advisory Committee.

SPECIFICATION NO. A-1

FOR

MASONRY AND ALLIED WORKS

**SPECIFICATION NO. A-1
FOR
MASONRY AND ALLIED WORKS**

C O N T E N T S

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**SPECIFICATION NO. A-1
FOR
MASONRY AND ALLIED WORKS**

1.00.00 SCOPE

This section covers furnishing, proper storage & handling of common building materials unless otherwise mentioned in this section, installation, repairing, finishing, curing, protection, maintenance and handing over of masonry and allied works for use in structures and locations covered under the scope of this package.

2.00.00 MATERIALS

a) Brick

Bricks for general masonry work shall be of highest class designation available in the locality as approved by the Engineer as per standard specification under IS:1077, well burnt, of uniform size, shape and colour, free from cracks, flaws or modules of free lime and emit clear ringing sound when struck. Fractured surface shall show uniform texture free from grits, lumps holes etc. Water absorption after 24 hours immersion shall not exceed 20% by weight for bricks. Dimensional tolerance shall not exceed 8% of the size shown in drawings for bricks. All bricks shall have rectangular faces and sharp straight edges. The bricks shall show no efflorescence after soaking in water and drying in shade.

Each brick shall have the manufacturer's identification marks clearly marked on the frog. Representative samples shall be submitted and approved samples shall be retained by the Engineer for further comparisons and reference. Any brick not found upto the specification shall be removed immediately from site at the Contractor's own cost.

Bricks shall not be dumped at site. They shall be stacked in regular tiers, even as they are unloaded; to minimise breakage and defacement of bricks. Bricks selected for different situation of use in the work shall be stacked separately.

b) Stone

All stones shall be obtained from approved quarries, hard, tough, durable compact grained, uniform in texture and colour and free from decay, flaws, veins, cracks and sand holes. The surface of a freshly broken stone shall be bright, clean and sharp and shall show uniformity of texture, without loose grains and free from any dull, chalky or earthy appearance. Stone showing mottled colours shall not be used for face work. A stone shall not absorb more than 5 per cent of its weight of water after 24 hours immersion. The type of stone shall be as specified on drawings and/or instructed by the Engineer. Samples shall be submitted by the Contractor and approved samples shall be retained by the Engineer for comparison of bulk supply.

c) **Lime**

Lime shall be stone lime and conform to the specification of Building Limes - IS:712. Lime putty may be prepared from hydrated lime or quick lime. Hydrated lime shall be mixed with water to form a putty and stored with reasonable care to prevent evaporation for at least 24 hours before use. Quick lime shall be shaken with enough water to make a cream, passed through a No. 0 Sieve and then stored with reasonable care to prevent evaporation for at least 7 days before use.

d) **Cement**

Cement used shall be ordinarily Portland Cement or Portland Slag Cement or Portland Pozzolana Cement conforming to IS Codes and shall be fresh when delivered. In special cases, Rapid Hardening Portland Cement, Low Heat Cement etc. may be permitted or directed to be used by the Engineer. The Contractor shall submit the manufacturer's certificate for each consignment of cement procured to the Engineer. If at any time, the Engineer feels that the cement being used by the Contractor is not upto specification, he may stop the work and send the samples of the cement to a testing laboratory for standard tests and all expenses incurred thus shall be borne by the Contractor. The Contractor shall also have no claim for this type of suspension of work.

The cement shall be stored above the ground level in perfectly dry and watertight sheds. The bags shall be stacked in a manner so as to facilitate removal on first in first out basis. Any material considered defective by the Engineer shall not be used by the Contractor and shall be removed from the site immediately.

e) **Coarse Aggregates**

Coarse aggregates shall be as per IS:383 latest editions, consisting of hard, strong and durable pieces of crushed stone and shall be free from organic or clay coatings and other impurities like disintegrated stones, soft flaky particles etc. and any other material liable to affect the strength, durability or appearance of concrete.

Aggregates other than crushed stone conforming to the provisions of specification may be used if permitted by the Engineer.

Washing of aggregates by approved means shall be carried out, if desired by the Engineer.

Grading of coarse aggregates shall generally conform to IS:383 and shall be such as to produce a dense concrete of the specified proportions and strength and of consistency that will work readily into position without segregation.

Aggregates shall be stored on brick soling or an equivalent platform so that they do not come in contact with dirt, clay, grass or any other injurious substances at any stage.

Aggregate of different size shall be kept in separate stacks. If so desired by the Engineer aggregate from different sources shall be stacked separately with proper care to prevent intermixing.

f) **Sand**

Sand shall be hard, durable, clean and free from adherent coatings or organic matter and shall not contain clay balls or pellets. The sand shall be free from impurities such as iron pyrites, alkalis, salts, coal, mica, shale or other laminated materials in such forms or quantities as to affect adversely the hardening, strength, durability or appearance of mortar, plaster or concrete or to cause corrosion to any metal in contact with such mortar, plaster or concrete. All sand shall be properly graded and shall be as per relevant IS Code. Sand for concrete shall conform to IS:383.

g) **Water**

Water shall be clean, fresh and free from organic matters, acids or soluble salts and other deleterious substances which may cause corrosion, discoloration, efflorescence etc.

h) **Reinforcement**

Reinforcement steel shall be clean and free from loose mill scales, dust, loose rust, oil and grease or other coatings which may impair proper bond. Structural steel shall conform to IS:2062. Mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement shall conform to IS:432. Cold twisted steel bars shall conform to IS:1786. Hand drawn steel wire fabric shall conform to IS:1566. Hexagonal wire netting shall conform to IS:3150. All steel bars including and above 10 mm diameter shall be of tested quality. All wire netting shall be galvanised.

Reinforcement bars shall be stored off the ground and under cover if so desired by the Engineer. If necessary, a coat of cement wash shall be given to the bars to guard against rusting.

3.00.00 **INSTALLATION**

3.01.00 **Soling**

3.01.01 **Brick Soling**

The ground shall be dressed, consolidated by ramming or by light rolling and a 12 mm thick cushion of sand laid. On the sand cushion the bricks shall be laid with fine joints and placed firmly in position by hammering with wooden mallet. The surface shall be free from undulations. The 'frog' side shall be on the underside. The joints shall be broken in all direction and bricks cut as required. Orientation shall be as desired by the Engineer. After laying of each layer of bricks sand shall be spread over and worked into the joints to pack the bricks tight.

3.01.02 **Stone Soling**

The stones for soling shall be selected on the basis of thickness of soling. The larger stones shall be laid and the gaps filled by smaller stones. The interstices shall then be firmly packed with sand by flooding with water.

3.02.00 **Brick Edging**

Excavation shall be done close to the brick dimensions and in perfect alignment. Bricks shall be firmly placed by hammering with wooden mallets and sides and joints packed firmly with earth so that the edging is not disturbed easily. Alignment and level shall be acceptable to the Engineer.

3.03.00 **Masonry**

3.03.01 **General**

All masonry work shall be true to lines and levels as shown on drawings. All masonry shall be tightly built against structural members and bonded with dowels, inserts etc. as shown on drawings.

3.03.02 **Mortar**

Mix for mortar shall be specified.

When lime is used hydrated lime shall be mixed with water to form a putty and stored with care to prevent evaporation for at least 24 hours before use. Quick lime shall be slaked with enough water to make a cream, passed through a No. 10 sieve and stored avoiding evaporation for seven days before use.

Lime putty and sand in proper proportion shall be mixed on a water-tight platform with necessary addition of water and thoroughly ground in a mortar mill. This mix shall be transferred to a mechanical mix, required quantity of cement added and the content mixed for at least 3 minutes. Mixtures of lime putty and sand may be stored avoiding drying out. For cement sand mortar cement and sand in requisite proportions shall be mixed dry in a mechanical mixer and then water added and mixed further. Minimum quantity of water shall be added to achieve working consistency.

Surplus mortar droppings from masonry, if received on surface free from dirt may be mixed with fresh mortar if permitted by the Engineer who may direct addition of additional cement without any extra payment. No mortar which has stood for more than half an hour shall be used.

3.03.03 **Brick Masonry**

Bricks shall be soaked by submergence in clean water for at least two hours in approved vats before use. Bricks shall be laid in English bond unless specified otherwise. Broken bricks shall not be used. Cut bricks shall be used if necessary to complete bond or as closers. Bricks shall be laid with frogs upwards over full mortar beds. Bricks shall be pressed into mortar and tapped into final position so as to embed fully in mortar. Inside faces shall be buttered with mortar

before the next bricks is placed and pressed against it. Thus all joints between bricks shall be fully filled with mortar.

Mortar joints shall be kept uniformly 10 mm thick. All joints on face shall be raked to minimum 10 mm depth using raking tool while the mortar is still green to provide bond for plaster or pointing.

Where plaster or pointing is not provided, the joints shall be struck flush and finished immediately. Brickworks two bricks thick or more shall have both faces in true plane. Brickwork of lesser thickness shall have one selected face in true plane.

3.03.04 **Exposed Brickwork**

Brickwork in superstructures which is not covered by plaster shall be as shown on drawing and executed by specially skilled mason. Courses shall be truly horizontal and vertical joints truly vertical. Wooden straight edges with brick course graduations and position of windowsills and lintels shall be used to control uniformity of brick courses. Masons must check workmanship frequently with plumb, spirit level, rule and string. All brickwork shall be cleaned at the end of days work. If face bricks are specified, the brickwork shall be in composite bricks, with face bricks on the exposed face and balance in routine bricks, but maintaining the bond fully. Where face bricks are not specified, bricks for the exposed face shall be specially selected from routine bricks. All exposed brickwork on completion of work shall be rubbed down, washed clean and pointed as specified. Where face bricks are used carborandum stone shall be used for rubbing down.

3.03.05 **Reinforced Brickworks**

Reinforcements shall be as specified. All reinforcements shall be thoroughly cleaned and fully embedded in mortar. Where M.S. bars are used as reinforcement, these shall be lapped with dowels if left in R.C. columns or welded to steel stanchions.

3.03.06 **Stone Masonry**

Stones shall be thoroughly soaked before laying. Stones shall be laid on their natural quarry beds. Individual stones shall be fitted with mallet and properly wedged to reduce thickness of mortar joints. Thickness of joint shall be not less than 8 mm and not greater than 25 mm. At least two stones shall run the full width of the wall for every square meter of surface area.

3.03.07 **Exposed Stonework**

Stonework which is to be kept exposed shall be as shown on approved drawing. It shall be executed by specially skilled mason. Stones used for exposed face shall be specially selected. All exposed stone faces shall be kept clean and free from mortar and pointed up neatly as the work proceeds in a manner called for in the drawings or instructions. A sample wall, 10 sq.m. in area shall be built and approved by the Engineer and all works shall match with this sample.

3.03.08 **Composite Masonry**

Where stonework facing with brick masonry backing is specified the bond between them shall be achieved by bond stones of dimensions and frequency as desired by the Engineer.

3.03.09 Expansion & Separation Joints

Location of joints shall strictly be as shown on drawings or as instructed by the Engineer. Expansion joints shall be as shown on drawings and specified. Expansion joint filler boards and sealing strips shall have minimum transverse joints. Transverse joints shall meet the approval of the Engineer.

Separation joints shall be with standard waterproof paper or with alkathene sheets about 1 mm in thickness. Length and sealing of laps shall be to the satisfaction of the Engineer.

3.03.10 Mouldings, Cornices, Drip Course

These shall be made as shown in drawings. Bricks or stone shall be cut and dressed as required. If no subsequent finish is envisaged, these shall be rubbed to correct profile with Carborundum stone.

3.03.11 Curing

Masonry shall be cured by keeping it wet for seven days from the date of laying. In dry weather at the end of days work top surface of masonry shall be kept wet by ponding.

3.03.12 Embedding of fixtures

All fixtures shall generally be embedded in mortar and masonry units shall be cut as required.

3.03.13 Encasing of Structural Steel

This shall be done by building masonry work round flanges, webs etc. and filling the gap between steel and masonry by minimum 12 mm thick mortar. Encased members shall be wrapped with chicken wire mesh when shown on drawings or instructed by the Engineer. The minimum lap in chicken wire mesh shall be 50 mm.

3.04.00 Damp Proof Course

Unless otherwise specified Damp-proof course shall be 50 mm thick "artificial stone" in proportion 1:1-1/2:3 cement sand stone-chips (10 mm down) with admixture of a waterproofing compound as approved by the Engineer. The percentage of admixture shall be as per manufacturer's specifications but not less than 2% by weight of cement. The top surface shall be double chequered and cured by ponding for seven days.

3.05.00 **Damp Proof Membrane**

Damp proof treatment using fibre or hessian base bitumen felt shall be 6, 8 or 10 course treatment as specified in IS:1609. The number of courses shall be as shown in drawings or as specified. Sequence of work shall be as directed by the Engineer. Extreme care shall be taken to prevent damage to felt during and after laying. The Contractor shall be obliged, at his own expense, to rectify any leakage appearing within 5 years of installation by removing and renewing the coats at the point of leakage.

Where shown on drawing, damp proof membrane with one layer bitumen paper or one layer alkathene sheet shall be laid with minimum 150 mm lap under slabs on grade.

4.00.00 **I.S. CODES**

Some of the important relevant codes for this section are :

IS:1077	:	Specification for common burnt clay Building Bricks.
IS:1127	:	Recommendations for dimensions and workman-ship of natural building stones for masonry work.
IS:1597	:	Code of Practice for Construction of stone Masonry.
IS:1609	:	Code of Practice for laying Damp-proof treatment using bitumen felts.
IS:2212	:	Code of Practice for Brickwork.
IS:2250	:	Code of Practice for preparation and use of Masonry Mortar.
IS:5134	:	Bitumen Impregnated Paper & Board.

SPECIFICATION NO. A-2

FOR

FINISH TO MASONRY AND CONCRETE

**SPECIFICATION NO. A-2
FOR
FINISH TO MASONRY AND CONCRETE**

C O N T E N T

CLAUSE NO.	DESCRIPTION	PAGE NO.
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**SPECIFICATION NO. A-2
FOR
FINISH TO MASONRY AND CONCRETE**

1.00.00 SCOPE

This Section covers furnishing, installation, repairing, finishing, curing, testing, protection, maintenance till handing over of finishing items for masonry and concrete. This shall also include the work to be done to make the surface suitable for receiving the finishing treatment.

Before commencing finishing items the Contractor shall obtain the approval of the Engineer regarding the scheduling of work to minimise damage by other trades. He shall also undertake normal precaution to prevent damage or disfiguration to work of other trades or other installation.

2.00.00 INSTALLATION

2.01.00 Preparation of Surface

All joints in masonry walls shall be raked out to a depth of at least 10 mm with a hooked tool made for the purpose while the mortar is still green. Walls shall be brushed down with stiff wire brush to remove all loose dust from joints and thoroughly washed with water. All laitance shall be removed from concrete to be plastered.

For all types of flooring, skirting and dado work, the base cement concrete slab or masonry surface shall be roughened by chipping and cleaned of all dirt, grease or loose particles by hard brush and water. The surface shall be thoroughly moist to prevent absorption of water from the base course. Any excess of water shall be mopped up.

At any point, the level of base shall be lower than the theoretical finished floor level by the thickness of floor finish. Any chipping or filling to be done to bring the base in the required level shall be brought to the notice of the Engineer and his approval shall be taken regarding the method and extent of rectification work required.

Prior to commencement of actual finishing work, the approval of the Engineer shall be taken as to the acceptability of the base.

2.02.00 Plastering

2.02.01 Mortar

Mortar for plastering shall be as specified in the schedule of items.

For sand cement plaster, sand and cement in the specified proportion shall be mixed dry on a watertight platform and minimum water added to achieve working consistency.

For lime gauged plaster, lime putty or hydrated lime and sand in the required proportion shall be mixed on a watertight platform with necessary addition of water and thoroughly ground in mortar mill. This mix shall then be transferred to a mechanical mixer to which the required quantity of cement is added and mixed for at least 3 minutes.

No plaster which has stood for more than half an hour shall be used; plaster that shows tendency to become dry before this time, shall have water added to it.

2.02.02 **Application of Plaster**

Plaster, when more than 12 mm thick, shall be applied in two coats - a base coat followed by the finishing coat. Thickness of the base coat shall be sufficient to fill up all unevenness in the surface; no single coat, however, shall exceed 12 mm in thickness. The lower coat shall be thicker than the upper coat, the overall thickness of the coats shall not be less than the minimum thickness shown on the drawings. The undercoat shall be allowed to dry and shrink before applying the second coat of plaster. The undercoat shall be scratched or roughened before it is fully hardened to form a mechanical key. The method of application shall be 'thrown on' rather than 'applied by trowel'.

To ensure even thickness and true surface, patches of plaster about 100mm to 150mm square or wooden screed 75 mm wide and of the thickness of the plaster, shall be fixed vertically about 2000mm to 3000mm apart, to act as gauges. The finished wall surface shall be true to plumb, and the Contractor shall, without any extra cost to the Owner, make up any irregularity in the brickwork with plaster.

All vertical edges of brick pillars, doorjambs etc. shall be chamfered or rounded off as directed by the Engineer. All drips, grooves, mouldings and cornices as shown on drawing or instructed by the Engineer shall be done with special care to maintain true lines, levels and profiles. After the plastering work is completed, all debris shall be removed and the area left clean. Any plastering that is damaged shall be repaired and left in good condition at the completion of the job.

2.02.03 **Finish**

Generally, the standard finish shall be used unless otherwise directed by the engineer. Wherever any special treatment to the plastered surface is indicated, the work shall be done exactly as shown on the drawings, to the entire satisfaction of the engineer regarding the texture, colour and finish.

a) **Standard Finish**

Wherever punning is indicated, the interior plaster shall be finished rough. Otherwise the interior plaster shall generally be finished to a smooth surface. The exterior surface shall generally be finished with a wooden float.

b) **Neat Cement Finish**

Immediately after achieving a true plastered surface with the help of a wooden straight edge, the entire area shall be uniformly treated with a paste of neat cement at the rate of one (1) kg. per Sq.M. and rubbed smooth with a trowel.

c) **Coloured Plaster Finish**

This shall be done in the same way as specified in Clause 2.02.02 but using coloured cement in place of ordinary cement. When coloured plastering is specified in more than one coat, the top coat only shall be made with coloured cement.

Coloured cement shall be either ready mixed material or may be obtained by mixing pigments and cement at site, as approved by the Engineer. The pigments to be mixed with cement shall conform to Appendix-A of IS:2114 latest edition.

Samples of colouring material shall be submitted to the engineer for approval and material procured, shall conform in all respects to the approved samples, which shall remain with the Engineer. All coloured cement and/or pigments shall be stored in an approved manner in order to prevent deteriorations.

d) **Pebble-dash Finish**

Mortar of required thickness consisting of 1 part cement and 4 parts sand by volume shall be applied in the usual manner as described under plastering Clause 2.02.02. While the mortar is still plastic small pebbles or crushed stone of size generally from 10mm to 20mm as approved by the Engineer shall be thrown on the plastered surface. The aggregate shall be lightly tapped into the mortar with a wood float or the flat end of a trowel, in order to ensure satisfactory bond between the dashing and the mortar.

e) **Rough-Cast Finish**

A wet plastic mix of 3 parts coloured cement 6 parts sand and 4 parts aggregate by volume (gravel or crushed stone of size from 6 mm to 12 mm as approved by the Engineer) shall be thrown on to the wall by means of a plaster's trowel and left in the rough condition.

f) **Scraped Finish**

Ordinary plaster as described under Clause 2.02.02 after being levelled and allowed to stiffen for a few hours, shall be scraped with a steel straight edge to remove the surface skin. The pattern shall be as approved by the Engineer.

g) **Textured Finish**

Mortar consisting of 1 part cement and 3 parts sand by volume shall be applied in a manner as specified under "Plastering" Clause 2.02.02. Ornamental treatments in the form of horizontal or vertical rib texture, fan texture etc. shall be applied by means of suitable tools to the freshly applied plastered surface, as approved by the Engineer.

h) **Sand Faced Plaster**

The plaster shall be applied in 2 coats. The first coat or the scratch coat should be approximately 14mm and shall be continuously carried out without break to the full length of wall or natural breaking points such as doors, windows, etc. The scratch coat shall be dashed on the prepared surface with heavy pressure, brought to true and even surface and then lightly roughened by cross scratch lines, to provide bond for the finishing coat. The mortar proportion for this scratch coat shall be as specified in the respective item or work. The scratch coat shall be cured for at least 7 days & then allowed to dry. The second coat shall be 6mm thick and it shall not be applied until at least 10 days have elapsed after the application of scratch coat. Before application of the second coat, the scratch coat shall be evenly damped. This coat shall be applied from top to bottom in one operation & without joints, finish shall be straight, true & even. The mortar proportion of this coat shall be as specified under the respective item of work. White sand for finish shall be used for the second coat & for finishing work. Sand for finish shall be of even coarse size & shall be dashed on the surface & sponged.

2.02.04 **Curing**

All plastered surfaces after laying, shall be watered, for a minimum period of seven days, by an approved method, and shall be protected from excessive heat and sunlight by suitable approved means. Moistening shall commence, as soon as the plaster has hardened sufficiently and not susceptible to damage. Each individual coat of plaster shall be kept damp continuously, for at least two days, and then dried thoroughly, before applying the next coat.

2.03.00 **Pointing to Masonry**

All joints of brickwork shall be raked out to a depth of 10 mm with a hooked tool made for the purpose while the mortar is still green. The brickwork shall then be brushed down with a stiff wire brush, so as to remove all loose dust from the joints and thoroughly washed with water. Mortar consisting of 1 part cement and 3 parts clean, sharp, well graded sand by volume shall be pressed carefully into the joints and finished with suitable tools to shape as shown on the drawings. Any surplus mortar shall be scraped off the wall face leaving the surface clean.

The pointed surface shall be kept wet for at least three days for curing.

2.04.00 **Plaster with Metal Lath**

The supports, hangers, brackets, cleats etc. shall be as shown on drawings and/or as approved by the Engineer. These shall have a coat of prime paint before and another coat of approved paint after erection.

The metal lath shall be expanded metal, with 12mm x 38mm mesh, 16 BG thick and 3 mm wide strands. Side laps shall be minimum 12 mm and end laps 25 mm minimum. The plastering shall be minimum 20 mm thick measured from the back of lath and applied in two layers. The mortar for plastering shall consist of 1 part cement and 4 parts sand by volume mixed as specified in plastering, Clause 2.02.01. The application, finish etc. shall be as specified under relevant clause above. Where called for a 2 mm Plaster of Paris punning shall be applied over plaster as a finishing coat to give perfectly smooth and even finish.

2.05.00 **Lime Punning**

For plastered surfaces, where an even smooth surface is specified, lime punning with 5 parts of shell lime properly slaked, strained and aged, mixed with 1 part clean, washed, sieved, fine sand by volume shall be done. The thickness of lime punning shall be not less than 2mm and more than 3mm. The plastered surface shall be saturated with water before application of the lime punning. The punning shall be applied by skilled workman and given a smooth and even finish free from undulations, cracks etc. and to the satisfaction of the Engineer.

2.06.00 **Plaster of Paris Punning**

Plastered surfaces, where specified shall be finished with Plaster-of-Paris punning. The material shall be from approved manufacturers and approved by the Engineer. The thickness of the punning shall be 2 mm and shall be applied by skilled workmen. The finish shall be smooth, even and free from undulation, cracks etc.

Before bulk work is taken in hand, a sample of punning shall be done on roughly 10 Sq.M. area and approval of the Engineer taken. The work shall then be taken in hand as per approved sample.

2.07.00 **Stone Facing**

Stone facing where specified shall be done as shown on design drawings and approved shop drawings and/or Schedule of Items. The stone shall be as specified on drawings. Samples of stone shall be submitted to the Engineer for approval and then bulk purchase made. The Contractor shall submit three copies of shop drawing for the Engineer's approval before commencing the work.

The thickness of facing stone shall be not less than 25mm unless otherwise specified on drawings.

The stone slabs shall be cut and finished to sizes as per pattern shown on drawings. They shall be fastened to wall with suitable noncorrodable anchorage as approved by the Engineer. Where mild steel clamps, stays etc. are used for anchorage, they shall be galvanised (weight of zinc coating shall not be less than 700 gms per square meter of surface) to prevent rust stains developing on the finished surface. There shall be at least 12 mm gap between the stone and masonry, which shall be filled up and packed by a mortar of 1 part cement and 3 parts of sand by volume. After the mortar is set and cured for at least four days, the exposed surface shall be rubbed and polished as approved by the Engineer.

The completed surface shall be neat, or uniform texture and acceptable to the Engineer.

Where pointing is specified on drawings it shall be done by mortar as specified on drawings and/or Schedule of Items.

3.00.00 **ACCEPTANCE CRITERIA**

Finish to masonry and concrete shall fully comply with the Specifications, approved samples and instructions of the Engineer with respect to lines, levels, thickness, colour, texture, pattern and any other special criteria as mentioned in the body of the specification or as shown on drawings.

4.00.00 **I.S. CODE**

Important relevant code for this Section :

- a) IS:1661 : Code practice for cement and cement-lime plaster finish on walls & ceilings.
- b) IS:4101 : Code of practice for external facings and veneers.

SPECIFICATION NO A-3

FOR

FLOOR FINISH AND ALLIED WORKS

**SPECIFICATION NO. A-3
FOR
FLOOR FINISH AND ALLIED WORKS**

C O N T E N T S

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**SPECIFICATION NO. A-3
FOR
FLOOR FINISH AND ALLIED WORKS**

1.00.00 SCOPE

This section covers furnishing, installation, finishing, curing, testing, protection, maintenance till handing over various types of floor finishes and allied items of work as listed below :

a) In Situ Finishes

- i) Integral finish to concrete base
- ii) Red Oxide of Iron finish
- iii) Terrazzo finish
- iv) Granolithic finish
- v) Patent Stone
- vi) Metallic Hardener Finish
- vii) Mastic Asphalt finish
- viii) Chemical Resistant finish

b) Tiled Finishes

- i) Terrazzo tile
- ii) Chequered tile
- iii) Glazed/unglazed ceramic tile
- iv) Heavy duty cement concrete (carborundum) tile
- v) Chemical Resistant tile
- vi) Rubber, Vinyl/PVC tile
- vii) Stone Slab including Kotah Stone.
- viii) Marble slab/tile

1.01.00 Base

The base to receive the finish is covered under other relevant specifications.

1.02.00 **Sequence**

Commencement, scheduling and sequence of the finishing works shall be planned in detail and must be specifically approved by the Engineer in view of the activities of other agencies working in that area. However, the Contractor shall remain fully responsible for all normal precautions and vigilance to prevent any damage whatsoever till handing over.

2.00.00 **INSTALLATION**

2.01.00 **Special Materials**

Basic materials are covered elsewhere under individual finishing items & Specification. In general, all such materials shall be as per relevant I.S. Codes where available. In all cases these materials shall be of the best quality available indigenously, unless specified otherwise or directed by the Engineer.

The materials for finishing items must be procured from well-reputed specialised manufacturers and on the basis of approval of samples by the Engineer. The materials shall be ordered, procured and stored well in advance to avoid compulsion to use substandard items to maintain the construction schedule.

2.02.00 **Workmanship**

Only workers specially experienced in particular items of finishing work shall be engaged, where such workers are not readily available, with the Engineer's permission, experienced supervisors recommended by the manufacturer shall be engaged. In particular cases where the Engineer so desires the Contractor shall get the finishing items installed by the manufacturer.

2.03.00 **Preparation of the Base Surface**

The surface to be treated shall be thoroughly examined by the Contractor. Any rectification necessary shall be brought to the notice of the Engineer and his approval shall be taken regarding method and extent of such rectification work.

For all types of flooring, skirting, dado and similar locations, the base to receive the finish shall be adequately roughened by chipping, raking out joints, chasing of wall etc. where required and cleaning thoroughly all dirt, grease etc. with water and hard brush and detergent if required, unless otherwise directed by the manufacturer of any special finishing materials or specifically indicated in this specification.

To prevent water from the finishing treatment the base shall be thoroughly soaked with water and all excess water mopped up.

The surface shall be made dry where adhesives are used for fixing the finishes.

Prior to commencement of actual finishing work the approval of the Engineer shall be taken as per the acceptability of the surface.

2.04.00 **In Situ Finishes**

2.04.01 **Integral Finish To Concrete Base**

While the surface of the concrete laid as per specification for 'Cement Concrete' has been fully compacted and levelled but the concrete is still 'green' a thick slurry made with neat cement shall be applied evenly and worked in with iron floats. When the slurry starts to set it shall be pressed with iron floats to have a firm compact smooth surface without trowel mark or undulations. This finish shall be as thin as possible by using 2.2 kg. of cement per Sq. M. of area.

The surface shall be kept in shade for 24 hours and then cured for at least 7 days continuously by flooding with water. The surface shall not be subjected to any load or abrasion till 21 days after laying.

As desired by the Engineer the surface, while still 'green' shall be indented by pressing strings, the marking shall be of even depth, in straight lines and the panels shall be of uniform and symmetrical patterns.

2.04.02 **Red Oxide of iron Finish**

It shall consist of an underbed and a topping over already laid and matured concrete base.

a) **Thickness**

Unless otherwise specified the total thickness of the finish shall be minimum 50 mm for horizontal and 20 mm for vertical surface of which the topping shall be not less than 10 mm. While the topping shall be of uniform thickness the underbed may vary in thickness to provide necessary slopes. The vertical surface shall project out 6 mm from the adjacent plaster or other finishes. Necessary cutting into the surface receiving the finish shall be done to accommodate the specified thickness.

All junctions of vertical with horizontal shall be rounded neatly to uniform radius off 25 mm.

b) **Mix**

i) **Underbed**

The underbed for floors and similar horizontal surfaces shall consist of a mix of 1 part cement, 2 parts coarse sand and 3 parts 10 mm down well graded stone chips by volume. For vertical and similar surfaces the mix shall consist of 1 part cement to 3 parts coarse sand by volume.

ii) **Topping**

For the topping cement, screened through a fine mesh and red oxide of iron pigment powder similarly screened shall be dry mixed thoroughly in proportions minimum 3.5 Kg red oxide for 1

bag of cement or as instructed by engineer to produce the desired colour when laid. The mix shall then be prepared with 1 part cement (mixed with pigment) and 3 parts coarse sand by volume.

The top surface then shall be finished with a floating coat of red oxide mixed cement slurry. The whole quantity required for each visible area shall be prepared in one batch to ensure uniform colour. The thickness of topping plaster shall be minimum 10mm thick.

c) **Laying**

The underbed shall be laid in panels of mixing area 5 Sq.M. each and no side shall be more than 2.5 M long. For outdoor locations the maximum area shall be 2.0 Sq.M. The forms for the panels shall have perfectly aligned edges to the full depth of the total thickness of finish. If specified aluminum or glass dividing strips shall be used.

The panels shall be laid in alternate bays or in chequered board pattern. No panel shall be cast in contact with another already laid until the contraction of the latter has taken place. The underbed shall be laid, compacted, levelled and brought to proper grade with a screed or float. The topping shall be placed after about 24 hours while the underbed is still somewhat 'green' but firm enough to receive the topping. The surface of the underbed shall be roughened for better bonding. The topping shall be rolled for horizontal areas and thrown and pressed for vertical areas to extract all superfluous cement and water to achieve a compact dense mass fully bonded with the underbed. The topping shall then be levelled up by trowelling and finished smooth with a slurry made with already prepared cement and pigment mixture. About 2.0 Kg. of the mixture shall be consumed/per Sq.M. for horizontal surface, and 1.0 Kg. for vertical surface. The surface shall be cured for seven days by keeping it moist.

2.04.03 **Terrazo Finish : In Situ**

It shall consist of an underbed and a topping laid over an already laid and matured concrete base.

a) **Thickness**

Unless otherwise specified the total thickness of the finish shall be minimum 50 mm for horizontal and 20 mm for vertical surface of which the topping shall be not less than 10 mm. While the topping shall be of uniform thickness the underbed may vary in thickness to provide necessary slopes. The vertical surface shall project out 6 mm from the adjacent plaster or other finish. Necessary cutting into the surface receiving the finish shall be done to accommodate the specified thickness.

All junctions of vertical with horizontal shall be rounded neatly to uniform radius of 25 mm.

b) **Mix**

i) **Underbed**

The underbed for floors and similar horizontal surfaces shall consist of a mix of 1 part cement, 1½ parts sand and 3 parts stone chips by volume. For vertical surfaces the mix shall consist of 1 part cement to 3 parts sand by volume. The sand shall be coarse. The stone chips shall be 10 mm down well graded. Only sufficient water to be added to give a workable consistency.

ii) **Topping**

The mix for the topping shall be 12mm thick & composed of cement, colour pigment, marble dust and marble chips. Proportions of the ingredients shall be such as to produce the terrazzo of colour texture and pattern approved by the Engineer. The cement shall be white or grey or a mixture of the two to which pigment shall be added to achieve the desired colour. To 3 parts of this mixture 1 part marble powder by volume shall be added and thoroughly mixed dry. To 1 part of this mix 1 to 1½ parts of marble chips by volume shall be added and thoroughly mixed dry again.

Marble chips of one colour or various colours shall be used and sample shall be prepared for approval of the Engineer. The chips shall be homogeneous, dense and uniform in colour. The sizes of marble chips shall be of grade 00 to 2 i.e. 1mm to 10mm. Where aggregate of size larger than 10mm are used, the minimum thickness of topping shall not be less than 1.5 times the maximum size of the chips. Where larger size chips such as 20mm or 25mm are used, they shall be used only with a flat shape bedded on the flat face so as to keep the minimum thickness of wearing layer. Sample of chips and its mixing grade shall be got approved prior to start of the work. Colouring pigments not less than 3.5 Kg/bag of cement shall be thoroughly mixed dry.

The pigment must be stable and nonfading. It must be very finely ground. The marble powder shall be from white marble and shall be finer than IS Sieve No.: 30. The size of marble chips may be between 1 mm to 20 mm.

Sufficient quantity to cover each visible area shall be prepared in one lot to ensure uniform colour. Water to make it just workable shall be added to a quantity that can be used up immediately before it starts to set.

c) **Laying**

The underbed shall be laid in panels. The panels shall not be more than 5 sq.m in area of which no side shall be more than 2.5 M long. For exposed locations the maximum area of a panel shall be 2.0 Sq.M. The panel shall be laid in alternate bays or chequered board pattern. No panel shall be cast in contact with another already laid until the later has contracted to the full extent. Cement slurry @ of 2 Kg per Sq.m shall be applied over RCC/Concrete base before laying of underbed.

Dividing strips made of aluminium or glass shall be used for forming the panels. The strips shall exactly match the total depth of underbed plus topping. Thickness of glass strips shall be 4mm thick and Aluminium strips shall be 3mm thick.

After laying, the underbed shall be levelled compacted and brought to proper grade with a screed or float. The topping shall be laid after about 24 hours while the underbed is still somewhat "green" but firm enough to receive the topping. A slurry of the mixture of cement and pigment already made shall be spread evenly and brushed in just before laying the topping. The topping shall be rolled for horizontal areas and thrown and pressed for vertical areas to extract all superfluous cement and water and to achieve a compact dense mass fully bonded with the underbed. The surface of the topping shall be trowelled over, pressed and brought to a smooth dense surface showing a minimum 75% area covered by marble chips in a even pattern of distribution.

d) **Curing**

The surface shall be left for curing for about 12 to 18 hours and then cured by allowing water to stand on the surface or by covering with wet sack for four days.

e) **Grinding and Polishing**

When the surface has sufficiently hardened it shall be watered and ground evenly with rapid cutting coarse grade (no. 60) grit blocks (carborundum stone), till the marble chips are exposed and the surface is smooth. Then the surface shall be thoroughly washed and cleaned. A grout with already prepared mixture of cement and pigment shall be applied to fill up all pinholes. The surface shall be cured for 7 days by keeping it moist and then ground with fine grit blocks (no.: 120). It shall again be cleaned with water, the slurry applied again to fill up any pinholes that might have appeared and allowed to be cured again for 5 days. Finally, the surface is ground a third time with very fine grit blocks (no.: 320) to get smooth surface without any pinhole. The grinding shall be done by a suitable machine. Where grinding machine can not be used hand grinding may be allowed when the first rubbing shall be with carborundum stone of coarse grade (no. 60), second rubbing with medium grade (no.: 80) and final rubbing and polishing with fine grade (no.: 120). The surface shall be cleaned with water, dried and covered with soil free, clean sawdust if directed by the Engineer. The final polishing shall be postponed till before handing over if desired by the

Engineer. Just before handing over the surface shall be dusted with oxalic acid at the rate of 33 gm. per. Sq.M, water sprinkled on to it and finished by rubbing hard with pad of woolen rags. The floor shall be cleaned with soft moist rag and dried.

2.04.04 **Granolithic Finish**

Granolithic finish shall either be laid monolithically over base concrete or separately over hardened base concrete.

a) **Thickness**

The finish shall be average 20 mm and minimum 12 mm thick, unless specified otherwise.

b) **Mix**

The mix shall consist of 1 part cement : 1 part coarse sand : 2 parts coarse aggregate by volume. The coarse aggregate shall be very hard like granite and well graded between 6 mm and 12mm. Minimum quantity of water to get workability shall be added.

c) **Laying of Monolithic Topping**

The concrete base shall be laid as per specification "Cement Concrete" and levelled upto the required grade. The form shall remain sufficiently protruding to take the finish.

Within about 3 hours of laying the base while it is still fully "green" the topping shall be laid evenly to proper thickness and grade. If considered necessary the surface of the base shall be roughened by wire brushing. Unless manual operation is permitted by the Engineer, mechanical vibrators of suitable design shall be used to press the topping firmly and work vigorously and quickly to secure full bond with concrete base.

The laitance brought to the surface during compression shall be removed carefully without disturbing the stone chips. The surface shall then be lightly trowelled to remove all marks. When sufficiently set, hand trowelling shall be done to secure a smooth surface without disturbing the stone chips.

For large areas the laying shall be in panels of maximum 25 Sq.M area. The panels shall be laid in chequered board pattern.

d) **Laying of Topping Separately on Hardened Base**

The base concrete shall be prepared as stated in clause 2.00.03 and a slurry of neat cement applied just prior to laying the granolithic concrete mix (1:1:2). The method of compaction etc. shall be same as for monolithic topping.

e) **Curing**

Immediately after laying, the finish shall be protected against rapid drying. As soon as the surface had hardened sufficiently, it shall be kept continuously moist for at least 10 days by means of wet gunny bags or pounding of water on the surface. The floor shall not be exposed to heavy traffic during this period.

f) **Grinding**

If grinding is specified, it shall start only after the finish has fully set. Clause 2.01.03 (e) shall be followed. However, the ultimate polish required shall be decided upon by the Engineer.

g) **Finishing**

Where specified, sodium silicate or magnesium or zinc silico fluoride treatment shall be done. The concentration and method of application of the solutions shall be as specified in IS : 5491.

2.04.05 **Patent Stone**

It shall consist of an underbed and a topping laid on an already laid and matured concrete base.

a) **Thickness**

The patent stone finish shall have thickness as stipulated under clause 2.01.02 (a) except that the topping shall be 6 mm thick.

b) **Mix**

i) **Underbed**

The mix shall be as stipulated under clause 2.01.03 (b).

ii) **Topping**

The mix for the topping shall consist of 1 part cement and 1 part fine sand by volume.

c) **Laying**

The Patent Stone finish, including the underbed shall be laid in alternate bays or in chequered board pattern. No panel shall be cast in contact with another already laid till the contraction of the latter has already taken place.

The maximum area of each panel shall be 3 Sq.M of which no side shall be more than 2 M long.

A cement grout shall be applied and worked into the surface to receive the finish, the underbed then laid, compacted and levelled to proper grade with a screed or float. The topping shall be applied evenly on the underbed while it is not fully set but firm enough and rolled and pressed to get full bond. The topping shall be trowelled to a dense finish to the satisfaction of the Engineer. All trowel marks shall be mopped out with a soft cloth to give a clean smooth surface.

After the surface is sufficiently set, the finished floor shall be kept moist for 7 days for curing. If desired the finish shall be polished as directed by the Engineer.

2.04.06 **Non-Metallic Hardener Finish with Carborundum Granules e.g. Chapdur**

This will consist of a topping with ready mix compound of very hard granulates of predetermined granular size. The compound is of mineral origin & selected for its high abrasion resistant qualities.

a) **Thickness**

Unless otherwise specified the floor hardener finish shall be of 3 mm thick minimum.

b) **Material**

The ready-mix hardening compound shall be free from oil, grease, sand, soluble alkaline compounds or other injurious materials. When desired by the engineer, actual samples shall be tested.

c) **Laying**

The concrete base for floor finish shall be laid as per specification 'Cement Concrete' and levelled upto the required grade. The forms, if any, shall remain sufficiently projecting to take the finish. The finish with floor hardener shall be laid in 3mm thickness minimum over the concrete base. Hardener shall be applied at 6 Kg. per square metre of floor area. Panels of the above flooring, if desired by the Engineer, shall be 2.0 metre x 2.0 metre with 20mm x 1.5mm thick aluminium strips

The ready-mix hardener compound will be spread over the newly laid concrete base (underbed) at a stage when a nail mark of 3-4mm will be obtained at standard pressure. The spreading is done by hand or with a suitable apparatus. Wait till the mixture has been uniformly moistened by the surface water contained in the green concrete. Smooth out with the steel trowel which will be maintained perfectly flat. The final smoothing, if necessary, will be carried out sometime later with the mechanical trowel by operating at a low speed.

Immediately after the flooring surface is finished it shall be protected from rapid drying. As soon as the surface is hardened sufficiently, to prevent damages to it, the same shall be kept continuously moist for 7 days by means of wet gunny bags or pooling water on the surface.

2.04.07 **Mastic Asphalt Finish**

This is a one layer treatment on concrete or brick base.

a) **Thickness**

The thickness shall be as specified in the drawing.

b) **Materials**

Bitumen shall be industrial bitumen of the grade 90/15 and 75/15 conforming to IS: 702.

Mineral filler shall be dry stone dust passing through 75-micron IS Sieve.

Fine aggregate shall be crushed and graded natural lime stone or other hard-work.

Coarse aggregate shall be crushed siliceous stone or other approved aggregate 6 mm stone chips shall be used for finish upto 20 mm thick & 10 mm chips for thicker finish.

c) **Composition**

Bitumen mastic shall conform to IS: 1195 and shall be either brought to site in blocks weighing about 25Kg. or prepared at site. If brought in blocks, these shall be remelted in mechanically agitated mastic cookers and coarse aggregate, preferably preheated fed in successive portions until the complete change is thoroughly incorporated. At no stage during the remelting and mixing process, shall the temperature exceed 205 Deg. C.

d) **Laying**

The hot mastic shall be laid on dry base surface cleaned thoroughly by wire brushing and sweeping. The mastic shall be leveled and when cooled to some extent shall be finished with a wooden float with addition of small quantity of fine sand if required. No load shall be allowed till the finish has cooled to normal temperature.

The mastic shall be laid in suitable panels of about 15 Sq.M in area each formed by formers. Succeeding panels shall be laid overlapping the finish panel so as to melt its edges and form a continuous finish without joint.

2.04.08 **Chemical Resistant in Situ Finish**

Chemical resistant in situ finish shall be as epoxy resin with suitable filler material over a primer. The minimum thickness shall be 6 mm. About its performance the Engineer shall have to be fully satisfied by test results and examination of similar treatment already in existence. The Contractor shall get it done by a specialised manufacturer get guarantee of performance from the

organisation and pass it on to the Owner in addition to his own guarantee.

2.04.09 **Metallic Hardener Finish**

It shall consist of an underbed and a topping (incorporating iron particles) laid over an already laid and matured concrete base.

a) **Thickness**

Unless otherwise indicated the total nominal thickness of the finish shall be minimum 50mm for horizontal surfaces of which topping shall be not less than 12mm. While the topping shall be of uniform thickness, the underbed may vary in thickness to provide necessary slope. The vertical surface shall project 6mm from adjacent plaster or other finishes. Necessary cutting into the surface receiving the finish shall be done to accommodate the specified thickness.

b) **Material**

The hardening compound shall be uniformly graded iron particles free from non-ferrous metal impurities, oil, grease, sand, soluble alkaline compounds or other injurious materials. When desired by the engineer, actual samples shall be tested.

c) **Mix**

- i) The underbed for floors and similar horizontal surfaces and for vertical surfaces shall be as per clause 2.04.03(b).
- ii) Proportion of the metallic hardener shall be as specified or as indicated by the manufacturer. However, in absence of any such direction 1 part metallic hardener shall be mixed dry with 4 parts cement, by weight. To this mixture 6 mm nominal size stone chips shall be added in proportion of 1 part cement (mixed with hardener) to 2 parts of stone chips by volume and uniformly mixed. Minimum quantity of water shall be added to make it workable.

d) **Laying**

The concrete floor shall be laid in panels of 1m x 1m or as directed by the Engineer. Alternate panels shall be laid on the same day followed by the other group of alternate panels the next day. The edges of the panels shall be supported either by wooden strips or flat angle iron pieces fixed in position properly. The concrete floor shall be laid upto the required grade. The forms, if any shall remain sufficiently projecting to take the finish. The surface shall be roughened by wire brush as soon as possible, whenever specified.

The junction of floor and walls, floors and dado or skirting shall be rounded off as directed. Wooden strips or flat iron pieces shall be removed from their place before the succeeding alternate layers are laid.

The finish shall be laid while the concrete underbed is still very "green" within about 3 hours of laying of the latter. The finish shall be of uniform thickness and even dense surface without trowel marks, pin holes etc. This topping layer shall be pressed firmly and worked vigorously and quickly to secure full bond with the concrete base. Just when the initial set starts the surface shall be finished smooth with steel trowel.

The finished floor shall be cured for 7 days by keeping it wet.

2.05.00 **Tiled Finish**

These shall include finish tiles, stone slabs and similar manufactured or natural items over already laid and matured base of concrete or masonry by means of an underbed or an adhesive layer.

2.05.01 **Terrazzo Tile Finish**

The finish will consist of manufactured terrazzo tile and an underbed.

a) **Thickness**

The total thickness including the underbed shall be minimum 50mm for floors 30 mm for walls unless otherwise specified.

The skirting, dado and similar vertical surfaces shall project out 6 mm uniformly from the adjacent plaster or other wall finishes. The necessary cutting into the surface receiving the tiled finish, to accommodate the specified thickness shall be done.

b) **Tiles : Terrazzo**

The tiles shall, unless specifically permitted in special cases be machine made under quality control in a shop. The tile shall be pressed hydraulically to a minimum of 140 Kg. per Sq.cm.

Each tile shall bear on its back permanent and legible trade mark of the manufacturer. All angles of the tiles shall be right angles, all arises sharp and true, colour and texture of the wearing face uniform throughout. Maximum tolerance allowance length and breadth shall be ± 1 mm and the thickness + 3 mm. Face of the tile shall be plane, free from pin holes and other blemishes.

The tiles shall be composed of a backing and topping. The topping shall be of uniform thickness not less than 10mm and shall be supplied with initial grinding and grouting of wearing layer.

The total thickness including the topping shall be as specified but not less than 22mm in any case and 25mm thick for tiles 300x300mm size.

The backing shall be composed of 1 part ordinary grey cement and 3 parts of stone chips by weight mixed with water.

The topping shall be as specified under clause 2.04.03 (b). Where colouring pigment are specified, the same shall not exceed 10 percent by weight of cement used in the mix.

The tile shall be cured at the shop for at least 14 days before delivery to the site. First grinding shall be given to the tiles at the shop before delivery. Tiles shall be packed properly to prevent damage during transit and storage. The tiles must be carefully stored to prevent staining by damp, rust, oil, and grease or other chemicals.

Tiles made in each batch shall be kept and used separately so that color of each area of the floor may remain uniform.

The manufacturer shall supply along with the tiles the grout mix containing cement and pigment in exact proportions as used in topping of the tiles. The containers for the grout mix shall be suitably marked to relate it to the particular type and batch of tiles.

c) **Mix : Underbed**

The underbed for floor and similar horizontal surfaces shall be 1:4 cement sand mortar. For skirting and dado and all vertical surfaces it shall be about 12 mm thick and composed of 1 part cement and 3 parts coarse sand by weight.

d) **Laying**

The underbed mortar shall be evenly spread and brought to proper grade and consolidated to a smooth surface. The surface shall be roughened for better bond. Before the underbed had time to set and while it is still fairly moist but firm, cement shall be hand dusted over it or a cement slurry applied and the tiles shall immediately be placed upon and firmly pressed by wooden mallet on to the underbed until it achieves the desired level. The tiles shall be kept soaked for about 10 minutes just before laying. The joints between tiles shall be as close as possible and not more than 1.5 mm wide.

Special care shall be taken to check the level of the surface and the lines of the joints frequently so that they are perfect.

When tiles are required to be cut to match the dimensions these shall be sawn and edges rubbed smooth. The location of cut tiles shall be planned in advance and approval of the Engineer taken.

At the junction of horizontal surface with vertical surface the tiles on the former shall enter at least 12 mm under the latter.

After fixing, the floor shall be kept moist and allowed to mature undisturbed for 7 days. Heavy traffic shall not be allowed.

If desired dividing strips as specified under Clause 2.01.03 (c) may be used for dividing the work into suitable panels.

e) **Grinding and Polishing**

Procedure shall be same as Clause 2.01.03 (e). Grinding shall not commence earlier than 14 days after laying of tiles.

2.05.02 **Chequered Tile Finish**

The finish shall consist of manufactured grey or coloured cement tiles or terrazzo tiles with chequered face and an underbed laid over concrete or brick surface.

a) **Thickness**

Thickness shall be same as in clause 2.05.01 (a).

b) **Tiles : Chequered**

The tiles shall have chequers not less than 2.5 cm. c/c and not more than 5 cm c/c. Depth of grooves shall be not less than 5 mm. The grooves shall be uniform and straight.

The tiles shall conform to clause 2.02.01 (b) except that these may have the topping in terrazzo or plain grey cement or colour pigment added to cement.

c) **Underbed**

As per clause 2.05.01 (c).

d) **Laying**

As per clause 2.05.01 (d).

e) **Grinding and Polishing**

As per clause 2.05.01 (e) except that the tiles shall be ground and polished by hand after laying taking special care in polishing the grooves properly and uniformly.

2.05.03 **Glazed Tiles Finish**

This finish shall be composed of glazed earthenware tiles with an underbed laid over a concrete or masonry base.

a) **Thickness**

The total thickness shall be between 20mm and 25mm including the underbed.

The tile finish on vertical surface shall project out 6 mm uniformly from the adjacent plaster or other wall finishes. The necessary cutting into the surface receiving the finish, to accommodate the specified thickness shall be done.

b) **Tiles : Glazed**

The tiles shall be of earthenware, covered with glaze white or coloured, plain or with designs, of 150 mm x 150 mm nominal sizes and 5.5 mm to 6 mm thick unless otherwise specified. The tolerance shall be $\pm 1.5\text{mm}$ for length and breadth and $\pm 0.5\text{mm}$ for thickness. Specials like internal and external angles, beads, covers, cornices, corner pieces etc. shall match. The top surface of the tiles shall be glazed with a gloss or matt unfading stable finish as desired by the Engineer. The tiles shall be flat and true to shape. The colour shall be uniform and fractured section shall be fine grained in textures, dense and homogeneous. The tiles shall be strong and free from flaws like cracks, craze, specks, crawlings, etc. and other imperfections. The edge and the underside of the tiles shall be completely free from glaze and the underside shall have ribs or indentations for better anchorage with the fixing mortar.

The coloured tiles, when supplied, shall preferably come from one batch to avoid difference in colour.

c) **Mix : Underbed**

The mix for the underbed shall consist of 1 part cement and 3 parts coarse sand by weight mixed with sufficient water or any other mix if specified.

d) **Laying**

Same as clause 2.05.01 (d).

e) **Finishing**

The joints shall be cleaned and flush pointed with white cement and cured for 7 days by keeping it wet. The surface shall be cleaned with soap or suitable detergent, washed fully and wiped with soft cloth to prevent scratching before handing over.

2.05.04 **Unglazed Ceramic Tiles Finish**

This finish shall be composed of unglazed ceramic tiles of approved reputed manufacturer like Kajaria, Regency or Somany or equivalent fixed over underbed laid over a concrete or masonry base.

a) **Thickness**

The total thickness of floor shall be 50mm including the underbed and for skirting and dado shall be 20mm thick including mortar. Skirting and dado shall be 6mm projected out from the adjacent plaster.

b) **Tiles**

Ceramic tiles for floor shall be of matt finish of sizes 200x200, 333x333, 450x450, 200x100 or 300x300 and thickness 6.8mm to 9mm according to size of tiles. Unless otherwise specified 300x300x7.5mm thick tiles

shall be provided for floor and 200x100x6mm thick for skirting, dado or wall shall be provided.

The tolerance shall be \pm Max 0.5% in length \pm Max 0.5% for thickness and in squareness \pm Max 0.6% and shall in general conform to IS:13753. Other properties of tiles shall be -

Wedging warpage	\pm Max 0.5%
Water absorption	Greater than 10%
Scratch resistance (Moh's Scale)	Between 6-7
Abrasion resistance	PE/ Group-II
Chemical resistance	Resistant to all acids and alkalis (except hydrofluoric acid & its compounds)
Bending strength	Avg. 150 Kg/cm ²

Underbed and laying shall be similar to 2.05.01(c) & (d).

2.05.05 **Chemical Resistant Tiled Finish**

This shall include all varieties of special tiles used for specific chemical resistance function and an underbed over already laid concrete or masonry.

a) **Tiles**

The chemical resistant tiles shall be of the best indigenous manufacture unless otherwise specified and shall be resistant to the chemical (both acid and alkali). The tiles shall have straight edges, uniform thickness, plain surface, uniform nonfading colour and textures.

Tiles shall be unglazed, ceramic, vitreous, acid resistant, 20mm thick for flooring and 12mm thick for skirting, dado or wall and shall conform to IS:4457.

Usually the chemical resistant tiles shall not absorb water more than 2% by weight. The tiles shall have at least compressive strength of 700 Kg/cm². The surface shall be abrasion resistant and durable.

b) **Laying**

The mortar used for setting or for underbed these tiles shall be durable, strong and chemical resistant potassium silicate based mortar as per IS:4832 (Part-I) over a primer coat and alkali resistant bituminastic ready mixed paint conforming to IS:158 with 6mm wide joints in between tiles filled with resin type mortar conforming to IS:4832 (Part-II) mortar. The grout which shall be to the full depth of tile shall have equal chemical resistant properties. Joints shall be pointed if so desired. The setting and fixing shall be according to the manufacturer's specification approved by the Engineer.

2.05.06 **Rubber, Vinyl or Vinyl Asbestos Tiles Finish**

This shall include various types of tiles manufactured from rubber, vinyl, etc. set with a adhesive on concrete or masonry base. An underbed may be required to secure desirable surface and grade.

a) **Thickness**

The thickness of the tiles shall be as mentioned in drawing.

b) **Tiles**

Unless otherwise desired the tiles shall be squares of approved dimensions. The tolerance in dimensions shall be ± 1.5 mm.

The face of the tiles shall be free from porosity, blisters, cracks, embedded foreign matters or either physical defects which affect appearance or serviceability. All edges shall be cut true and square. The colour shall be nonfading and uniform in appearance, insoluble in water and resistant to alkalies, cleaning agents and usual floor polishes.

Each tile shall be marked on the back legibly and indelibly with manufacturers's trade mark, the thickness, sizes, batch number and date of manufacture.

Tiles shall be delivered securely packed and stored in clean, dry well ventilated place at a temperature near about to that the tiles shall be called upon to stand ultimately.

Adhesive to be used for sticking the tiles shall be approved by the tile manufacturer. The adhesive shall have a short drying time and long life in addition to toughness.

c) **Mix : Underbed**

The underbed where required to make up the right type of surface shall be composed of 1 part lime putty : 1 part cement : 4 parts coarse sand mixed with just sufficient water to make it workable.

d) **Laying**

The tiles shall be kept in the room to be tiled for at least 24 hours to bring them to the same temperature as the room. For air conditioned space, the air-conditioning shall be completed before tiling is taken up.

The surface to receive this finish shall be firm even textured but not too smooth, without undulations and other deficiencies. If an underbed is laid the same shall be cured for at least 7 days by keeping it moist and then fully dried.

The surface shall be thoroughly cleaned. All loose dust particles shall be removed. Oil and grease if any shall be completely cleaned by use of detergent.

The adhesive shall be applied to fully dry surface in desired thickness uniformly. The adhesive shall also be applied to the backs and edges of the tiles and allowed to surface dry. The tiles shall be placed neatly on the surface exactly to the approved pattern and set with a suitable tool. If the edges tend to curl, weights are to be used to keep the edges down. Special care shall be taken to avoid formation of air pockets under the tiles. The joints shall be very fine. Any adhesive squeezed out through the joints shall be removed immediately.

e) **Finishing**

If any adhesive mark is there on the surface a soft cloth soaked in solvent shall be used to wipe it off. The surface shall be cleaned with soft soap, dried and polished with an approved type of polish just before handing over.

2.05.07 **Stone Slab Finish : Marble, Stone and Similar Fine Grained Stone including Kotah stone**

a) **Thickness**

The underbed shall be minimum 12 mm and average 20 mm thick. The slabs will be 25 mm thick.

b) **Stone Slab**

The stone slabs shall be made from selected stock which are hard, sound, homogeneous and dense in texture and free from flaws. Angles and edges shall be true, square, free from chipping and surface shall be plane. The slabs shall preferably be machine cut to the required dimensions. Tolerance of ± 5 mm in dimensions and ± 2 mm in thickness will be allowed. Unless specified the slabs shall be minimum 300 mm x 300 mm.

The stone slabs shall come from specific regions and in specified quality with top surface fine chisel dressed. All sides shall also be fine chisel dressed to the full depth to allow finest possible joints.

The slabs shall be delivered to the site well protected against damages and stored in dry place under cover.

c) **Mix : Underbed**

Same as clause 2.02.01 (c).

d) **Laying**

The sides and top surface of the slabs shall be machine rubbed or table rubbed with coarse sand stone and washed before laying.

The underbed mortar shall be evenly spread and brought to proper level on the area under each slab. The slab shall be laid over the underbed, pressed and tapped down with wooden mallet to the proper level. The slab shall then be lifted and the underbed corrected as necessary and allowed to stiffen a little. Next, a thick cement slurry shall be spread over the surface. The edges of the slab shall be buttered with slurry of cement, grey/white/ mixed with pigment matching the colour of the stone slabs. The slab shall be gently laid and tapped with wooden mallet to bed properly to a very fine joint and to the required level. All surplus cement slurry shall be removed and the surface mopped clean with wet soft cloth. The laid finish shall be cured for 7 days by keeping it wet.

e) **Polishing, Finishing**

Fine chiselling shall be done to remove the slight undulations that usually exist at the joints. The polishing and finishing shall be done as specified under clause 2.02.01 (e). However, the joints shall be so fine in the case of stone slabs that grouting shall not be called for.

2.05.08 **Stone Slab Finish : Sand Stone and Similar Coarse Grained Stone Finish**

Generally clause 2.02.07 shall be followed except that the workmanship and finish shall not be fine as which are explained hereunder.

The slabs shall be rough chiselled or fine chiselled as specified. Tolerance may be allowed upto ± 6 mm for rough finish, but no sharp unevenness shall be allowed. For fine chiselling the unevenness shall be limited to ± 2 mm. The sides shall be chisel dressed at least to half slab depth so that the maximum deviation from straight line shall be within 25 mm. Beyond this depth the edge may be slightly splayed.

The joint thickness shall be kept limited to 5 mm in case of rough finish and 3 mm in case of fine finish unless wider joints are specified. The joints shall be grouted with white or coloured cement.

2.05.09 **Heavy duty Cement Concrete (Carborundum) Tile**

The finish will consist of manufactured carborundum tiles and underbed.

a) **Thickness**

The total thickness including the underbed shall be minimum 50mm thick for floor and 30mm for walls unless otherwise specified.

The skirting, dado and similar vertical surfaces shall project out 6mm uniformly from adjacent plaster. Required chasing shall be done for the same over the surfaces.

b) **Tiles : Carborundum**

Heavy duty concrete tile shall be procured from reputed manufacturers only. This tile shall be produced in a well set up factory under strict quality control. Tiles should be compressed under a high pressure of about 0.15t/sq.cm. Samples of the tile shall be submitted to the Engineer for approval before starting regular production.

IS:1237 shall be followed as general guidance for the specification of heavy duty concrete tile.

Size of the tile shall be 300x300mm unless otherwise specified. Minimum thickness shall be 22mm. However, actual thickness shall be as per designed strength requirement.

Stone grit shall be used in the bottom layer of tile and the mix shall not be leaner than 1:3. Thickness of wearing layer shall be not less than 8mm. For top layer nominal proportion of cement to aggregate shall be 1:1.5 unless otherwise agreed. Distribution of chips appearing over top surface should be uniform for aesthetic appearance. For darker shade of colours, 50% white cement of the total cement content shall be used. However, for lighter shade of colours, only white cement shall be used. Aggregate shall be hard stone chips of different colours. Carborundum, granite, quartzite chips shall be used. Properly graded aggregate upto 10mm size shall be used. Marble chips shall not be used unless specifically approved by the Engineer and shall not exceed 10% of the total quantity. Only good quality pigment having durable colour shall be used. Organic colours and lead pigments shall not be used. Manufacturer should ensure durability of the colour against possibility of any colour fading. Matching of colour between different batches shall be ensured. Physical properties and dimensional tolerance of the tile shall be as per IS:1237. However, surface hair cracks shall not be acceptable. For slipperage prone areas, rib tile/fluted type or chequered tiles shall be used. Tile shall be supplied with initial grinding (preferably twice) at factory premises. For laying and finishing of tile, IS:1443 shall be followed for general guidance.

c) **Mix : Underbed**

The underbed for floor and similar horizontal surfaces shall be 1:4 cement sand mortar. For skirting and dado and all vertical surfaces it shall be about 12 mm thick and composed of 1 part cement and 3 parts coarse sand by weight.

d) **Laying**

The underbed mortar shall be evenly spread and brought to proper grade and consolidated to a smooth surface. The surface shall be roughened for better bond. Before the underbed had time to set and while it is still fairly moist but firm, cement shall be hand dusted over it or a cement slurry applied and the tiles shall immediately be placed upon and firmly pressed by wooden mallet on to the underbed until it achieves the desired level. The tiles shall be kept soaked for about 10

minutes just before laying. The joints between tiles shall be as close as possible and not more than 1.5 mm wide.

Special care shall be taken to check the level of the surface and the lines of the joints frequently so that they are perfect.

When tiles are required to be cut to match the dimensions these shall be sawn and edges rubbed smooth. The location of cut tiles shall be planned in advance and approval of the Engineer taken.

At the junction of horizontal surface with vertical surface the tiles on the former shall enter at least 12 mm under the latter.

After fixing, the floor shall be kept moist and allowed to mature undisturbed for 7 days. Heavy traffic shall not be allowed.

If desired dividing strips as specified under Clause 2.04.03 (c) may be used for dividing the work into suitable panels.

e) **Grinding and Polishing**

Grinding shall be done as per recommendation of the manufacturer including use of special type grinding stone. Atleast two additional grindings shall be done at site after laying in addition to initial grinding at shop. Oxalic acid polishing shall be same as 2.05.01(e).

3.00.00 **ACCEPTANCE CRITERIA**

The finish shall be checked specially for :

- a) Level, Slope, Plumb as the case may be
- b) Pattern and Symmetry
- c) Alignment of joints, dividing strip etc.
- d) Colour, texture
- e) Surface finish
- f) Thickness of joints
- g) Details at edges, junctions etc.
- h) Performance
- i) Precautions specified for durability

4.00.00 **I.S. CODES**

Important relevant codes for this section :

IS : 777 : Glazed earthenware tiles

IS : 1196	:	Code of practice for laying bitumen mastic flooring.
IS : 1197	:	Code of practice for laying of rubber floors.
IS : 1237	:	Cement concrete flooring tiles
IS : 1443	:	Code of practice for laying and finishing of cement concrete flooring tiles.
IS : 2114	:	Code of practice for laying in situ terrazzo floor.
IS : 3461	:	PVC asbestos floor tiles
IS : 4860	:	Specification for acid resistant bricks
IS : 5518	:	Code of practice for laying of flexible PVC Sheet and tile flooring.
IS:5491	:	Code of practice for laying in situ granolithic floor topping.

SPECIFICATION NO. A-4

FOR

CARPENTRY AND JOINERY

**SPECIFICATION NO. A-4
FOR
CARPENTRY AND JOINERY**

C O N T E N T S

CLAUSE NO.	DESCRIPTION	PAGE NO.
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**SPECIFICATION NO. A-4
FOR
CARPENTRY AND JOINERY**

1.00.00 SCOPE

This section covers/supply, fitting and fixing of timber frames to doors and windows with M S holdfasts, flush doors, panel doors, windows, shutters, partitions, wall paneling, pelmets, shelves, furniture, etc. as shown in drawings, including a prime coat of approved paint, varnish, or fixing of decorative plastic laminated board where called for. This shall also include the supply and fixing of all hardware and fixtures.

2.00.00 INSTALLATION

2.01.00 Materials

a) Timber

Unless otherwise specified, all timber shall be best quality well seasoned Sal wood / C P teakwood free from large or loose knots cracks or other defects. Timber shall be treated with approved wood preservative before use. Before starting the carpenters work, the Tenderer shall have the rough timber approved by the Engineer. Sal wood shall be provided for frames only.

b) Plywood

Plywood shall be commercial quality or with decorative surface veneer. Unless specifically permitted otherwise, the adhesive used in plywood shall be phenol-formaldehyde resin of B W R grade conforming to IS:848.

c) Decorative Laminated Plastic Sheets

The colour, pattern, finish and texture shall be approved by the Engineer and the bulk supply procured in sheet sizes which will ensure the least number of joints in one surface.

d) Flush Doors

Flush doors shall be solid core doors with commercial or decorative faces and hardwood edges. The core for solid core doors shall be of block board or wood particle board. Manufacturer's literature and test certificates shall be submitted for the approval of the Engineer. The Contractor shall give a guarantee that the adhesive used is phenol formaldehyde of B W R grade, conforming to IS:848. The thickness shall be as specified. Where specified factory made flush door decorative or non-decorative faces shall be provided.

e) **Panel Doors**

Panel door shall be of teakwood shutter frame and panels with teakwood/commercial ply/laminated particleboard. Other considerations shall be as mentioned in item (d) above.

f) **Fixtures**

Hardware for doors, windows, furniture, etc. shall be as specified. These shall be of heavy type, best quality and from approved manufacturer. For hardware of doors Annexure-A of specifications for Metal doors etc. shall be referred.

2.02.00 **Workmanship**

2.02.01 **General**

The work shall be done by skilled carpenters as per details shown on drawing or instructed by the Engineer.

Framing timber and other work shall be close-fitting with proper wood joinery, accurately set to required lines or levels and rigidly secured in place. The surface of frames etc. which will come in contact with masonry after fixing, shall be given two coats of approved paint before fixing. Mastic caulking shall be done after fixing external door and window frames. Special care shall be taken to match the grain of timber or plywood which will be subsequently polished. Screwing or nailing will not be permitted to the edge of plywood and particleboard. The edge of all plywood, block board and particle board shall be finished with teakwood lipping unless otherwise shown on drawings.

Fixing for frames and partitions shall generally be with 40mm x 6mm x 300mm long MS holdfasts bifurcated at end and grouted with 1:2:4 cement concrete. The gap between masonry and external door and window frame shall be caulked with polysulphide sealant. MS grills or guard bars shall be provided to windows where called for in the drawings.

2.02.02 **Finish**

All carpentry work after finishing shall be sand papered smooth. A prime coat paint shall be given after inspection of the Engineer to all surfaces other than those which shall be subsequently polished or covered with laminated plastic sheet.

2.02.03 **Surface Treatment**

When shown on drawings or called for, decorative ply or laminated plastic sheets shall be bonded under pressure to the surface to be finished. The adhesive used shall be of approved brand and brought to site in sealed containers. The rate of application and the length of time for which the pressure is to be applied shall be as per the manufacturer's instructions. The edge of sheets shall be protected by teak lipping or beveled as shown on drawings.

3.00.00 **ACCEPTANCE CRITERIA**

3.01.00 **Door and Window Frames**

All frames shall be square and flat at the time of delivery and shall be checked for dimensions and corner angles. After fixing they shall be on a fine vertical plane. All external door and window frames shall be caulked with mastic.

3.02.00 **Door and Window Shutters**

Shall be of proper size, shape and design and free of warp. When fixed to frames, these shall operate smoothly without jamming and all latching or locking devices shall engage properly without undue pressure.

3.03.00 **Partitions, Paneling, Pelmets, Furniture, etc.**

3.03.01 **General**

These shall conform to drawings in all details. No unsightly nailmarks etc. shall be permitted. Plywood grains shall be matched to give a uniform and pleasing appearance.

3.03.02 **Partition**

Shall be checked for rigidity of fixing, plumb and horizontal as well as vertical alignment.

3.03.03 **Pelmets**

Shall be checked for rigidity of fixing and adequate clearance of fixture.

3.03.04 **Cupboard Shutters**

Shall operate smoothly without jamming and locks, bolts and double ball catches shall engage securely. Single ball catches shall not be used.

3.03.05 **Drawers**

Shall operate smoothly and have backstops to prevent them from being pushed too far. Locks shall engage securely.

3.03.06 **Loose Furniture**

When placed on a level surface tables tops etc. shall be horizontal and the pieces stand stably on legs or supports.

4.00.00 **IS CODES**

Some of the important relevant Codes for the Section are:

IS : 4021 - Timber door, window and ventilator frames.

IS : 1003 - Timber paneled and glazed shutters.

- IS : 2191 - Wooden flush door shutter (Cellular and hollow core type).
- IS : 2202 - Wooden flush door shutters (solid core type).

SPECIFICATION NO. A-5

FOR

SUSPENDED CEILING

**SPECIFICATION NO. A-5
FOR
SUSPENDED CEILING**

C O N T E N T S

CLAUSE NO.	DESCRIPTION	PAGE NO.
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**SPECIFICATION NO. A-5
FOR
SUSPENDED CEILING**

1.00.00 SCOPE

This section covers supply and installation of suspended ceiling using Gypsum board of India Gypsum or equivalent with the suspension system as shown on drawing with all materials, labour and equipments. The work shall also include providing of openings in the ceiling for lighting, air-conditioning diffusers etc. as shown on drawings or instructed by the Engineer.

2.00.00 INSTALLATION

2.01.00 Suspension System

2.01.01 General

Suspension system shall consist of the grid supporting the ceiling panels, intermediate runner supports for the grid if any and hangers, wall angles etc. required to suspend the grid or the runners from structural works, slabs and beams.

All members of the suspension system shall be of sufficient strength and rigidity to carry the ceiling boards or sheets in a true and level plane without exceeding a deflection of 1/360th of their span. All joints in ceiling panels shall run straight and cross joint shall be at perfect right angles. Angle moulds where shown on drawings shall be securely fixed to walls. All drillings of structural concrete and installation of suitable anchoring device for installation including welding of the suspension system shall be included in the rate. All M.S. sections used for supports etc. shall be given one coat of synthetic enamel paint over a coat of red lead primer.

2.01.02 Metal Grid Suspension System

Metal grid suspension system shall be concealed type consisting of a range of metal components for supporting Gypboard false ceiling. The suspension system comprises of intermediate channel, ceiling section, ceiling angle, perimeter channel, expansion rawplug, etc. as manufactured by India Gypsum Ltd. or equivalent.

2.02.00 Ceiling Panels

2.02.01 Materials

Ceiling panels shall be best quality material in thickness and properties called for. The Contractor shall submit test certificates to the Engineer for approval before bulk supply. The ceiling panels shall be as manufactured by India Gypsum Ltd.

2.02.02 **Installation of Ceiling Panels**

Installation of suspension system shall be as per manufacturer's details.

Perimeter channels shall be levelled at the required position above the finished ceiling line and shall be fixed to the wall at 610mm C/C. Other metal suspension components shall be installed to form a regular grid, suspended from soffit cleats by ceiling angle at 1220mm C/C connected to the intermediate channels which shall be set 1220mm apart. Ceiling section shall be fixed at 450mm C/C at right angles to the underside of intermediate channels using connecting clips.

The gypboard with bound edges shall be fixed at right angles to ceiling sections with all joints staggered. Gypboard shall be screwed to ceiling sections and perimeter channels at board ends with gypboard dry wall screws with joints staggered. Joints and screw marks shall be finished seamless as per India Gypsum standard specification.

3.00.00 **SAMPLES**

Samples of Gypboard panels and metal suspension system components as noted below shall be submitted for Engineer's approval :

Panels	:	3 samples approximately 300 mm square each
Suspension System	:	3 short sections - each of main and secondary system

4.00.00 **SHOP DRAWINGS**

Shop drawings shall be submitted for approval as required and approval obtained prior to delivery of ceiling components. Shop drawings shall be co-ordinated with all related work and shall show the following information :

- a) A reflected ceiling plan of areas indicated to receive the ceiling showing electrical and mechanical features.
- b) Typical intermediate framing for support where required.
- c) Hanger fastening details.
- d) Panels - unit support at ceiling penetrations.
- e) Details of splicing method for main and cross runners.
- f) A table indicating load bearing capacity of main and cross runners.
- g) A note stating that the suspension system member furnished will not deflect more than 1/360 of a 1.2 metre span under the indicated loading.

5.00.00 **ACCEPTANCE CRITERIA**

Finished ceiling shall be at the correct plane and present a pleasing and uniform appearance, free from sags, warps, disfigured or damaged board. Cutouts for light fixtures, diffusers etc. shall be of exact dimensions and in exact locations.

SPECIFICATION NO. A-6

FOR

**METAL DOORS, WINDOWS,
VENTILATORS, LOUVRES ETC.**

**SPECIFICATION NO. A-6
FOR
METAL DOORS, WINDOWS, VENTILATORS, LOUVRES ETC.**

C O N T E N T S

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**SPECIFICATION NO. A-6
FOR
METAL DOORS, WINDOWS, VENTILATORS, LOUVRES ETC.**

1.00.00 SCOPE

This section covers supplying and/or erecting and installing of all metal doors, windows, ventilators, louvres, glazed partitions, etc. The scope of work shall also include the assembly and erection of all doors, windows, louvres, glazed partitions, etc. Supplying and/or fixing of all door and window accessories and hardware is also included in the scope.

2.00.00 INSTALLATION

2.01.00 Materials

Steel sections used for fabrication of doors, windows etc. shall be standard rolled steel sections specified in IS:1038 and IS:1361 or as specified.

Steel sheets for frames, shutters, louvre blades etc. shall be of gauge mentioned in drawings and schedules.

Aluminium sections for fabricating doors, windows, partitions etc. shall be extruded sections conforming to IS:1948 and 1949 or as manufactured by Indian Aluminium Company Limited or approved equivalent. The alloy used shall conform to IS Designation HE 9-WP of IS:733.

Hardware and fixtures shall be as specified and the best quality from approved manufacturers shall only be used. The Tenderer shall specifically state the particular manufacturer's materials he proposes to use. Improper alignment or faulty operation due to inadequate strength of hardware or fixture shall entirely be the Contractor's responsibility.

All hardware and fixtures shall be able to withstand repeated use. Door closures shall conform to IS:3564 and shall be suitable for doors weighing 61-80 Kg. unless otherwise stated. Each closer shall be guaranteed against manufacturing defect for one year and any defect found within this period shall be rectified or the closer replaced free of charge. Concealed door closers shall be either floor mounted or transom mounted, suitable for installation with metal doors. It shall conform to the performance requirements and endurance test stated in IS:3564 - Appendix-A.

The Contractor shall submit samples of each type of hardware to the Engineer. The approved samples shall be retained by the Engineer for comparison of bulk supply. The samples shall be returned to the Contractor towards the end for incorporation in the job.

The mastic/silicon sealant for Aluminium or where specified for caulking shall be of best quality from a manufacturer approved by the Engineer. In general, the mastic for fixing of metal frames shall be as per IS:1081 and/or as approved by the Engineer.

2.02.00 **Fabrication**

2.02.01 **Steel Doors, Windows, Ventilators, Louvres etc.**

a) **Door Frames**

Frames shall be fabricated from 1.6mm thick mild steel sheets. They shall be mortised, reinforced, drilled and tapped for hinges and lock and bolt strikes. Where necessary, frames shall be reinforced for door closers. Welded construction with mitred corners shall be used. Rubber door silencers shall be furnished for the striking jamb. Loose "T" masonry anchors shall be provided. Frames shall finish flush with floor and adjustable floor anchors shall be supplied. Frames shall be brought to site with floor ties/ weather bars installed in place.

b) **Double Plate Flush Door Shutters**

Door shutters shall be 45 mm thick, completely flush design and shall comprise of two outer sheets of 1.25mm thick steel sheets, rigidly connected and reinforced inside with continuous vertical & horizontal 1mm thick stiffeners, spot welded in position at not more than 150 mm on centres.

Both edges of doors shall be joined and reinforced full height by steel channels placed immediately inside and welded to the door faces. Top and bottom of doors shall be reinforced horizontally as shown on drawing by steel channels running full width of door. Doors shall not have more than 2.5 mm clearance at jambs and heads, shall have proper level on lock stiles and rails to operate without binding, and shall be reinforced at corners to prevent sagging or twisting. Pairs or double doors shall have meeting-stile edges beveled or rebated. Where shown on drawing, the doors shall be sound-deadened by filling the inside voids with mineral wool or other suitable approved materials.

Doors shall be mortised, reinforced, drilled & tapped in shop for hinges, locks & bolts. They shall also be reinforced for closers, push-plates and other surface hardware where necessary. Any drilling and tapping required for surface hardware shall be done at site. Where shown in drawing, provision shall be made for fixing glazing, vision panels, louvres etc. glazing, mouldings shall be of 18 G steel or extruded aluminium sections and suitable for fixing 6 mm. glass. Louvres blades shall be V or Z shaped and made out of 16 G sheets.

c) **Single Sheet Door Shutters**

Single sheet doors shall be made from best quality 18 G mild steel sheets, and shall present a flush surface on the outside. The inside shall be stiffened with semitubular edge and central stiffening rail which shall convey the lock and other furniture. The frames shall be made from best quality 16 G mild steel sheets.

Wherever required, provisions for fixing glass panes, louvres etc. shall be made.

The manufacturing shall be done as specified in 2.02.01 (b) "Double Plate Flush Door Shutters".

d) **Sliding Doors**

Sliding doors shall be either double plate or single plate construction made out of 1.25mm thick steel sheets with adequate stiffeners. The Contractor shall specify the weight of the door in his shop and submit the manufacturer's catalogue of the sliding gear he proposes to use. Where called for the Contractor shall make provision for openings to the door for mono-rail beams. Doors shall close positively to exclude rain water from seeping in. When called for, sliding doors shall withstand specified wind loads without buckling or jamming. The door shall slide freely under all ambient conditions.

e) **Door Threshold**

Door threshold shall be provided. Doors without threshold shall have bottom tie of approved type.

f) **Steel Windows, Sashes, Ventilators etc.**

These shall conform in all respects to IS:1038 or IS:1361 latest editions. The details as called for in the above codes shall be applicable for coupling mullions, transoms, weather bars, pivot arrangements for ventilators, etc. or as called for. All welds shall be dressed flush on all exposed and contact surfaces. Where composite unit openings are required the individual window units shall be joined together with requisite transoms and mullions. All windows shall be outside glazed, fixed with putty or metal glazing beads. Where aluminium glazing beads are specified, they shall be extruded aluminium channel 9.5 mm x 9.5 mm x 1.6 mm (Indal Section No. 2209) unless otherwise shown on drawings. Aluminium beads shall be given one coat of zinc chromate primer before fixing to windows.

- g) M.S grill shall be provided for windows of specified areas. M.S flats of minimum size 20x5mm shall be used. Spacing between flats shall not be more than 75-100mm. All joints of the grill shall be properly welded. Grill shall be fixed by welding with window in case of steel windows. For aluminium windows the same shall be fixed with masonry or available steel structural members. All grills shall have a shop coat of red lead or zinc chromate primer prior to installation.

2.02.02 **Aluminium Door, Windows and Frames**

Extruded sections of approved manufacturer shall be used. Aluminium alloy shall conform to IS:737 of corrosion resistance grade. All sections shall be approved by the Engineer before fabrication is taken up. Doors, windows, frames, mullions, transome etc. shall be anodized in a bath of sulphuric acid to provide a clear coating of min. 15 micron thickness. The anodized materials shall then be sealed by immersing in boiling water for 15 minutes. A protective transparent coating shall be applied to the sections before shipment from the factory.

All work shall be fitted and shop assembled to a first class job, and ready for erection. Shop joints shall be made to hair lines and then welded or braced by such method as will produce an uniform colour throughout the work. Work on the above, other than described, shall be carefully fitted and assembled with neat joints with concealed fasteners. Wherever possible, joints shall be made in concealed locations and on edges of doors. Field connections of all work may be made with concealed screws or other approved type of fasteners. Glazing beads clips shall be snap fit type without visible screws and shall be of sizes to accommodate single glazing as well as double glazing as required. All work shall be adequately braced and reinforced as necessary for strength and rigidity.

2.03.00 **Shop Coat or Paint**

The shop paint for steel doors, windows etc. shall be best red lead or zinc chromate primer paint from approved manufacturer. All surfaces shall be thoroughly cleaned of rust, grease, loose mill scales etc. and given one coat of shop paint. Portions like mullions, transoms etc. which will be inaccessible after assembly of units shall be given an extra coat of paint before assembly.

Where called for, all steel doors, windows, etc. shall be hot dip galvanised to give a coating weight of 1-1/2 - 2 oz. per sft. One coat zinc chromate primer coat shall then be applied as shop paint.

Portions of aluminium frame which come in contact with masonry construction, shall, before shipment from workshop, be protected with a heavy coat of alkali paint. Aluminium coming in contact with other incompatible metals shall be coated with zinc chromate primer.

2.04.00 **Handling & Storage of Fabricated Material**

All metal doors, windows, etc. shall be packed and crated properly before despatch, to ensure that there will be no damage to the fabricated materials. Loading into wagons and trucks shall be done with all care to ensure safe arrival of materials at site in undamaged condition.

All metal doors, windows etc. shall be stored under cover in a way to prevent damage or distortion. Special care shall be taken to prevent staining of aluminium products by rust, mortar etc.

2.05.00 **Assembly & Erection at Site**

In general, the fixing of steel doors, windows, ventilators, louvres, etc. shall conform to IS:1081 all aluminium doors, windows and partition as per approved manufacturer's fabrication details. The Contractor shall assemble and install all steel doors, windows, sashes, fixed metal louvres, etc. including transoms and mullions for composite units in respective places, keeping proper lines and levels, and in approved workman-like manner, to give trouble free and leak-proof installations. The installation shall be done according to the instructions of the manufacturer, and/or as approved by the Engineer. If required by the Engineer, the installation shall have to be carried out under the supervision of the manufacturer's staff. The Contractor shall take every precaution against damage of the components during installation. Necessary

holes, chases, etc. required for fixing shall be made by the Contractor and made good again as per original, after installation, without any extra charge.

After installation of steel or aluminium doors, partitions, windows, etc. all abrasions to shop-coat of paint shall be retouched and made good with the same quality of paint used in shop-coat.

All coupling mullions, transoms, frames, etc. in contact with adjacent steel and other members, shall be well bedded in mastic/sealant. The Contractor shall bring to the site the mastic cement/sealant in original sealed containers of manufacturer and shall apply it as per the instructions. Caulking shall be done properly as per drawings, specifications and as per instructions of the Engineer.

Door shutters, partitions hardware fixtures etc. shall be fixed only after major equipment have been installed in rooms.

Frames shall be fabricated to a true right angle. The frames shall be mitered at the corner and in case of steel shall be welded. All vertical members shall be embedded in floor finish. For glazed partition walls unsupported at top, alternate vertical members shall be extended upto the structural ceiling for proper support.

Wherever required, nylon cords of approved quality shall be supplied along with pivoted sashes and shall be of adequate length to terminate one metres from the floor. Loose ends of cords shall end in metal or plastic pull as approved by the Engineer.

3.00.00 **ACCEPTANCE CRITERIA**

3.01.00 **For fabricated Items**

- a) Overall dimensions shall be within ± 1.5 mm of the size shown on drawings.
- b) Mullions, transoms etc. shall be in one length and permissible deviations from straightness shall be limited to ± 1.5 mm from the axis of the member.
- c) Door and window shutters shall operate without jamming. The clearance at head and jamb for door shutters shall not exceed 1.5 mm. For double leaf doors, the gap at the meeting stiles shall not be more than 1.5 mm.
- d) Door leaves shall be undercut where shown on drawings.
- e) Doors, windows, frames, etc. shall be on a true planes, free from warp or buckle.
- f) All welds shall be dressed flush on exposed and contact surfaces.
- g) Correctness of location and smoothness of operations of all shop installed hardwares and fixtures.

- h) Provision for hardwares and fixtures to be installed at site.
- i) Glazing beads shall be cut with mitred corners.
- j) Glazing clips, fixing devices etc. shall be supplied in adequate numbers.
- k) Shop coats shall be properly applied.
- l) Exposed aluminium surfaces shall be free from scratches, stains and discolouration. Anodised surfaces shall present a uniform and pleasing look.

3.02.00 **For Installed Items**

- a) Installations shall be at correct location, elevation and in general, on a true vertical plane.
- b) Fixing details shall be strictly as shown on drawings.
- c) Assembly of composite units shall be strictly as per drawings with mastic caulking of transoms and mullions, gaskets, weather strips etc. complete.
- d) All frames on external walls shall be caulked with silicon sealant to prevent leakage through joint between frames and masonry/ other members.
- e) All openable section shall operate smoothly without jamming.
- f) Locks, fasteners etc. shall engage positively. Keys shall be non-interchangeable.
- g) Cutting to concrete or masonry shall be made good and all abrasions to shop paint shall be touched up with paint of same quality as shop paint.
- h) Aluminium doors, windows, etc. shall be free from scratches stain or discolouration.

Contractor shall see that the material is protected from mortar, paint, plaster, terrazzo or other staining material during construction and shall thoroughly clean all framing members to the satisfaction of the site in charge before handing over to Owner.

4.00.00 **INFORMATION TO BE SUBMITTED**

4.01.00 **With Tender**

- a) Names of manufacturers for doors, windows etc.
- b) Manufacturer's catalogue for all hardwares and fixtures proposed to be used.

4.02.00 **After Award**

- a) Before starting fabrication of all metal doors, windows, etc. the Contractor shall submit detailed fabrication drawings to the Engineer for approval. The fabrication shall be started only after approval of drawings.
- b) Contractor shall submit a programme of work to be done for the approval of the Engineer.
- c) Before bulk supply, he shall submit for the approval of the Engineer samples of all bought out items and samples of each type of fabricated items. The samples shall be retained by the Engineer for comparison of bulk supply and returned to the Contractor towards the end for final incorporation in the job.

5.00.00 **IS CODES**

Following are some of the important I.S. Codes as relevant to this section :

Steel doors, windows and ventilators	-	IS:1038
Steel windows for industrial buildings	-	IS:1361
Aluminium doors windows and ventilators	-	IS:1948
Aluminium windows for industrial buildings	-	IS:1949
Steel door frames	-	IS:4351
Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows, and ventilators	-	IS:1081
Tower bolts (non-ferrous metal)	-	IS:204 (Part-II)
Door handles	-	IS:208
Steel butt hinges	-	IS:1341
Anodic coating on aluminium and its alloy	-	IS:1868
Door closer	-	IS:3564
Flush bolt	-	IS:5187
Floor springs (hydraulically regulated for heavy door)	-	IS:6315
Fire check door	-	IS:3614 (Pt-I)
Steel sliding shutter (Top hung)	-	IS:10451

ANNEXURE-A SCHEDULE OF HARDWARE

All hardware and fittings shall conform in general to relevant IS Codes and shall be procured from an approved & reputed manufacturer.

A. TIMBER DOORS

1. For single leaf panel/flush doors :

- | | | | |
|------|--|---|--------|
| i) | 100 mm brass butt hinges with screws | - | 3 Nos. |
| ii) | 150 mm brass tower bolts with screws on inside leaf | - | 1 No. |
| iii) | 100 mm x 225 mm clear plastic push plate with counter sunk brass screws | - | 1 No. |
| iv) | 150 mm brass coat hook with screws | - | 1 No. |
| v) | Mortice latch & lock on active leaf - for flush door. For door-closure, see "Door Schedule". | | |
| vi) | Mortice latch on toilet door. | | |

B. ALUMINIUM DOORS

1. For double leaf door :

- | | | | |
|------|---|--|--|
| i) | Concealed hanging arrangement for door leaves. | | |
| ii) | Concealed double acting floor spring for each leaf. | | |
| iii) | Standard lock on active leaf. | | |
| iv) | Pull handle of approved design on both leaves. | | |
| v) | Doors stops for both leaves. | | |
| vi) | Flush bolt for each leaf. | | |

C. STEEL DOORS AND WINDOWS

1. Doors

a) Double leaf doors

- | | | | |
|-----|----------------------------|---|---|
| i) | 100mm butt hinges | - | 3 Nos. on each leaf. |
| ii) | 300mm aluminium tower bolt | - | 2 Nos. (top and bottom) on inside of inactive leaf. 1 No. (Top only) on inside active leaf. |

- | | | | |
|------|--|---|---|
| iii) | 200 mm anodised aluminium pull handle (heavy type) | - | 1 No. of each leaf. on both sides |
| iv) | Door stop of approved design | - | 1 No. for each leaf. |
| v) | Mortice latch & lock | - | At least one in each room |
| vi) | Hydraulic door colser | - | For all doors between A/C & non A/C area for office & cabins, main entry door to toilets. |

b) **Single leaf doors**

- | | | | |
|------|--|---|---|
| i) | 100 mm butt hinges | - | 3 Nos. |
| ii) | 300 mm aluminium tower bolt | - | 2 Nos. top & bottom of inside face. |
| iii) | 200 mm anodised aluminium pull handle (heavy type) | - | 1 No. |
| iv) | Door stop of approved design | - | 1 No. |
| v) | Mortice latch & lock | - | At least one in each room |
| vi) | Hydraulic Door colser | - | For all doors between A/C & non A/C area for office & cabins, main entry door to toilets. |

2. **Windows, Ventilators, etc.**

a) **Side Hung Windows (steel)**

- | | | | |
|------|--------------------------|---|---|
| i) | Hinges | - | Standard approved friction hinges in each leaf. |
| ii) | 300 long brass peg stays | - | 1 No. per leaf |
| iii) | 2 point brass handles | - | 1 No. per leaf |

b) **Top Hung Ventilators (Projecting Out)**

- | | | | |
|-----|-------------------------|---|--------------------------|
| i) | Hinges | - | Standard approved hinges |
| ii) | Adjustable folding stay | - | 2 Nos. per leaf |

- iii) 2 point handles - 1 No. per leaf.

3. **Aluminium Windows, Ventilators, etc.**

a) **Side Hung Windows**

- i) Hinges - Standard approved pivot hinge two nos. per leaf.
- ii) Standard approved friction stay - 1 No. per leaf
- iii) Standard approved locking handle - 1 No. per leaf

b) **Top Hung Ventilators** (Projecting Out)

- i) Hinges - Standard approved hinge
- ii) Adjustable folding type stay - 2 Nos. per leaf
- iii) Standard approved locking handle - 1 No. per leaf

SPECIFICATION NO. A-7

FOR

GLASS AND GLAZING

**SPECIFICATION NO. A-7
FOR
GLASS AND GLAZING**

C O N T E N T S

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**SPECIFICATION NO. A-7
FOR
GLASS AND GLAZING**

1.00.00 SCOPE

This section covers supplying and fixing of all glass and glazing including all clips, putty, mastic cement etc. wherever required as per specifications.

2.00.00 INSTALLATION

2.01.00 General

The Contractor shall supply and install all glass and glazing as required for various doors, windows, sashes, ventilators and fixed louvres, miscellaneous glazing and partitions, from approved manufacturer having uniform refractive index and free from flaws, specks and bubbles. The glass shall be brought to site in the original packing from the manufacturer and cut to size at site.

2.02.00 Materials

- a) Clear glass shall be float glass of minimum 5mm thick for door and shall conform to IS : 2835.
- b) 6mm thick bronze tinted toughened glass shall be provided in partition two A/C room for single glazed partition.
- c) Wired glass shall be thick rolled glass with centrally embedded 0.56mm wire mesh of Georgian type. This shall be of clear glass and shall conform to IS : 5437.
- d) Obscure glass shall have a cast surface in one side.
- e) 6mm thick clear float glass shall be used in partition or windows where clear vision is required.
- f) 4mm thick clear float glass for windows below elevation (+)2.5M, if approved by the engineer, for office, cabin, laboratory, etc.
- g) In general, the putty shall conform to IS : 419 and be of best quality from approved manufacturer. It shall be brought to site in the manufacturer's original packing. Quick setting putty shall be used for windows and sashes except where glare reducing glass is used where it shall be non-setting type.
- h) EPDM gaskets with snap-fit glazing beads shall be fixed as per manufacturer's instructions and shall sit snugly against glass to give a leakproof installation.
- i) Thermal insulating shall be used between A/C and non-A/C areas and shall consist of two 6mm thick float bronze tinted toughened glass hermetically sealed with 12mm gap in between. Insulated glass shall be of approved manufacturer. Toughened glass shall conform to IS : 2553.

2.03.00 **Glazing, Setting and Finish**

All glazing clips, bolts, gaskets, nuts, putty, mastic cement/sealant etc. as required shall be as per approved sample.

All glass shall be thoroughly cleaned before putting in position. Each glass pane shall be held in place by special glazing clips of approved type. As specified in relevant I.S. Codes, four glazing chips shall be provided per glass pane, except for large panes where six or more clips shall be used as per Engineer's instructions. All holes that may be necessary for holding the clips glazing heads and all other attachments shall be drilled by the Contractor.

Glass panes shall be set without springing, and shall be bedded in putty and back puttied, except where moulding or gasket are specified, putty, mastic cement etc. shall be smoothly finished to the even line.

After completion of glazing work, the Contractor shall remove all dirt stains, excess putty etc. clean the glass panes and leave the work in perfectly acceptable condition. All broken cracked or damaged glass shall be replaced by new ones at the Contractor's own cost.

3.00.00 **ACCEPTANCE CRITERIA**

- a) All installation shall be free from cracked, broken or damaged glass. Edges of large panes of thicker glass and heat absorbing glass shall be inspected carefully for chipped, cracked or underground edges.
- b) Glazing shall be carefully done to avoid direct contact with metal frames.
- c) All glass shall be embedded in mastic or fixed by EPDM gaskets to give a leakproof installation.
- d) At completion, the panes shall be free from dirt, stains, excess putty etc. to the complete satisfaction of the Engineer.

4.00.00 **I.S. CODES**

Following are some of the important I.S.Codes relevant to this Section:

- | | | |
|-----------|---|---|
| IS : 3548 | - | Code of practice for glazing in building. |
| IS : 1081 | - | Code of practice for fixing and glazing metal doors, windows & ventilators. |
| IS : 2835 | - | Specification for Flat Transparent Sheet Glass. |
| IS : 2553 | - | Specification for Safety Glass. |
| IS : 5437 | - | Specification for Wired and Figured Glass. |
| IS : 419 | - | Specification for putty for use on Window Frames. |

SPECIFICATION NO. A-8

FOR

ROLLING STEEL SHUTTERS AND GRILLS

**SPECIFICATION NO. A-8
FOR
ROLLING STEEL SHUTTERS AND GRILLS**

C O N T E N T S

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4.00.00	I.S. CODE	3

**SPECIFICATION NO. A-8
FOR
ROLLING STEEL SHUTTERS AND GRILLS**

1.00.00 SCOPE

This Section covers the design, supply of materials, fabrication, delivery and erection of Rolling Shutters/Grills with motor drive and/or manual operation including all accessories as hereinafter specified.

2.00.00 INSTALLATION

2.01.00 Components

- a) Slats for rolling shutters shall be made from tested bright cold rolled, annealed M.S. strips, not less than 0.9 mm thick for shutters upto 4.5 M wide and not less than 2.25 mm thick for shutters 5.5 M wide and above, machine rolled at 75 mm rolling centres, interlocking with each other. The profile, will be such as to prevent excessive deflection under specified wind load.
- b) Rolling grills shall be constructed out of 6 mm dia. rods at 35 mm on centres running horizontally flexible connected with vertical links spaced not more than 200 mm centres. Alternatively, rolling grills shall be made from perforated slats of approved design reinforced with 6 mm dia. rods.
- c) End locks shall be heavy type M.C.I./C.I. and shall be provided at each end of alternate slats unless specified otherwise.
- d) Bottom bars shall be finished with two angles not less than 6 mm thick for external shutters. When shown on drawings, a flexible weather strip shall be applied to make tight contact with the floor.
- e) Guides shall be of such depth as to retain the shutter under a wind pressure of 150 Kg/Sq.M.
- f) Shafts shall be of steel pipe of sufficient size to carry the torsional load with a maximum deflection of 1/360th of span. Grease packed ball bearings or bushings shall be provided for smooth trouble free operation.
- g) Hoods shall be formed of not less than 1mm thick steel, suitably reinforced to prevent sag.
- h) Locks shall be slide bolt and hasp, or cylinder lock operable from one or both sides. Provision securing hand chain with pad-lock, provision for removable handle for hand cranks etc. shall be made as prescribed by the Engineer.

- i) Power unit shall be suitable for 3 phase, 50 cycle, 415 volt A.C. power supply and shall be either floor or wall mounted unit. The motor shall be of sufficient capacity to move the shutter in either direction at a speed of 0.3 metres per second. In addition to the gear motor each standard power unit shall include a magnetic brake, a reversing starter with built-in overload protection, a geared limit switch and one push button station located inside the building unless otherwise stated in drawing.

It is desirable that the bottom bar of motor operated doors shall be provided with a sensitive edge, electrically connected to stop the travel of the door on meeting an obstruction.

- j) Operating chains shall be of tested quality, heavily galvanised and with all ends rounded to assure smooth operation and hand protection.
- k) Reduction gears shall be high strength grey cast iron, machine moulded from machine out patterns.

2.02.00 **Manually Operated Shutters/Grills**

Manually operated shutters shall be easily operable by one person. The speed of operation shall be about 0.3 metres per second. In general, manually operated shutters shall be push pull type for openings upto 9Sq.M in area. Larger shutters shall be either chain and gear operated or crank and gear operated. The crank handle shall be removable. All shutters shall be lockable from one or both sides as desired by the Engineer.

2.03.00 **Power Operated Shutters/Grills**

These shall be operable from a push button station conveniently located beside the door. One emergency hand chain/crank operation shall also be provided for use in case of failure of the electric system. Where called for, externally mounted shutters shall be operated by control mechanism located inside the building.

2.04.00 **Shop Coat**

Shutters shall be painted with one coat of red lead or zinc chromate primer. Where specified, doors shall be galvanized and subsequently painted one coat of zinc chromate for adhesion of field coat.

2.05.00 **Erection**

Door shall be installed by the manufacturer or his authorised representative and all work shall be as per manufacturer's instructions. Any drilling or cutting to concrete, masonry etc. shall be made good after erection of shutters and all abrasion to shop coat shall be touched up. All electrical work shall be in strict accordance with the latest Indian Electricity Rules.

3.00.00 **ACCEPTANCE CRITERIA**

3.01.00 **Shop Inspection**

After completing the manufacture of the different components of the rolling shutter, an arrangement for shop inspection by the Engineer shall be made to check the conformity with approved shop drawings.

3.02.00 **Field Inspection**

After installing the shutters, the Contractor shall test the performance of the shutter in the presence of the Engineer. The doors shall be smoothly operable under all ambient conditions. All control and locking devices shall give fault-free performance.

3.03.00 **Guarantee**

The Contractor shall give one year's guarantee for the successful operation of the shutters. This shall be supported by a separate and unilateral guarantee from the manufacturer of the shutters.

4.00.00 **I.S. CODE**

IS : 6248 - Metal rolling shutters and rolling grills.

SPECIFICATION NO. A-9

FOR

MISCELLANEOUS METAL

**SPECIFICATION NO. A-9
FOR
MISCELLANEOUS METAL**

C O N T E N T S

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**SPECIFICATION NO. A-9
FOR
MISCELLANEOUS METAL**

1.00.00 SCOPE

This section covers supply, fabrication and erection of miscellaneous metal items of light nature in gates, grills, balcony and stair hand rails particulars, structural mullions and transoms, ladders, hangers, masonry anchors, shield anchor bolts, fasteners, etc. as shown on drawing or as instructed by the Engineer. The above items shall be of fabricated or cast M.S./aluminium/brass, cast iron, M.S. & galvanised M.S. sheets, aluminium sheets, expanded metal, wire mesh etc. as shown on drawings or specified. The scope shall further include erection of items of similar nature to this described above.

2.00.00 INSTALLATION

2.01.00 Fabrication/Casting

2.01.01 General

All work shall be done according to approved shop drawings. All workmanship shall be equal to the best practice in modern structural or foundry shop.

2.01.02 Shop Connections

- a) All shop connections shall be riveted or welded except when noted otherwise on drawings.
- b) Welding of steel shall be done in accordance with the IS:816 Use of metal arc welding for general construction in Mild Steel.
- c) Welding of aluminium shall be done in accordance with IS:2812, Arc welding of Aluminium and Alloys, Special care shall be taken to grind smooth all welded surface that shall remain exposed to view. Welds shall be electrically continuous if so required by the Engineer.

2.01.03 Shop Coat

Before leaving the shop, all metal work shall be thoroughly cleaned by effective means of all loose mill scale, rust and foreign matter. Except where encased in concrete, all steelwork shall be given one coat of approved metal protective paint, applied by brush thoroughly and evenly, well worked into joints and other open spaces. All paint shall be applied to dry surfaces. When specified steel work shall be galvanised or galvanised and painted with a coat of zinc chromate primer. Aluminium surfaces which shall come in contact with masonry shall be given one coat of bituminous paint.

2.02.00 **Erection**

2.02.01 **Bracing**

The Contractor shall provide all necessary temporary guys and braces to ensure alignment and stability of the members and to take care of all loads to which the structure may be subjected, including erection of equipment and operation of the same.

2.02.02 **Temporary Bolting-Up**

As erection proceeds the Contractor shall plump up and level all members and shall securely bolt up to take care of all dead load, wind load and erection stresses, wherever pipes or materials, erection equipment or other loads are carried during erection, proper provision shall be made to take care of the stresses resulting from the same.

2.02.03 **Turned Bolt**

For field connections where bolting is specified, holes for the turned bolts may be reamed in the field, if required. All drilling or reaming for turned bolts shall be done after the parts to be connected are assembled.

2.02.04 **Welding**

Where specified on drawings, welding shall be done in accordance with IS:816 for steel and IS:2812 for Aluminium & Alloys.

2.02.05 **Cutting and Fitting**

No cutting of sections, flanges, webs of angles shall be done without the approval of the Engineer. Where indicated on the drawings holes, cuttings, etc. shall be provided as required for installation, to the work by the other Contractors. No additional holes or cuttings, than those shown on drawings, shall be made without the approval of the Engineer.

2.02.06 **Drifting**

Correction minor misfits and a reasonable amount of reaming and cutting of excess stock from rivets may be permitted. For this, light drifting may be allowed to draw holes together. Twist drills shall be used to enlarge as necessary to make connections, Reaming that weakness the members or make it impossible to fill the holes properly or to adjust accurately after reaming shall not be allowed.

Any error in shop work which prevents the proper assembling and fitting of parts by moderate use of drift pins or a moderate amount of reaming and slight chipping and cutting shall immediately be called to the attention of the Engineer-and approval of the method of correction obtained. The use of cutting torches to enlarge or alter rivet holes shall not be permitted.

2.02.07 **Grouting**

All bearing plates, loose, lintels and beams, etc. shall be set to per grade and level by the Contractor and the Engineer's approval obtained before proceeding with the grouting. Grouting shall be done in 1:1 1/2:3 concrete with 6mm down stone chips.

2.02.08 **Anchor Bolting**

When shown on drawings, the miscellaneous metal items shall be fixed to concrete by case hardened and drawn carburizing steel expander nut and bolt. The Contractor shall submit the manufacture's literature showing the average pull out and average shear value for bolts of various sizes. The bolts shall be fixed strictly as per the manufacturers instructions.

2.02.09 **Pipe Joints**

M.S. Pipes shall be joined by threaded sockets or by welding Cast iron pipes shall be socket and spigot joined and caulked with hemp and molted head.

2.02.10 **Spot Painting**

All field rivets and bolts and also any serious abrasion to shop paint shall be spot painted with the same materials and used for the shop paint or equivalent.

2.02.11 **Making Good**

All cutting to concrete or masonry shall be made good to the satisfaction of the Engineer.

3.00.00 **ACCEPTANCE CRITERIA**

- a) All items shall be correct shape, size, weight etc. shown on drawings.
- b) For installed items, the tolerances shall be as follows :
 - i) Permissible deviation from straightness - 1 in 1000.
 - ii) Seats, stiffener connections etc. shall be as per approved drawings and shall not interfere with architectural clearances.
- c) All castings shall be free from blow holes, cracks and other blemishes.

SPECIFICATION NO. A-10

FOR

PAINTING, WHITE WASHING, POLISHING

ETC.

**SPECIFICATION NO. A-10
FOR
PAINTING, WHITE WASHING, POLISHING ETC.**

C O N T E N T S

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**SPECIFICATION NO. A-10
FOR
PAINTING, WHITE WASHING, POLISHING ETC.**

1.00.00 SCOPE

This section covers painting, white washing, varnishing, polishing etc. of both interior and exterior surfaces of wood work, masonry, concrete plastering, plaster of paris, false ceiling, structural and other miscellaneous steel items, rain water down comer, floor and roof drains, soil, waste and service water pipes, and other ferrous and non-ferrous metal items.

Copper, bronze, chromium plate, nickel, stainless steel, aluminium and monel metal shall generally not be painted or finished except if otherwise specified.

Before commencing painting, the Contractor shall obtain the approval of the Engineer in writing regarding the schedule of work to minimize damage, disfiguration or staining by other trades. He shall also undertake normal precautions to prevent damage, disfiguration or staining to work of other trades or other installations.

2.00.00 INSTALLATION

2.00.01 Materials

Materials shall be highest grade products or well-known approved manufacture and shall be delivered to the site in original sealed containers, bearing brand name, manufacturer's name and colour shade, with labels intact and seals unbroken. All materials shall be subject to inspection, analysis and approved by the Engineer. It is desired that materials of one manufacturer only shall be used as far as possible and paint of one shade is obtained from the same manufacturing batch. All paint shall be subject to analysis from random samples taken at site from painters bucket, if so desired by the Engineer.

All prime coats shall be compatible to the material of the surface to be finished as well as to the finishing coats to be applied.

All unspecified materials such as shellac, turpentine or linseed oil shall be of the highest quality available and shall conform to the latest IS standards. All such materials shall be made by reputable recognised manufacturers and shall be approved by the Engineer.

All colour shall be as per painting schedule and tinting and matching shall be done to the satisfaction of the Engineer. In such cases, where samples are required, they shall be executed in advance with the specified materials for the approval of the Engineer.

a) White Washing

Shall be done from pure shell lime or fat lime, or a mixture of both as instructed by the Engineer; and shall conform to IS:712 latest edition.

Samples of lime shall be submitted to the Engineer for approval, and lime as per approved sample shall be brought to site in unslaked condition. After slaking, it shall be allowed to remain in a tank of water for two days and then stirred up with a pole, until it attains the consistency of thin cream. 100 grams of gum to 6 litres of white wash water and a little quantity of indigo or synthetic ultramarine blue shall be added to the lime.

b) **Dry distemper**

Shall be made from suitable pigments, extenders, lime proof tinters, water soluble binders etc. and shall conform to IS:427.

c) **Acrylic Bound Washable Distemper**

Shall be of acrylic emulsion type and water based.

d) **Waterproof Cement Paint**

Shall be made from best quality white cement and lime resistant colours with accelerators, waterproofing agents and fungicides. The paint shall conform to IS:5410.

e) **Acrylic Emulsion Paint**

Shall be water-based acrylic copolymer emulsion with rutile titanium dioxide and other selected pigments and fungicide. It shall exhibit excellent adhesion to plaster and cement surface and shall resist deterioration by alkali salts. The paint film shall allow the moisture in wall to escape without peeling or blistering. The paint, after it is dried, shall be able to withstand washing with mild and water without any deterioration in colour, or without showing flaking, blistering or peeling and shall conform to IS : 5411(Part-II).

f) **Synthetic Enamel Paint**

Shall be made from synthetic resins and drying oil with rutile titanium dioxide and other selected pigments to give a smooth, hard, durable and glossy finish to all exterior and interior surfaces. White and pastel shades shall resist yellowing and darkening with aging. The paint shall conform to IS:2932 and IS:2933.

g) **Aluminium Paint**

Shall be in two pack containers and shall resist weathering. The paint shall conform to IS:2339.

h) Shall be best quality alkyd varnish suitable for brushing over the tint of paint or light natural wood and shall not darken or yellow with age.

i) **French Polish**

Shall be made from best quality shellac, denatured spirit and other suitable alcohol soluble ingredients and made by a well known approved manufacturer. The material shall conform to IS:348.

French polish shall not be used on bare wood. It shall only be used as finishing coat on wood after the wood is pretreated with a liquid wood filler conforming to IS:345 is applied and rubbed out.

2.00.02 **Storage**

The Contractor shall arrange for safe and proper storage of all materials and tools. The storage space if allotted within the building shall be adequately protected from damage, disfigurement & stains. Paint shall be kept covered at all times and mixing shall be done in suitable containers. All necessary precautions shall be taken by the Contractor to prevent fire.

2.01.00 **Preparation of Surface**

Before starting the work the Contractor shall obtain the approval of the Engineer regarding the soundness & readiness of the surface to be painted on.

2.01.01 **Wood**

All surfaces shall be free from dirt and loose or peeling paints. The surface shall be rubbed down smooth. All nails & screws shall be sunk below the surface and filled with putty after applying an under coat. Small knots that do not justify cutting and sap streaks shall be covered with minimum 2 coats of pure shellac coating applied thinly & extended 25 mm beyond the area. All large, loose or resinous knots shall be removed and filled with sound wood. All work shall be done as per IS:2338.

2.01.02 **Masonry, Concrete and Plastered Surface**

Surface shall be free from all oil, grease, efflorescence, mildew, loose paint or other foreign and loose materials. Masonry cracks shall be cleaned out and patch filled with mortar similar to the original surface and uniformly textured. Where this type of resurfacing may lead to the finishing paint being different in shade from the original surfaces, the resurfaces area shall be treated with minimum one coat of cement primer which should be continued to the surrounding area for a distance of minimum 100 mm.

Surface with (a) mildew or (b) efflorescence shall be treated as below :

a) **Mildew**

All mildewed surfaces shall be treated with an approved fungicide such as ammoniacal wash consisting of 7g of copper carbonate dissolved in 80 ml. liquor ammonia and diluted to 1 litre with water, or 2.5 percent magnesium silicofluoride solution and allowed to dry thoroughly before paint is applied.

b) **Efflorescence**

All efflorescence shall be removed by scrubbing affected surface with a solution of muriatic acid and water (1:6 to 1:8) and washed fully with clear water and allowed to dry thoroughly.

2.01.03 **Metal**

All metal surface shall be absolutely clean, dry and free from wax, grease or dried soap films. In addition, all steel and iron surfaces shall be free from rust, surfaces shall be cleaned by mechanical power tools to remove mill scales unless otherwise approved by the Engineer for exposed chemical resistant paints, surfaces shall be blast cleaned to near white metal. All galvanised iron surfaces shall be pretreated with a compatible primer according to the manufacturer's direction. Any abrasion in shop coat shall be touched up with the same quality of paint as the original coat.

2.02.00 **Application**

2.02.01 **General**

The method of application shall be as recommended by the manufacturer. In case of selection of special shades and colour (not available in standard shades) the Contractor shall mix different shades and prepare test panels of minimum size 1 meter square as per instruction of the Engineer and obtain his approval prior of application of finishing paints.

Proper tools and implements shall be used. Scaffolding if used shall be independent of the surface to be painted to avoid shade differences of the freshly repaired anchor holes.

Painting shall be done by skilled labours in a workmanlike manner. All materials shall be evenly applied so as to be free of sags, runs, crawls or other defects. All coats shall be of proper consistency. In case of application by brush, no brush marks shall be visible. The brushes shall be clean and in good condition before application of paint.

All priming undercoats for painting shall be applied by brush only, and rollers spray equipments etc. shall not be used.

No work shall be done under conditions that are unsuitable for production of good results. No painting shall be done when plastering is in progress or is drying. Application of paint which seals the surfaces to moisture shall only be done after the moisture on and below the surface has dried out.

All coats shall be thoroughly dry before succeeding coat is applied. Coats of painting as specified are intended to cover surfaces perfectly. In case the surface is not covered properly by applying the specified number of coats, further coats shall be applied by the Contractor when so desired by the Engineer.

All primers and undercoats shall be tinted to approximate the colour of the finishing coats. Finished coats shall be of exact colour and shade as per approved samples and all finish shall be uniform in colour and texture. All parts of mouldings and ornaments shall be left clean and true to finish.

Painting on ferrous metal surface shall be done as per IS:1477 (Part 1 & 2). The total dry thickness of the film should not be less than 120 micron.

2.02.02 **White Washing**

The surface where white washing is to be applied shall be cleared of all loose materials and dirt. All holes and irregularities of the surface shall be filled up with lime putty and shall be allowed to dry up before application of the lime solution.

One coat of whitewash shall consist of one stroke from top downwards, another from bottom upwards over the first stroke and another from left to right before the previous one dries up. Second coat shall be applied and in case the Engineer feels that one or more coats are required the Contractor shall do so without any extra cost to the Owner. No brush marks shall show on the finished surface.

2.02.03 **Dry Distemper**

New plastered surface shall be allowed to dry for at least two months. New lime or lime cement plastered surface shall be washed with a solution of 1 part Vinegar to 12 parts water or 1:50 sulphuric acid solution and for 24 hours after which the wall shall be thoroughly washed with clean water. For cement plastered surface, the surface shall be washed with a solution of 100 gms. of zinc sulphate to 1 litre of water and then allowed to dry.

Dry distempering shall be done as per manufacturer's instruction. In applying the distempers the brush should first be applied horizontally and immediately crossed off perpendicularly. Brushing shall not be continued too long as otherwise brush marks may result.

2.02.04 **Acrylic washable distemper**

The acrylic washable distemper shall be applied after surface is primed with a primer, and followed by minimum two coats of acrylic washable distemper all as per manufacturer's instruction.

2.02.05 **Waterproof Cement Paint**

Surface to be coated with cement paint shall be washed and brushed down. As soon as the moisture has disappeared, the surface shall be given one coat of paint. Care shall be taken so that the paint does not dry out too rapidly. After 4 to 6 hours, the water shall be sprinkled over the surface to assist curing and prevent cracking. After the first coat has dried (24 to 48 hours) the second coat shall be applied in a similar manner. The finished surface shall be kept moist by occasional sprinkling with water for seven days after painting.

2.02.06 **Acrylic Emulsion Paint**

Lime gauged cement plastered surfaces shall not be painted for at least one month after plastering. A sample patch shall be painted to check alkali reaction if so desired by the Engineer. Painting shall be strictly as per manufacturer's specification. Minimum two coats of paints shall be provided over a coat of cement primer.

2.02.07 **Synthetic Enamel Paint**

Shall be applied on properly primed surface. Subsequential coat shall not be applied till the previous coat is dry. The previous shall be lightly sand papered for better adhesion of subsequent coats. Minimum two coats shall be applied.

2.02.08 **Aluminium Paint**

The paint, supplied in two pack containers shall be mixed and applied strictly as per manufacturer's direction. When more than one coat of paint is required or indicated, the next coat shall only be applied after the previous coat become hard dry.

2.02.09 **Clear Synthetic Varnish**

The Varnish shall be applied on wood surface after (a) filling, (b) staining & (c) sealing operations are carried out. The application of a combination of filler and stain shall not be permitted.

For the finishing coats of varnish, the surface shall be allowed to dry and be rubbed down lightly, wiped off and allowed to dry. Careful attention to cleanliness is required for varnishing. All dust and dirt shall be removed from the surface as well as from the neighbourhood. Damp atmosphere and draughts shall be avoided, and exposure to extreme heat or cold & dampness shall not be allowed.

The varnish shall be applied liberally with a brush and spread evenly over a portion of the surface with light strokes to avoid frothing. It shall be allowed to flow on while the next section is being laid on excess varnish shall then be scrapped off the brush and the first section be crossed, recrossed and then laid off lightly. The varnish once it has began to set, shall not be retouched. In case of any mistake in application, the varnish shall be removed and the work started afresh.

The varnish shall be minimum of two coats, with the first coat being a flatting varnish. This shall be allowed to dry hard and be flatted down, before applying the next coat. Sufficient time must be allowed between coats to get a hard dry surface before next coat is applied. All work shall be as per relevant IS Code.

2.02.10 **French Polish**

All unevenness of the surface shall be rubbed down to smoothness with sand paper and the surface shall well dusted. The pores in the wood shall be filled up with a paste of whiteing in water or methylated spirit with a suitable pigment like burnt siemme or umber.

After application of the filler paste, the french polish shall be applied with a pad of woolen cloth covered by a fine cloth. The pad shall be moistened with polish and rubbed hard on the surface in a series of overlapping circles so that the polish is sparingly but uniformly applied over the entire area to give an even surface. A trace of linseed oil may be used on the pad for ease of application. The surface shall be allowed to dry before further coats are applied in the same manner. To finish off, the pad shall be covered with a fresh piece of clean fine cloth, slightly dampened with methylated spirit and rubbed lightly and quickly with circular motions to leave the finished surface with a uniform texture and high gloss.

2.02.11 **Chemical Resistant Paint**

For chemical resistant paints, epoxy, chlorinated rubber or vinyl butryl paint system shall be used manufacturer's recommendation regarding the paint system exposed to moderately severe corrosive condition and subject to acid/alkali spillage and fumes, shall be followed.

2.02.12 **Acrylic Exterior Paint**

Acrylic exterior paint shall be weather resistant paint and shall be of quality to resist scorching sun, battles torrential rain, withstand the toughest tropical fungi and water repellant and suitable for coastal areas also. The paint film shall be capable of withstanding expansion and contraction of the structure due to extreme temperature and also withstand vibration. Paint shall be of pure acrylic copolymer base.

The surface shall be absolutely clean before application of paint. All minor cracks and defects shall be rectified with cement sand 1:3 and made smooth. In no case putty or any filling compound shall be used to fill up the crack or any unevenness.

Minimum two coats of paint shall be provided with 2-4 hours between the coats or as instructed by the manufacturer. For parapet minimum 3 coats of paint shall be provided. No primer shall be applied.

2.03.00 **Protection**

Furniture and other movable objects, equipment, fittings and accessories shall be moved, protected and replaced upon completion of work. All stationary equipment shall be well covered so that no paint can fall on them. Work finished by other agencies shall be well protected. All protections shall be done as per instructions of the Engineer.

2.04.00 **Cleaning up**

In addition to provisions in general conditions the Contractor shall, upon completion of painting etc. remove all marks and make good surfaces, where paint has been spilled, splashed or splattered, including all equipment, fixtures, glass, furniture, fittings etc. to the satisfaction of the Engineer.

3.00.00 **ACCEPTANCE CRITERIA**

- a) All painted surfaces shall be uniform and pleasing in appearance.
- b) All varnished surfaces shall be of uniform texture and high glossy finish.
- c) The colour, texture etc. shall match exactly with those of approved samples.
- d) All stains, splashes and splatters of paints and varnishes shall be removed from surrounding surfaces.

4.00.00 **I.S. CODE**

Important relevant IS Codes for this Sections are listed below :

IS:348	:	Specification for French Polish
IS:427	:	Specification for Distemper, dry colour as required.
IS:428	:	Specification for Distemper oil emulsion, colour as required.
IS:1477	:	Code of Practice for painting of (I&II)ferrous metal in buildings.
IS:2338	:	Code of Practice for finishing of (I&II)wood and wood based materials.
IS:2339	:	Specification for Aluminium Paints for general purposes in dual containers.
IS:2395	:	Code of Practice for painting concrete, masonry and plaster surface.
IS:2932	:	Specification for enamel, synthetic, exterior, type-I.
IS:5410	:	Specification for cement\paint, colour as required.

SPECIFICATION NO. A-11

FOR

**ROOF WATER PROOFING,
INSULATION AND ALLIED WORKS**

**SPECIFICATION NO. A-11
FOR
ROOF WATER PROOFING,
INSULATION AND ALLIED WORKS**

C O N T E N T S

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**SPECIFICATION NO. A-11
FOR
ROOF WATER PROOFING,
INSULATION AND ALLIED WORKS**

1.00.00 SCOPE

This section covers furnishing, installation, repairing, finishing, curing, testing, protection, maintenance till handing over of roof water-proofing, insulation and allied works for buildings and at locations covered under the scope of this package.

2.00.00 INSTALLATION

2.01.00 Grading Underbed

The surface to receive the underbed shall be roughened and thoroughly cleaned with wire brush and water. Oil patches if any shall be removed with detergent. The surface shall be soaked with water and all excess water removed just before laying of the underbed.

The underbed shall not be laid under direct hot sun and shall be kept in shade immediately after laying so as to avoid quick loss of water from the mix and separation from the roof surface. The underbed shall be cured under water for at least 7 days.

The underbed shall be laid to provide an ultimate run off gradient not less than 1 in 100 and as directed by the Engineer. Upto an average thickness of 25mm the underbed shall usually be composed of cement and sand plaster. For higher thickness the underbed shall be made with cement concrete.

The underbed shall be finished to receive the waterproofing treatment direct or insulation as the case may be.

2.01.01 Plaster

The grading plaster shall be average 25 mm thick maximum. It shall consist of cement and coarse sand in the ratio 1:3 nominal by volume. The sand and cement shall be thoroughly mixed dry and then water added. Each batch of mix shall be consumed before the initial set starts.

The plaster shall be fully compacted to the desired grade in continuous operation. The surface shall be even and reasonably smooth.

2.01.02 Concrete

The concrete shall be used where the sub grade is more than average 25mm thick. It shall consist of cement concrete 1:2:4 nominal mix by volume with 12mm down stone chips and coarse sand. The aggregate shall be mixed dry and minimum quantity of water shall be added to make the mix workable.

The mix shall be laid to proper grade, fully consolidated and surface shall be smooth and even.

2.02.00 **Insulation**

The Tenderer shall along with the tender send specifications of insulating materials he proposes to use and the proposed method of laying. Before bulk supply, the contractor shall send samples of insulating material to the Engineer, and after approval of the samples, the Contractor shall procure and transport the bulk material to the site. Whenever asked by the Engineer, the Contractor shall furnish test certificates from testing laboratory on the insulating and other properties of the materials.

After laying the insulation the surface shall be made ready as required to receive the waterproofing treatment. If any plastering is used it shall be not leaner than 1:4 cement sand by volume and not thinner than 18mm and it shall be cured for seven days.

2.02.01 **Foam Concrete**

This shall be of light weight foam concrete of average 50 mm thickness or as specified or as shown on drawings. This may be laid in situ in suitable panels or in precast blocks. The insulating properties shall be such that the thermal conductivity shall not exceed 0.125 Kcal m/sq.m h degree C. The weight of the insulating material shall be from 0.3 to 0.5 gm/cu.cm.

Before starting the laying of foam concrete samples shall be prepared at site and got tested for approval of the Engineer.

The foam concrete laid shall be sufficiently strong to make the usual work load and standard loads expected on the roof. Any damaged portion shall be removed and replaced forthwith. Approval of the Engineer shall be taken before laying the waterproofing over the insulation.

While laying the foam concrete, samples from each batch of the mix shall be kept for test if so desired by the Engineer.

2.02.02 **Expanded Polystyrene Blocks**

The expanded polystyrene block insulation shall be fire retardant quality and shall have a maximum thermal conductivity of 0.026 Kcal m/sq.m h degree C. It must be strong enough to withstand without deformation the workload and standard loads expected on the roof.

The Contractor shall lay the expanded polystyrene block as per manufacturer's approved specification. Only specifically experienced workers shall be used for this work. If the Engineer is not satisfied about the efficiency of the workers the Contractor shall secure manufacturers' supervision at no extra cost to the Owner.

2.03.00 **Fillets**

Fillets at junction of roofs and vertical walls shall be provided with the same insulating material as provided for the main roof insulation. The fillets shall be 150 mm x 150 mm in size unless otherwise shown on drawings or instructed by the Engineer.

Where there is no insulation over roof slab, fillets shall be cast-in-situ cement concrete (1:2:4) nominal mix by volume.

2.04.00 **Waterproofing**

Waterproofing treatment shall be laid by a specialist firm with long experience in the particular trade.

The waterproofing treatment for roofs with Bitumen Felts shall be done following relevant IS:1346. Bitumen felt shall conform to IS:1322 and Bitumen primer to IS:3384.

The bonding materials shall consist of blown type conforming to IS:702 or residual bitumen to IS:73 or a mixture of the two to withstand local conditions of prevailing temperature or gradient of roof surface. The Contractor shall convince the Engineer that the bonding material proposed to be used is suitable for the particular job.

The Contractor shall state the source from where he proposed to procure the materials. Samples of the self finished felt shall be submitted in advance to the Engineer along with test certificates for his review. Test certificates for the bonding materials shall also be submitted and samples, if desired by the Engineer, shall be provided for confirmatory tests. Samples of pea sized gravel shall be submitted if instructed by the Engineer.

Minimum overlaps of 100 and 75 mm shall be given at the end and sides of strips of felt and properly bonded with bitumen. Joints in successive layers of felt shall be staggered.

Normal treatment with one layer of felt, heavy treatment with two layers of felt or Extra Heavy treatment with three layers of felt shall be indicated. Brief details of the various treatments shall be as follows :

a) **Normal Treatment - Four courses**

- 1) Hot applied bitumen at the rate of 1.2 kg/sq.m Min.
- 2) Hessian base self finished felt, type 3, grade 1.
- 3) 20 mm thick pressed precast concrete tiles with 15 mm thick 1:4 cement-sand mortar underbed.

b) **Heavy Treatment - Six Courses**

With Hessian base felt

- 1) Hot applied bitumen at the rate of 1.2 kg/sq.m Min.
- 2) Hessian base self-finished felt, type 3, grade 1.
- 3) Hot applied bitumen at the rate of 1.2 kg/sq.m Min.
- 4) Hessian base self-finished felt, type 3, grade 1.
- 5) 20 mm thick pressed precast concrete tiles with 15 mm thick 1:4 cement:sand mortar underbed.

or

With fibre base felt

- 1) Hot applied bitumen at the rate of 1.2 kg/sq.m Min.
- 2) Fibre base self-finished felt, type 2, grade 2.
- 3) Hot applied bitumen at the rate of 1.2 kg/sq.m Min.
- 4) Fibre base self-finished felt, type 2, grade 2.
- 5) 20 mm thick pressed precast concrete tiles with 15 mm thick 1:4 cement:sand mortar underbed.

c) **Extra Heavy Treatment - Eight courses**

With fibre based felt

- 1) Hot applied bitumen at the rate of 1.2 kg/sq.m Min.
- 2) Fibre-base self-finished felt type 2, grade 1.
- 3) Hot applied bitumen at the rate of 1.2 kg/sq.m Min.
- 4) Fibre base self-finished felt type 2, grade 1.
- 5) Hot applied bitumen at the rate of 1.2 kg/sq.m Min.
- 6) Fibre base self-finished felt type 2, grade 1.
- 7) 20 mm thick pressed precast concrete tiles with 15 mm thick 1:4 cement:sand mortar underbed.

or

With Hessian base felt

- 1) Hot applied bitumen at the rate of 1.2 kg/sq.m Min.
- 2) Hessian base self-finished felt, type 3, grade 1.
- 3) Hot applied bitumen at the rate of 1.2 kg/sq.m Min.
- 4) Hessian base self-finished felt, type 3, grade 1.
- 5) Hot applied bitumen at the rate of 1.2 kg/sq.m Min.
- 6) Hessian base self-finished felt, type 3, grade 1.
- 7) 20 mm thick pressed precast concrete tiles with 15 mm thick 1:4 cement:sand mortar underbed.

However, in special cases, more courses or a combination of fibre base and hessian base felts may be asked for.

The surface to receive the waterproofing treatment must be cleaned and dried satisfactorily and the Engineer's approval taken before starting the work. If any existing waterproofing treatment is being augmented the existing top course shall be completely removed and all damaged felts or other defects repaired.

The Engineer may instruct the Contractor to lay part of the stipulated courses at the first instant to be followed later on with the balance courses. This interim finish shall be done with a course of hot applied bitumen. While doing the balance again hot bitumen shall be applied to start with after repair of all damages to the already laid course.

After completion the surface shall be cleaned taking care that felt cuttings etc. do not find their way into rain water down comers.

2.04.01 Waterproofing by epoxy resin based application

Exposed surfaces of cement concrete, lime concrete or brickwork to be treated for waterproofing by the resin based application shall be thoroughly cleaned and the epoxy resin based material to be applied as directed by the manufacturer. The material shall not have any adverse effect on the surface on which it is applied and must stick to it uniformly to make a strong durable bond. It shall not be affected by short duration from fire, sun, light traffic. The application shall be resistant to growth of fungus and proof against saltpeter action. If desired by the Engineer, a sample shall be prepared in advance and tested for waterproofness for 48 hours under 300 mm depth of standing water. The Contractor shall arrange the demonstration by providing free the materials and labours for the application. This item shall carry a guarantee as specified.

2.04.02 Flashing

Unless otherwise stated flashing shall be done in the same way as the waterproofing except that the last layer shall be finished with two coats of bituminous primer. The flashing shall be extended up the vertical surfaces as

shown on drawing. The flashing shall end in grooves in vertical walls. The grooves shall be at least 65 mm deep and caulked with waterproof mastic cement. The minimum overlap with horizontal roofing felt shall be 100 mm.

Where specified or directed by the Engineer, metal flashing shall be provided. The materials shall be 18g. or 22g. G.I. sheets, as specified or as directed by the Engineer.

3.00.00 **ACCEPTANCE CRITERIA**

The surface level shall be such as to allow quick draining of rains without leaving any pool anywhere. The finishing course shall be fully secured and shall have an even density. There shall not be any bubble formation or crushed or squeezed insulation or underbed.

The Contractor shall give a guarantee in writing for all works executed under this specification supplemented by a separate and unilateral guarantee from the specified agency for the roof waterproofing treatment work. The guarantee shall be for materials and workmanship for 5 years in case of normal treatment, 10 years for heavy treatment and 20 years for extra heavy treatment. The mode of execution of the guarantee shall be acceptable to the Owner.

4.00.00 **I.S. CODES AND STANDARDS**

- | | | | |
|----|---------|---|---|
| a) | IS:73 | : | Paving Bitumen |
| b) | IS:702 | : | Industrial Bitumen |
| c) | IS:1203 | : | Methods of testing tar and bitumen |
| d) | IS:1322 | : | Bitumen felts for waterproofing and damp proofing. |
| e) | IS:1346 | : | Code of practice for waterproofing of roofs with bitumen felts. |
| f) | IS:3384 | : | Bitumen primer for use in water-proofing and damp proofing. |

SPECIFICATION NO. A-12

FOR

WATER SUPPLY

**SPECIFICATION NO. A-12
FOR
WATER SUPPLY**

C O N T E N T S

CLAUSE NO.	DESCRIPTION	PAGE NO.
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4.00.00	I.S.CODES.....	7

**SPECIFICATION NO. A-12
FOR
WATER SUPPLY**

1.00.00 SCOPE

This section covers supply of all materials, labour and incidentals for water supply for residential, business and industrial and other types of buildings. The water supply system of a building or premises covers service pipes and the necessary connecting pipes, fittings, control valves and all appurtenances in or adjacent to the building or premises.

1.01.00 Materials

All materials, fittings, fixtures and appliances shall be of the best quality conforming to relevant Indian Standard and shall be procured from approved manufacturers. Unless specifically allowed by the Engineer, the Contractor shall submit samples of fittings and fixtures which will be retained by him for comparison when bulk supplies are received at the site. Ultimate choice of type, model and manufacturer lies completely with the Engineer.

It shall be the responsibility of the Contractor to procure the materials selected by the Engineer. Hence order are to be placed with the manufacturers in time, so that the materials are available at the site well ahead of their requirement.

The materials brought to the site, shall be stored in a separate secured enclosure away from the building materials. Pipe threads, sockets and similar items shall be specially protected till final installation. Brass and other expensive items shall be kept under lock and key. Fragile items shall be checked thoroughly when received at the site and items found damaged shall not be retained at the site.

1.02.00 Pipes and Pipe Fittings

Under this Section, pipes and pipe fittings may be any or a combination of the following types :

- a) Cast Iron
- b) Steel : lined, coated with bituminous composition, out coated with cement concrete or mortar or galvanised.
- c) Reinforced Concrete
- d) Prestressed Concrete
- e) Asbestos cement
- f) Lead (Not to be used for potable water)

- g) P.V.C.
- h) Copper
- i) Brass
- j) Wrought iron
- k) G.I. Pipe

1.03.00 **Water Reservoirs**

Water reservoirs like pressed steel tanks and G.I. tanks shall come under this Section. Reservoirs made of concrete masonry or fabricated steel shall be covered by respective work specifications.

1.04.00 **Related Works**

All works, like earthwork, masonry, concrete, steelwork, cutting holes, chases, repairs and rectification associated directly with installation of water supply systems shall come under scope of the Contractor unless specifically excluded. These works are not detailed out in this Section.

1.05.00 **Regulation**

The work which is required to be carried out under this section, shall be executed by a licensed Plumber only (engaged by the Contractor) and he shall obtain all necessary sanctions, permissions, certificates etc. from Municipal and/or other Local Authorities and shall abide by all the rules of such Authorities.

2.00.00 **INSTALLATION**

While basic layouts may be available in the drawings provided, the details might have to be supplemented by the Contractor for approval of the Engineer.

Special attention shall be given by the Contractor to economy. Symmetry of layout is very important. Fittings meant for operation shall be located and oriented to allow easy reach and operation. Maintenance, repairs and replacements of pipes, fittings and fixtures must be conveniently possible.

2.01.00 **Pipe Lines**

2.01.01 **Laying**

In addition to fulfilling the functional requirements all pipelines shall be laid true to line, plumb and level. Any deviation shall need approval of the Engineer. Meticulous care shall be taken to avoid chances of airlock and water hammer.

Pipes shall be laid on continuous unyielding surface or on reliable supports at least one near each joint and spacings as directed by the Engineer. The support must be strong, neat and shall have provisions for securing the pipes in every direction and easy maintenance. Pipes shall be encased or concealed in masonry or concrete if shown on drawing or directed by the Engineer.

2.01.02 **Back Flow**

The layout of pipe work shall be such that there is no possibility of back flow towards the source of supply from any cistern or appliances, whether by siphonage or otherwise. All pipe works shall be so laid or fixed and maintained as to be and to remain completely water-tight, thereby avoiding waste of water, damage of property and the risk of contamination of the water conveyed.

2.01.03 **Contamination**

There shall be no cross connection whatsoever between a pipe or fitting for conveying or containing wholesome water and a pipe or fitting for containing impure water or water liable to contamination or of uncertain quality of water which has been used for any purpose.

No piping shall be laid on fixed so as to pass into or through any sewer, scour outlet or drain or any manhole connected therewith.

2.01.04 **Underground Pipings**

Underground piping shall be laid at such a depth that it is not likely to be damaged by traffic and other loads and frost, where applicable.

The size and depth of the trench shall be as approved by the Engineer. Back-filling shall be done with selected fine earth, unless otherwise permitted, in 150 mm layers and carefully consolidated. Special care shall be taken while filling in the vicinity of the pipe to avoid damage. Before backfilling the laid pipe shall be fully tested and approved.

Where the pipe rests on rock it may be bedded on a layer of fine selected material or concrete to avoid local point support.

The trench shall be so treated by gradient and filling in the area that it does not act as a drainage channel.

2.01.05 **Concealed Piping**

Where desired by the Engineer or shown on the drawings the pipes shall be concealed in masonry or concrete of the structure. The Contractor may co-ordinate with the building Contractor for leaving the chases, openings, conduits as necessary. However, the Contractor will rectify if required the chases, openings and conduits, supplement and make good after laying and testing of the concealed pipelines.

2.01.06 **Jointing of Pipes**

Jointing of pipes shall be completely leakproof and durable. Instruction of the manufacturer shall be followed unless desired otherwise by the Engineer. However, usually recommended practices are stated below for guidance :

a) **Cast Iron**

i) **Spigot and Socket Joints**

Lead Joint : The joint is made by first caulking in clean spun yarn upto half depth and filling the remainder by running in molten lead taking care that no dross enters the joint and then thoroughly caulking the lead. The lead need not extend into the joint further than the back of the groove formed in the socket. After completing the joint it shall not be allowed to move. For rectification the joint shall be completely redone.

ii) **Flanged Joints** : Flanged joints shall be made by jointing rings of good quality, smooth and hard compressed fibre board of thickness not less than 1.5 mm and of such width as to fit inside the circle of bolt. Diagonally opposite bolts shall be tightened in pairs and in stages so that degree of all bolts in a joint are similar. Damaged gaskets shall be replaced.

b) **Steel**

Plain ended steel pipes may be jointed by welding. Screwed and socketed joints shall be carefully tightened. Care shall be taken to remove any burr from the ends of the pipes. Jointing compound, if used, shall be lead free and approved by the Engineer.

c) **G.I. Pipes**

Threads shall be cut with sharp tools, and before jointing all scales shall be removed from pipes by suitable means. The screw/threads of the pipe shall be cleaned out and the joint made by screwing the fittings after treating the threads with approved pipe jointing compound. Once a joint has been screwed up it shall not be backed off unless threads are recleaned and new compound applied.

d) **Asbestos Cement Pipes**

Socket and spigot ended pipes shall be jointed by caulking with tarred gaskets and grouted with 1:3 cement sand mortar.

e) **Lead**

Lead and lead alloy pipes shall be jointed with wiped solder joints.

f) **Concrete**

Concrete pipes may be socket and spigot ended, collar or band jointed. Joints shall be effected by caulking with 1:3 cement sand mortar.

g) **P.V.C.**

Manufacturer's instruction shall be followed. For heating approved equipment with adequate control shall be used.

h) **Tyton Joint**

The manufacturer's instruction shall be strictly followed in making such joints. Tyton joints shall be made by push-on type specification stipulated by the pipe manufacturer. The tools specified by the pipe manufacturer shall be used to secure the joint fully.

2.01.07 **Painting**

Where required, underground steel and cast iron pipes shall be given 2 coats of bituminous paint on the outside after laying, when painting is to be done above ground G.I. pipes shall be given a coat of zinc chromate primer, G.I. and M.S. pipes shall be given one coat of red lead or zinc chromate primer. Top coats shall be minimum 2 coats of best quality paint.

2.02.00 **Storage Tank - Pressed Steel Tank**

Unless otherwise mentioned, water storage tanks for auxiliary buildings other than those already specified in Volume : IID, shall be pressed steel tanks of nominal size and capacity as required and fabricated with all flanges external, all flanges internal, or bottom flange internal and side flanges external. The fabricator shall supply 6 prints of fabrication drawings to the Engineer for prior approval showing thickness of plates, method of jointing the plates, all supports, stays, gussets etc. Pads, cleats etc. required for supporting the tanks shall be supplied by the manufacturer. Inlet, overflow vent pipes, manholes etc. shall be arranged and provided as required. Unless otherwise specified, the outlet pipe shall be 50 mm above the bottom of the tank and there shall be a 150 mm free board at the top of the tank.

All tanks shall be supplied with mosquito-proof covered top with manhole not less than 450 mm diameter. Tanks deeper than 1.00 Metre shall be provided with m.s. internal access ladder adjacent to the manhole. Water level indicator shall be provided if required. Two coats of anti-corrosive paint over a suitable primer shall be applied to both internal and external surface of tanks. Such paint if used shall/ not impart any taste or odour to water and be of lead free composition.

Erection of tanks shall be in accordance with detailed drawings and manufacturer's instructions. The two finishing coats of paint shall be applied to outside after erecting is complete.

2.02.01 **G.I. Water Tank**

G.I. Water tanks shall be procured from a reputed manufacturer. The design shall be good enough to withstand the loads safely. Galvanised iron water storage tank shall be made of minimum 2 mm thick galvanised iron sheet. Plain sheets shall be fixed at the corner to angle iron frames by means 6 mm rivets at 40 mm pitch for tanks upto 1000 litres capacity and 8 mm rivets at 35 mm pitch for tanks above 1000 litres capacity. Tanks above 1000 litres shall have 20 mm dia. galvanised/iron stay rods, one fixed to angle framing at top & two in the body of the tank for extra strength. Holes for rivetting shall be drilled and not punched. White lead shall be applied to the joints before rivetting.

In case it is desired by the Engineer that corners of tank should be welded instead of rivetted then the sheets shall be welded to form a tank will not have angle iron frame.

Tanks shall have 400 mm dia. holes at the top with hinged covers. The covers shall be made of galvanised iron sheet with angle iron frame. The cover shall be just loose but close fitting to keep out dust and mosquito and will not be airtight. It shall be complete with lockable arrangement.

Tanks shall be provided with rising main inlets of 40 mm dia. galvanised iron pipe or as shown on Drawing and 25 mm dia. G.I. overflow pipe. The rising main shall be connected to the tank with a ball valve near the top which disconnects the supply when tank is full up to the point of overflowing.

The ball valve permits the entry of water when the tank is empty and disconnects the supply when the tank is full. It consists of a hollow floating ball made of copper, plastic or hand Tubber, 110 mm in diameter, attached to an arm which is so pivoted that the end near the pivot closes the orifice of the main when the ball is raised to the required height of water in the tank and opens the main as soon as the ball drops with the fall of water level as it is drawn off through the distribution pipes. The ball valve shall be fixed to the tank independent of the inlet pipe and set in such a position that the body of the ball valve cannot submerge when the tank is full upto the water line. The ball valve shall be so adjusted as to limit the level of the water line. The level of the water in the tank to 75 mm below the lip of the overflow pipe. Free surface shall be about 150 mm above the maximum water filled level.

2.03.00 **Valve, Cocks, Taps**

All valves, stop cocks, taps etc. shall conform to relevant Indian Standard Specification and shall be of best quality from approved manufacturers. These shall be suitable for normal working pressures. Nominal size and material shall be as required.

2.04.00 **Protection**

Open end of each pipe shall be protected during installation by suitable covers or plugs so that the ends, threads, sockets or spigot are not damaged and no foreign material can find its way into the pipe line.

Fittings and fixtures liable to be misused or stolen during the construction phase shall be fitted only before testing and handing over.

3.00.00 **TESTING AND ACCEPTANCE CRITERIA**

3.01.00 **Inspection Before Installation**

All pipes, fittings and appliance shall be inspected, before delivery at the site to see whether they conform to accepted standards. The pipes and fittings shall be inspected on site before laying and shall be sounded to disclose cracks. Any defective items shall be clearly marked as rejected and forthwith removed from the site.

3.02.00 **Testing of Mains After Laying**

After laying and jointing, the main shall be slowly and carefully charged with water, so that all air is expelled from the main by providing a 25 mm inlet with a stop-cock, allowed to stand full of water for a few days if time permits, and then tested under pressure. The test pressure shall be 5 Kg/sq.cm or double the maximum working pressure, whichever is greater. The pressure shall be applied by means of a manually operated test pump, or in the case of long mains or mains of a large diameter, by a power driven test pump, provided that the pump is not left unattached. In either case due precaution shall be taken to ensure that the required test pressure is not exceeded. Pressure gauges shall be accurate and shall preferably have been recalibrated before the test. The pump having been stopped, the test pressure shall maintain itself without measurable less for at least five minutes. The end of the main shall be closed by fitting a water-tight expanding plug and the plug shall be secured by struts to resist the end thrust of the water pressure in the mains.

3.03.00 **Testing of Service Pipes and Fittings**

The service pipes shall be slowly and carefully charged with water allowing all air to escape avoiding all shock or water hammer. The service pipe shall then be inspected under working conditions of pressure and flow. When all draw-off taps are closed, the service pipes shall be absolutely water-tight. All pipings, fittings and appliances shall be checked for satisfactory support and protection from damage, corrosion and frost.

4.00.00 **I.S.CODES**

Important relevant IS Codes for this Specification are listed below :

Latest editions shall always be consulted.

IS : 2065	:	Code for Practice for Water Supply in buildings.
IS : 1172	:	Code of basic requirements for water supply, drainage and sanitation.
IS : 1200	:	Laying of water and sewer lines including (Pt.XVI) appcurtnant items.
IS : 1239	:	Specification for Mild Steel Tubes and Mild Steel (Pt.I & III) Tubulars and other wrought steel pipe fittings (10 mm to 15 mm nominal diameter).
IS : 1536	:	Specification for Centrifugally cast (Spun) iron pressure pipes for water gas and sewage.
IS : 1537	:	Specification for vertically cast iron pressure pipes for water, gas and sewage.
IS : 3486	:	Specification for Cast iron spigot and socket drain pipes (80 mm to 250 mm nominal diameter).

IS : 3589	:	Specification for Electrically welded steel pipe for water, gas & sewage (200 mm to 2000 mm nominal diameter).
IS : 784	:	Prestressed concrete pipes.
IS : 458	:	Concrete pipes (with or without reinforcement)
IS : 783	:	Code of Practice for laying of concrete pipes.
IS : 1592	:	Asbestos cement pressure pipes.
IS : 1626	:	Asbestos cement pressure pipes, gutters and fittings (Spigot and Socket types).
IS : 404	:	Lead pipes.
IS : 3076	:	Low density polyethylene pipes for portable water supplies.
IS : 4984	:	High density polyethylene pipes for portable water supplies.
IS : 2501	:	Copper tubes for general engineering purposes.
IS : 407	:	Brass tubes for general purposes.
IS : 1230	:	Cast iron rain water pipes and fittings.
IS : 804	:	Rectangular pressed steel tanks.

SPECIFICATION NO. A-13

FOR

SHEET WORK IN ROOF AND SIDING

**SPECIFICATION NO. A-13
FOR
SHEET WORK IN ROOF AND SIDING**

C O N T E N T S

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**SPECIFICATION NO. A-13
FOR
SHEET WORK IN ROOF AND SIDING**

1.00.00 SCOPE

This section covers the supply & erection of asbestos, C.G.I., aluminium or other sheet covering to roof and side walls at various elevations and the fabrication and/or installation of asbestos, C.G.I. or aluminium gutters, flashings etc., as specified.

2.00.00 INSTALLATION

2.01.00 Storage of Materials

All materials shall be stored by the Contractor in proper way to prevent all damage.

2.02.00 Workmanship

The workmanship shall be according to best construction practice to give a water tight finish to the satisfaction of the Engineer. Fixing of gutters and down pipes shall be according to IS:2527.

2.02.01 Asbestos Sheeting

Asbestos sheets of profiles as specified shall be fixed with minimum 150 mm end lap and side laps as per manufacturer's specification. Hook bolts or J-bolts shall be 8 mm dia. at 305 mm centres. Six (6) mm dia. galvanised iron seam bolt and nut with G.I. flat washers and bitumen washers shall be used for stitching ridge cappings, corner pieces, ventilators, north light curves etc.

2.02.02 C.G.I. Sheeting and Aluminium Sheeting

Side laps shall be 2 corrugations for roof and one corrugation for side sheeting. End laps shall be minimum 150 mm for roof and 100 mm for side sheeting. In ridges and hips where plain sheets are used, the end laps shall be minimum 100 mm. Holes in C.G.I. sheets shall preferably be made on the ground; the sheets should be placed on trestles and holes punched in the ridge of the corrugation from the outside inward for obtaining proper seating of limpet washers. Sheets shall be secured to sheet framing by 8 mm dia. galvanised iron hooks or J-bolts and maximum 305 mm apart. The length of the hook or J-bolts shall be to suit the sections of the bearers. Sheets shall also be bolted at the ends at every third corrugation with 6 mm dia. galvanised iron seam bolts and G.I. flat washers and bituminous washers.

2.02.03 **Fibre Glass Reinforced Plastic Sheeting**

This shall be of thickness and profile as specified. Colour and light transmittance shall be as mentioned. Where used in conjunction with C.G.I. or asbestos sheeting, the end and side laps and fixing device shall be same as used for general sheeting. Where used in lieu of glass, the fixing shall be by means of timber or metal glazing beads. In all cases, the installation shall be completely watertight and able to withstand the designed wind-pressure.

3.00.00 **ACCEPTANCE CRITERIA**

The installations shall present a neat appearance and shall be checked for water tightness. The following shall be checked :

- a) Side and end laps
- b) Absence of cracks, holes or damages in sheet
- c) Spacing of bolts
- d) Provision of double washers (G.I. and asbestos or bituminous washers)
- e) Proper installation of flashing.

4.00.00 **IS CODES**

The following are some of the important I.S. Codes relevant to this section :

- | | | |
|-----------|---|--|
| IS : 3007 | : | Code of practice for laying of asbestos cement sheets. |
| IS : 2527 | : | Code of practice for fixing rain water gutters and down pipes for roof drainage. |
| IS : 1626 | : | Specification for asbestos cement building pipes, gutters and fittings. |
| IS : 277 | : | Specification for galvanised steel sheets (plain and corrugated). |

SPECIFICATION NO. A-14

FOR

DRAINAGE AND SANITATION

**SPECIFICATION NO. A-14
FOR
DRAINAGE AND SANITATION**

C O N T E N T S

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**SPECIFICATION NO. A-14
FOR
DRAINAGE AND SANITATION**

1.00.00 SCOPE

1.01.00 This section covers the layout and construction of drains for roof water, surface water and sewage together with all fittings and fixtures and inclusive of ancillary works, such as connections, manholes and inspection chambers used within the building and from the building to the connection to a public sewer or to treatment work, septic tank and soak pit dispersion trenches.

2.00.00 INSTALLATION

2.01.00 General

All pipe lines, locations of fittings and fixtures, etc. shall be as per drawings or as directed by the Engineer. Correctness of lines, plumb, orientation, symmetry and levels shall be strictly ensured. All items shall be fully secured against movement in any direction and so located as to allow easy maintenance.

All pipe lines, fittings and fixtures shall be installed leakproof. When the works under scope of this specification linked up with works executed by others, the connections shall be such as to prevent any splashing or spilling or emission of foul odour and gases.

2.01.01 Rainwater Downcomers

Rainwater downcomers shall be standard Cast Iron or Asbestos Cement Pipes. In case where specifically desired, M.S. pipes may also be used. M.S. pipes shall be painted outside with two coats of anticorrosive paints under a coat of primer.

Rainwater downcomers shall run along and be secured to walls, columns etc. Where desired by the Engineer these may have to be installed in chases cut in the structure. All pipes shall be well secured and supported by adequately strong brackets. The brackets may be wrought iron clevis type, split ring type or perforated strap iron type as approved by the Engineer. For vertical runs each pipe shall hang freely on its brackets fixed just below the socket. Suitable spacer blocks shall be provided against the vertical surface to which the pipe is fixed.

All bends and junctions shall be supplied with watertight cleanouts.

Roof and floor drains and yard gullies shall be installed, if required, by cutting into the structure and grouted with 1:2:4 cement concrete. All gutters shall be provided with removable gratings.

All horizontal pipes shall have a minimum fall of 1 in 100.

2.02.00 **Gutters**

The gutters shall be made of G.I. or A.C. All gutters shall be supplied by reputable specialised firms. Each section shall be sufficiently rigid, edges and corners straight and the slopes perfectly uniform. G.I. gutters shall have the edges strengthened by suitable means.

Unless noted otherwise the gutters shall have a minimum fall of 1 in 120. Adequate number of string supports shall be provided so that there is no reflection even when the gutter is full. Each joint must have a support. Unless otherwise specified the supports shall be fabricated M.S. brackets. All junctions shall be thoroughly watertight. The joints may be made by rivetting, bolting or soldering. All joints between successive lengths of gutters shall have an overlap of at least 5 cm. The drop in the overlap shall always be in the direction of the fall of the gutter. Ends of gutters shall be closed watertight. Junction with rainwater down comers shall be made fully watertight and secured.

2.03.00 **Soil and Drainage Pipes**

2.03.01 **Gradients**

If not specified the minimum gradients of soil and drainage pipe line shall be as follows :

100 mm nominal dia	:	1 in 35
150 mm nominal dia	:	1 in 65
230 mm nominal dia	:	1 in 120
300 mm nominal dia	:	1 in 200

2.03.02 **Relation with water supply pipe lines**

Unless specifically cleared by the Engineer, under no circumstances shall special drainage and soil pipes be allowed to come close to water supply pipelines.

2.03.03 **Laying**

Each separate pipe shall be individually set for line and for level. Where lengths of sewer or drain pipes are laid in trench, properly painted sight rails shall be fixed across the trench at a height, equal to length of the boning rod to be used, above the required invert level of the drain or sewer at the point where the sight is fixed. More sight rails shall be required at manholes, change of gradient and intermediate positions if the distance for sighting is more than 50 ft. apart. The excavation shall be boned in at least once in every 6 ft. The foot of the boning rod shall be set on a block of wood of the exact thickness of the wall of the pipe. Each pipe shall be separately and accurately boned between sight rails.

2.03.04 **Support and Protection on Pipelines**

All pipes shall be laid with sockets leading uphill. Preferably the pipe shall rest on solid and even foundations for the full length of the barrel. However, the pipe manufacturer's instruction as approved by the Engineer shall be followed in the matter of support and jointing.

To achieve full and continuous support, concrete for bedding and packing is the best. Where pipes are not bedded on concrete, the floor shall be left slightly high and carefully placed so that the pipe barrels rest on undisturbed ground. If anywhere the excavation has been carried too low packing shall be done in concrete. Where laid on rock or very hard ground which cannot be easily excavated to a smooth surface, the pipes shall be laid on a cradle of fine concrete floor of gravel and crushed stone over laid with concrete or on a well consolidated gravel and crushed stone bed as desired by the Engineer. PVC or similar pipes shall be laid directly on stable soil and packed with selected soil.

The minimum support and protection for glazed stoneware pipes shall be as follows:

- a) When cover is less than 2 metre below ground level and where pipes are unavoidably exposed above ground surface, the pipes shall be completely encased or surrounded with concrete.
- b) Where pipes are laid on soft soil with the maximum water table laying at the invert of the pipe, the sewer shall be bedded on concrete.
- c) Where the pipes have to be laid on soft soil with the maximum water table rising above the invert of the pipe, but below the top of the barrel, the pipe sewer shall be haunched.
- d) Where maximum water table is likely to rise above the top of the barrel or wherever the pipe is laid on soft soil the pipe sewers shall be completely encased or surrounded with concrete.

Vitrified clay pipes shall be laid on a bed of 150 mm thick cement concrete (1:3:6) nominal mix by volume.

Cast iron pipes and concrete pipes may be supported on suitable concrete or brick support, where specified. The supports shall be unyielding and strong enough. At least one support shall be located close to ends. Spacing of intermediate supports shall be as decided by the Engineer. Pipes shall be secured to the supports by approved means.

Anchoring of pipes where necessary shall be achieved by suitable concrete encasing designed for the expected thrust.

2.03.05 **Entry into structures**

For entry of the pipe lines into any building of structure suitable conduits under the structure or sleeves shall be used. The conduits and sleeves shall be such as to allow easy repairs and replacement of the pipes. When openings or chases are required to be made in the structure for entry of pipe lines, locations and sizes shall be marked and checked by the Engineer. After laying of the pipeline the openings and chases shall be mended.

2.03.06 **Ducts**

Where solid, waste and ventilating pipes are accommodated in ducts, access to cleaning areas shall be provided. Connection to drain shall be through a gully with sealed cover to guard against ingress of sewer gas, vermin or backflow.

2.03.07 **Traps and Ventilating Pipes**

Pipes are carrying off the waste from water closets and waste water and overflow water from baths, wash basins, sinks to drains shall be trapped immediately beneath such fixtures. Traps shall have minimum water seal of 50 mm and shall be ventilated whenever such ventilation is necessary to maintain water seal of the trap.

Ventilating pipes shall be carried up vertically from the drain to a height of at least 600 mm above the outer covering of the roof of the building or as shown on drawings. All vertical ventilating, anti-syphonage and similar pipe shall be covered on top with a cowl. The cowl shall be made of C.I. unless desired otherwise by the Engineer.

2.03.08 **Manhole and Inspection Chambers**

The maximum distance between manholes shall be 30 meter unless specially permitted otherwise. In addition, at every change of alignment gradient or diameter there shall be a manhole or inspection chamber. The distance between manhole or inspection chamber and gully chamber shall not exceed 6 metres unless desired otherwise. Manhole shall be constructed so as to be watertight under test. The bending at the sides shall be carried out in such a manner as to provide no lodgement for any splashing in case of accidental flashing of the chamber. The channel or drain at the bottom of chamber shall be plastered with 1:2 cement, sand mortar and finished smooth to the grade. The channels and drains shall be shaped and laid to provide smooth flow.

Connecting to existing sewer-lines shall be through a manhole.

Manholes shall be provided with standard C.I. covers. The covers shall be close fittings so as to prevent gases from coming out. Suitable heavy duty covers shall be used where necessary as decided by the Engineer.

2.03.09 **Cutting of Pipes**

Manufacturer's instructions shall be followed for cutting of pipes where necessary. Suitable and approved tools shall be used for the cutting so as to leave surface clean and square to the axis of the pipe.

2.03.10 **Jointing**

Jointing of laid pipes shall be so planned as to avoid completely any movement or strain to the joints already made. If any joint is suspected to be damaged it shall be opened out and redone.

All joints between pipes, pipes and fittings and manholes shall be gas-tight when above ground and water-tight when underground. Method of jointing shall be as per instructions of the pipe and fittings manufacturer and as approved by the Engineer. However, in the absence of any instruction available from the manufacturer the methods as detailed hereunder shall be used.

a) **Cast Iron Pipes**

Socket and spigot pipes shall be jointed by the cast lead joints. The spigot shall be centered in the socket of the next pipe by tightly caulking in sufficient turns of tarred gasket or hemp yarn to have unfilled half the depth of socket. When the gasket or hemp yarn has been caulked tightly a jointing shall be placed round the barrel and tightened against the face of the socket to prevent airlock. Molten lead shall then be poured in to fill the remainder of the socket and caulked with suitable tools right round the joint to make up for shrinkage of the molten metal on cooling and shall be finished 3 mm behind the socket face.

Joints in cast iron pipes with special jointing arrangements like 'Tyton' joints etc. shall follow the instructions of the manufactures.

In special cases if flanged joints are accepted by the Engineer the joints shall be made leakproof by inserting approved type of rubber gaskets. The bolts shall be secured in stages to avoid uneven strain.

b) **Concrete Pipes**

Care shall be taken to place the collar centrally over the joint.

c) **Glazed Stoneware Pipes**

Tarred gasket or hemp yarn soaked in thick cement slurry shall first be placed round the spigot of each pipe and the spigot shall then be placed into the socket of the pipe previously laid. The pipe shall then be adjusted and fixed in the correct position and the gasket caulked tightly so as not to fill more than 1/4 of the total depth of the socket. The remainder of the socket shall be filled with a stiff mixture of cement mortar of 1:1 proportion. Then the socket is filled, a fillet shall be formed round the joint with a trowel, forming an angle of 45 deg. with the barrel of the pipe. The newly made joints shall be protected, until set and shall be covered with damp cloth or other suitable materials.

d) **Virtified clay pipes**

These shall be made from refractory clay mixed with crushed pottery and stone and burnt at a high temperature. These shall be hard, compact and glazed to make them acid resistant and impervious, and shall be obtained from approved manufacturer.

Special care shall be taken in handling these pipes. The pipes shall not be jointed until the earth has been partly refilled over the portion of the pipe between the joint holes. Before laying the second pipe, the socket of the first pipe laid shall be thinly painted all round on the inside with

cement slurry (1 part of cement and 2 parts of clean, sharp sand). A ring of rope yarn (closely twisted hemp or jute) dipped in neat cement paste or tar or bitumen, shall be inserted in the socket of pipe and driven home with caulking tools. The rope shall fully encircle the spigot with a slight overlap and shall not occupy more than one-fourth of the total depth of the socket. Where the spigot end of the pipe is made for receiving the gasket, it shall be wrapped with two or three turns of tarred spun, as close to the end as possible, before inserting into the socket. The joint shall then be completely filled with cement mortar (1:1) which shall have very little water and levelled to form a splayed fillet at an angle of 45 degrees with the outside pipe. Special care shall be taken so that any excess mortar etc. left inside the pipe joints is neatly cleaned off immediately after each joint is made. A semi-circular wooden scrapper or a rubber disc to which a long handle is fixed could be used for this purpose.

e) **Lead Pipes**

The joints in lead pipes shall be made as wiped solder joint. The minimum and the maximum length of the wiped solder joints shall be 8 cm. and 9 cm. respectively. The solders shall generally consist of two parts of lead and one part of tin.

f) **Polythylene Pipes**

The joints shall be thermo-welded or bolted as per manufacturer's instructions.

g) **Jointing Cast Iron Pipes with Stoneware Pipes**

Where any cast iron soil pipe, ventilating pipe or trap is connected with a stoneware or semi-vitrified waste pipe or drain communicating with a sewer, the beaded spigot end of such cast iron soil pipe, waste or ventilating pipe or trap shall be inserted into a socket of such stoneware pipe or drain and the joint made with mortar consisting of one part of cement and one part of clean sharp sand after placing a ratted gasket or hemp yarn soaked in neat cement slurry round the joint and inserted in it by means of a caulking tool.

h) **Jointing Stoneware with Cast Iron Pipes**

Where any water closet pan or earthenware trap connected to such a pan is to be jointed with a cast iron soil pipe, the joint between the stoneware spigot and the cast iron socket shall always be of a flexible nature. Such joint shall be made with a mixture of bitumen and chopped asbestos fibre.

2.04.00 **Trenches and other excavations**

Width of the trench at the bottom shall be such as to provide 200 mm clearance on either side of the pipe for facility of laying and jointing.

Excavated material shall be stacked sufficiently away from the edge of the

trench and the side of the spoil bank shall not be allowed to endanger the stability of the excavation. Spoil may be carted away and used for filling the trench behind the work.

Turf, top soil or other surface material shall be set aside, turf being carefully rolled and stacked for use in reinstatement.

All excavation shall be properly timbered, where necessary.

Efficient arrangements for dewatering during excavation and keeping it dry till backfilling shall be made to the satisfaction of the Engineer. Sumps for dewatering shall be located away from the pipe layout.

Where the excavation proceeds through roads necessary permissions shall be secured by the Contractors from the appropriate authorities.

Special care shall be taken not to damage underground services, cables etc. These when exposed shall be kept adequately supported till the trench is backfilled.

The backfilling shall be done only after the pipeline has been tested and approved by the Engineer. Special care shall be taken under and sides of the pipe during handpacking with selected material. At least 300 mm over the pipe shall also be filled with soft earth or sand. Consolidation shall be done in 150 mm layers. The surface water shall be prevented from getting into the filled up trench. Traffic shall not be inconvenienced by heaping up unduly the backfilling material to compensate future settlement. All future settlements shall be made good regularly to minimise inconvenience of traffic where applicable.

2.05.00 **Fixtures**

Fixtures manufactured by Hindustan/Pasriware/Cera shall be used. The Bidder shall procure the fixtures from the above named reputed manufacturers and shall mention in his bid the type & make of the fixtures he intends to use.

All fixtures and fittings shall be of approved quality and type manufactured by well known manufacturers. All items brought to the site must bear identification marks of the type of the manufacturer. Procurements shall be made well in advance and inspected and approved immediately by the Engineer. All fixtures shall be adequately protected, covered and plugged till handed over.

All fittings, gratings, fasteners, unless specified otherwise, shall be chromium plated. The connecting lead pipes and bends shall weigh at least 3 kg. per 25 mm dia per meter length. Where PVC or similar pipes are allowed the Contractor shall produce the test reports and convince the Engineer about their durability.

Unless specified in the contract the fixtures shall be as specified hereinafter.

2.05.01 **Water closet**

a) **Raised type**

It shall include glazed vitreous china basin with siphon, open front solid plastic seat and plastic cover, low level glazed stoneware flushing cistern with valveless fittings, supply connections and necessary fittings. All fittings shall be chromium plated. Colour of basin, cistern, seat and cover shall be as desired by the Engineer.

b) **Squatting type**

It shall include glazed vitreous china pan with foot rests and high level cast iron flushing cistern with valveless fittings, supply connections and necessary fittings. All fittings shall be chromium plated. The foot rests shall be made of white glazed vitreous china with chequered surface. The flushing cistern shall be painted as desired by the Engineer.

2.05.02 **Urinals**

It shall consist of wall type glazed vitreous china urinals, cast iron automatic flushing cistern complete with supply connections, flush pipe, lead pipes, gratings, traps and all other necessary fittings. Automatic flushing shall be approximately once every five minutes. For a number urinals located together may be served by one cistern of adequate capacity. All fittings shall be chrome plated.

2.05.03 **Wash basin**

It shall be made of glazed vitreous china. The basin shall be flat back, wall hung by painted cast iron brackets and complete with pattern with hot and cold brass faucets with nylon washers, waste chain, waste washers, lead waste pipes with traps, perforated waste complete with necessary fittings. All fittings including faucets shall be chromium plated.

2.05.04 **Sink**

It shall be made of glazed stoneware. It shall be wall hung by painted cast iron brackets and complete with one brass faucet with nylon washers, waste chain, waste washers, lead waste pipes with traps, perforated waste with necessary fittings. All fittings including faucets shall be chromium plated.

2.05.05 **Bathroom mirror**

It shall be made of the best quality 6 mm thick glass and produced by a reputed mirror manufacturer. It shall be wall mounted with adjustable revolving brackets. The brackets, screws and other fittings shall be chromium plated.

2.05.06 **Glass shelves**

Glass shelves shall consist of 6 mm thick clear glass with guard rails and shall be wall mounted with brackets. All brackets, guard rails and screws shall be chromium plated.

2.05.07 **Towel rail**

Towel rails shall be 20 mm dia chromium plated MS pipes wall mounted with steel brackets. The brackets, screws etc. shall also be chromium plated.

2.05.08 **Soap holder**

It shall be made of chromium plated strong members. The holders shall be wall mounted with chromium plated screws.

2.05.09 **Liquid soap dispenser**

It shall be round and easily revolving with removable threaded nozzle. The body, bracket for wall mounting and screws shall be chromium plated.

2.05.10 **Toilet roll holder**

It shall be made of glazed vitreous china with suitable cover cum cutter. Wall mounting screws shall be chromium plated.

2.05.11 **Installation**

All plumbing fittings and fixtures shall be installed in most workmanlike manner by skilled workers. These shall be perfect in level, plumb, plane, location and symmetry. All items shall be securely anchored to walls and floors. All cuttings in walls and floors shall be made good by the Contractor.

2.06.00 **Septic tank and effluent disposal**

2.06.01 **Septic tank**

Septic tank shall consist of the tank itself with inlet and outlets therefrom complete with all necessary earthwork and backfilling. The details of septic tank shall be as shown on drawings. This item shall also include ventilating pipe of at least 100 mm dia whose top shall be provided with a suitable mosquito proof wiremesh and cowl. Ventilating pipe shall extend to a height of about 2 meter when the septic tank is at least 15 meter away from the nearest building and to a height of 2 meter above the top of building when it is located closer than 15 meter. Ventilating pipes can be connected to the normal soil ventilating system of the building where allowed.

2.06.02 **Effluent Disposal**

The effluent from the septic tank shall be disposed by allowing it into an open channel or a body of water if the concerned authority approves or into a soak pit for absorption by soil or shall be allowed to be absorbed by soil through open jointed SW pipes laid in a trench filled with broken bricks.

2.06.03 **Soak pit**

The soak pit shall be complete. It shall consist of a 900 mm dia pit 1000 mm in depth below the invert level of the inlet pipe. The pit shall be lined with stone,

brick or concrete blocks set in cement mortar (1:6) and filled with brick bats. Inlet pipe shall be taken down to a depth of 900 mm from the top as an anti-mosquito measure.

2.06.04 **Open joined SW Pipe/dispersion trenches**

Minimum dia of the SW pipes shall be 150 mm nominal. The trench for laying the pipes shall be minimum 600 x 600 mm pipes. The joints of the pipes shall be left unsealed. The entire length of the pipe within the trench shall be buried in a 250 mm layer gravel or crushed stone of uniform size. On top of gravel/ crushed stone layer is a 150 mm bed of well graded coarse aggregate. Ordinary soil is used for filling the top of trench.

2.06.05 **Commissioning septic tank**

After the septic tank has been proved watertight and the sewage system is checked the tank shall be filled with water to its outlet level before the sewage is let into the tank. It shall be seeded with well digested sludge obtained from septic tank or sludge digestion tank. In the absence of digested sludge a small quantity of decaying organic matter such as digested cow-dung may be introduced.

3.00.00 **TESTING AND ACCEPTANCE CRITERIA**

3.01.00 **Inspection before installation**

All pipes, fittings and fixtures shall be inspected, before delivery at the site to see whether they conform to accepted standards. The pipes shall again be inspected on site before laying by sounding to disclose cracks. All defective items shall be clearly marked and forthwith removed from the site.

3.02.00 **Testing of Pipelines**

Comprehensive tests of all pipe lines shall be made by simulating conditions of use. The method of actual tests shall be decided by the Engineer. All test data shall be recorded and submitted to the Engineer for review and instruction. The Engineer's discretion regarding tolerance shall be final.

General guidance for the tests are given below :

a) **Smoke test**

All soil pipes, waste pipes and vent pipes and all other pipes when above ground shall be approved gastight by a smoke test conducted under a pressure of 25 mm of water and maintained for 15 minutes after all trap seals have been filled with water. The smoke is produced by burning oily waste or tar paper or similar material in the combustion chamber of a smoke machine. Chemical smokes are not satisfactory.

b) **Water test**

For pipes other than Cast Iron

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

Subsidence of test water may due to one or more of the following cases:

- a) Absorption by pipes and joints
- b) Sweating of pipes or joints
- c) Leakage at joints or from defective pipes
- d) Trapped air.

Allowance shall be made for (a) by adding water until absorption has ceased and after which the test proper should commence. Any leakage and the defective part of the work shall be cut out and made good.

For cast iron pipes

Cast iron sewers and drains shall be tested as for glazedware and concrete pipes. The drain plug shall be suitably strutted to prevent their being forced out of the pipe during the test.

c) **For straightness**

- i) By inserting at the high end of the sewer or drain a smooth ball of a diameter 13 mm less than the pipe bore. In the absence of obstruction, such as yarn or mortar projecting through the joints, the ball will roll down the invert of the pipe and emerge at the lower end; and
- ii) By means of a mirror at one end of the line and lamp at the other. If the pipe line is straight, the full circle of light may be observed. The mirror will also indicate obstruction in the barrel if the pipe line is not straight.

3.03.00 **Testing Septic Tank**

The septic tank shall be tested for watertightness. It shall be filled up with water and allowed to soak for 24 hours. Then, it shall be topped up and allowed to stand again for 24 hours and loss of level recorded. The fall shall not be more than 15 mm.

3.04.00 **Fixtures etc.**

All fixtures and fittings shall be connected by watertight joints. No dripping shall be accepted.

4.00.00 **CODES AND STANDARDS**

Some of the important Codes and Standards relevant to this specification shall be followed : Latest editions shall always be consulted.

- | | | |
|-----------|---|--|
| IS : 1172 | - | Code of basic requirements for water supply drainage and sanitation. |
| IS : 1200 | - | Laying of water and sewer lines including (Pt. XVI) appurtenant items. |
| IS : 1239 | - | Mild Steel Tubes and Mild Steel Tubulars (Pt. I & II) and other wrought steel pipe fittings. |
| IS : 1536 | - | Centrifugally cast (Spun) iron pressure pipes for water gas & sewage. |
| IS : 1537 | - | Vertically cast iron pressure pipe for water, gas & sewage. |
| IS : 3486 | - | Cast Iron spigot & socket drain pipes. |
| IS : 1742 | - | Code of Practice for building drainage. |
| IS : 5329 | - | Code of Practice for sanitary pipe work above ground for buildings. |
| IS : 2470 | - | Code of Practice for designs and construction of septic tank for small and large installations. |
| IS : 3076 | - | Low density polythelene pipes for potable water supplies. |
| IS : 4984 | - | High density polythelene pipes for potable water supplies. |
| IS : 1537 | - | Vertically cast iron pressure pipes for water, gas and sewage. |
| IS : 1538 | - | Cast Iron fittings for pressure pipes for water, gas & sewage. |
| IS : 1230 | - | Cast Iron rain water pipes and fittings. |
| IS : 3889 | - | Centrifugally cast (spun) iron spigot & socket soil waste and ventilating pipes, fittings and accessories. |
| IS : 1729 | - | Sand cast iron spigot & socket soil, waste and ventilating |

pipes & accessories.

- IS : 1626 - Asbestos cement building pipes, gutters and fittings (spigot & socket types).
- IS : 458 - Concrete pipes (with and without reinforcement)
- IS : 783 - Code of Practice for laying of concrete pipes.
- IS : 784 - Prestressed concrete pipes.
- IS : 651 - Salt glazed stoneware pipes & fittings.
- IS : 4127 - Code of practice for laying of glazed stoneware pipes.
- IS : 1726 - Cast Iron manhole covers & frames intended for use in drainage works.
- IS : 5961 - Cast Iron gratings for drainage purposes.
- IS : 5219 (Part 1) - 'P' & 'S' traps.
- IS : 771 - Glazed earthen-ware sanitary appliance.
- IS : 772 - General requirements of enamelled cast iron sanitary appliances.
- IS : 774 - Flushing cistern for water closets & urinals (valveless siphonic type).
- IS : 775 - Cast Iron brackets & supports for wash basins and sinks.
- IS : 2548 - Plastic water closet seats & covers.
- IS : 2527 - Code of Practice for fixing rain water gutters and down-pipes for roof drainage.

SPECIFICATION NO. A-15

FOR

ANTI-TERMITE TREATMENT

**SPECIFICATION NO. A-15
FOR
ANTI-TERMITE TREATMENT**

C O N T E N T S

CLAUSE NO.	DESCRIPTION	PAGE NO.
1.00.00	SCOPE	1
2.00.00	EXECUTION	1
3.00.00	ACCEPTANCE CRITERIA.....	2
4.00.00	I.S.CODE	2

**SPECIFICATION NO. A-15
FOR
ANTI-TERMITE TREATMENT**

1.00.00 SCOPE

The scope of work is to set up a chemical barrier against attack by subterranean while the building is under construction.

2.00.00 EXECUTION

2.01.00 General

All work shall in general be executed as specified in IS:6313 Part-II and as per approved Specification of the agency having special know-how for the job.

All necessary work to ensure uniform distribution and proper penetration of treating solution shall be done according to the instruction of the Engineer.

Soil treatment shall not be done when it is raining or when the soil is wet with rain or subsoil water. Once formed, the treated soil barrier shall not be disturbed.

2.02.00 Chemicals and Rate of Application

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

Chemicals		Concentration by weight, Percentage
Dieldrin (IS:1052-1962)	:	0.5
Hyptachlor	:	0.5
Aldrin (IS:1306-1958)	:	0.5
Chlordane (IS:2863-1964)	:	1.0

2.03.01 Treatment of Column pits. wall Trenches and Basement Excavations

Foundations, basements etc. may either be fully enveloped by the chemical barrier or the treatment may start 500 mm below ground level. The bottom surface and sides of excavation (upto a height of about 300mm) for column pits, walls trenches and basements shall be treated with chemicals at the rate of 5 liters/M² of surface area. Backfills around columns, walls etc. shall be treated at the rate of 15 litres/M² of the vertical surface. Chemicals treatment shall be done in stages following the compaction of earth in layers. The treatment shall be carried out after the ramming operation is done by rodding the earth at 150 mm centres close to the wall surface and spraying the chemicals in the specified dose.

2.03.02 **Treatment of Top Surface of Plinth Filling**

Holes 50 mm to 75 mm deep at 150 mm centres both ways shall be made with crow-bars on the surface of compacted plinth fill chemical emulsion at the rate of 5 litres/M² of surface shall be applied prior to laying soling or sub-grade. Special care shall be taken to maintain continuity of the chemical barrier at the junction of vertical and horizontal surfaces.

2.03.03 **Treatment of Soil Surrounding Pipes, Wastes and Conduits**

Special care shall be taken at the points where pipes and conduits enter the building and the soil shall be treated for a distance of 150 mm and a depth of 75 mm at the point where they enter the building.

2.03.04 **Treatment of Expansion Joints**

These shall receive special attention and shall be treated in a manner approved by the Engineer.

3.00.00 **ACCEPTANCE CRITERIA**

The contractor shall give a 10 year service guarantee in writing supplemented by a separate and unilateral guarantee from the specialised agency for the job to keep the building free of termites for the specified period at no extra cost to the Owner.

4.00.00 **I.S.CODE**

Relevant code applicable for this specification.

IS : 6313 (Part-II) - 1971 : Code of practice for Anti-Treatment Measures in Buildings.

SPECIFICATION NO. A-16

FOR

FALSE FLOORING

**SPECIFICATION NO. A-16
FOR
FALSE FLOORING**

C O N T E N T S

CLAUSE NO.	DESCRIPTION	PAGE NO.
1.00.00	SCOPE	1
2.00.00	FALSE FLOORING SYSTEM	1
3.00.00	ACCEPTANCE CRITERIA	2
4.00.00	I.S. CODES.....	3

**SPECIFICATION NO. A-16
FOR
FALSE FLOORING**

1.00.00 SCOPE

This section covers furnishing, installation, finishing, testing, protection and maintenance till handing it over of removable free access false flooring systems for Unit Control Rooms, Computer and Control equipment room.

2.00.00 FALSE FLOORING SYSTEM

This system is consisting of an assembly of removable panels mounted on adjustable pedestal and supporting steel grid system to provide underfloor space. The whole system shall be installed as per equipment layout and approved manufacturer's system, detail and supervision.

2.01.00 Base

The system shall be placed over a base of R.C.C. floor slab and with necessary grouting etc. to fix the supporting structure.

2.02.00 Supporting Structure

The supporting structure shall comprise of fabricated jacks made out of MS rounds of required diameter having threads at top. This jack shall be welded to MS base plate pedestal of required size. Pedestals shall be vertically true and shall have integral load dispersion ribs to transmit the load evenly to the base floor and located at 610mm centre to centre to conform to the size of the floor panels and shall be fixed to the RCC floor slab with ARALDITE. The jack shall be equipped with locking device to prevent loss of finished elevation. Adjustment shall be provided by the threaded rod member and elevating nut. The capital shall be of zinc aluminium alloy die cast and shall receive cold rolled MS floor supporting channels of size 40mm x 40mm x 40mm x 3.15mm thickness; both for main and cross runners. The pedestal shall be equipped with conducting grounding pad. All MS members shall be treated with steel protective polyurethane paint.

2.03.00 Floor Panels

The floor panels shall be of phenol formaldehyde bonded particle board treated with fire resistant chemical. Size of each panel shall be 610mm x 610mm with all panel edges finished to a tolerance of +0.25mm on the diagonals. The edges of the floor panels shall be covered by 2mm thick rigid PVC edging. The underside of the panel shall have 0.05mm thick aluminium foil which shall be fixed to the particle board with resin based adhesive. The finished panel shall be perfect in size, shape and alignment free from undulation and warpings. The floor plan shall have cut out for equipment and cable routing. Concrete sub floor shall be treated with two coats of ployurethane paint.

2.04.00 **Strength**

Each 610mm x 610mm floor panel must be capable of supporting a uniform minimum live load of 2000 Kg/Sq.M. or a concentrated minimum load of 800 Kg. applied through a phenolic caster 75mm in diameter and 45 mm wide, with a maximum deflection of 1/400 of the span. The ultimate strength shall be capable of carrying a 2500 Kg. axial load without deformation of any part. The samples shall be accepted only after carrying out load tests. Additional pedestals shall be provided for taking additional load that may occur as per equipment layout.

2.05.00 **Surface Finish**

All removable panels shall have the top surface finished with 2mm thick Antistatic Vinyl Flooring of approved sample bonded to the surface with adhesive as per manufacturer's specification.

2.06.00 **Skirting**

Skirting shall be of the same Antistatic Vinyl tiles, 150mm high and 2mm thick, completely matching with the false flooring surface finish materials and fixed with the plastered wall surface as per manufacturer's installation instructions.

2.07.00 **Installation**

All steel surfaces are to be protected by two coats of polyurethane paint over a compatible primer and any damage to the paint during installation shall be made good. Finished floor surface, when specified by the Engineer shall be protected by the Contractor with kraft paper taped and sealed at edges to prevent tearing.

Any damage to the sub floor during installation of the false flooring system shall be made good by the Contractor without any extra cost to the Owner. All installation work of the false flooring system shall be made under supervision of manufacturer's authorised representative.

3.00.00 **ACCEPTANCE CRITERIA**

The false flooring system shall be checked specially for:

- a) Level
- b) Alignment of joints
- c) Thickness of joints
- d) Surface finish
- e) Colour and texture
- f) Details at edges & junctions

4.00.00 **I.S. CODES**

Important Codes applicable to this section are :

- | | | |
|-----------|---|---|
| IS : 2571 | : | Code of practice for laying in situ concrete flooring. |
| IS : 3461 | : | PVC (Vinyl) asbestos floor tiles. |
| IS : 5318 | : | Code of practice for laying of flexible PVC sheet and tile flooring. |
| IS : 2046 | : | Specification for Decorative Thermosetting Synthetic Resin Bonded Laminated Sheets. |

SPECIFICATION NO. A-17

FOR

WALL CLADDING AND ROOF DECKING

**SPECIFICATION NO. A-17
FOR
WALL CLADDING AND ROOF DECKING**

C O N T E N T S

CLAUSE NO.	DESCRIPTION	PAGE NO.
1.00.00	SCOPE	1
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3.00.00	CODES AND STANDARDS.....	1
4.00.00	METAL WALL CLADDING (SANDWITCH THERMALLY INSULATED)	2
5.00.00	ROOF DECKING.....	10
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**SPECIFICATION NO. A-17
FOR
WALL CLADDING AND ROOF DECKING**

1.00.00 SCOPE

This section of the specification covers the design, supply & erection of thermally insulated sandwiched metal wall cladding, metal profiled sheet roof decking and single sheet wall cladding.

2.00.00 WALL CLADDING (GENERAL REQUIREMENTS)

2.01.00 The Contractor shall furnish all labour, plant, equipment, materials, etc. as required for the completion of the work.

2.02.00 The Contractor shall furnish, at the time of bidding, the complete details of the materials, name of the manufacturers and other particulars of the products proposed to be used.

He should submit the sample of materials, before procuring, for approval of the Engineer.

2.03.00 The Contractor shall prepare the detailed design and working drawings including sheet cutting plan, fixing arrangement, flashing, trim etc. and submit to the Engineer for his approval. However, the approval of the Engineer to such plans, procedures, etc. shall not absolve the Contractor of his responsibility for accuracy, safe and sound work. Contractor shall consider deflection under maximum wind load shall not exceed $L/80$ with L is the length measured between support points. All wall cladding shall be designed to provide complete protection against aggressive stormy climate and driving rain.

2.04.00 The Contractor shall follow all safety measures during handling, transportation and erection of sheets. This shall include safety against health hazards during use of products containing asbestos.

2.05.00 Handling, transportation and storage of the sheets shall be done with proper care so as to avoid any damage to the sheets. The sheets shall be stored under a covered shed in a dry condition to eliminate the possibility of formation of water stains.

3.00.00 CODES AND STANDARDS

3.01.00 All applicable standards, specifications, acts and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions. A complete set of all such documents, shall generally be available at site, with the Contractor.

3.02.00 In case of conflict between this specification and those IS Standards, Codes etc. referred to herein (in para 3.03.00), the former shall prevail.

3.03.00 Some of the relevant Indian Standards, Acts and Codes are referred to here below :

IS:277	Galvanised steel sheets (plain or corrugated)
IS:513	Cold-rolled carbon steel sheets
IS:737	Wrought aluminium and aluminium alloys (for general engineering purposes).
IS:800	Code of practice for use of structural steel in general building construction.
IS:801	Code of practice for use of cold formed light gauge steel structural members in general building construction.
IS:875 (Pt. I to V)	Code of practice for design loads (other than earthquake) for buildings and structures.
IS:1200 (Pt-IX)	Method of measurement of building and civil engineering works : roof covering (including cladding).
IS:1367	Technical supply conditions for threaded steel fastener.
IS:1573	Electroplated coatings of zinc on iron and steel.
IS:2676	Dimensions of wrought aluminium and aluminium alloys.
IS:6113	Aluminium fasteners for building purposes.
IS:7178	Technical supply conditions for tapping screw.
IS:7809	Pressure sensitive adhesive tapes for electrical purposes.
IS:8147	Code of practice for use of Aluminium alloys in structures.
IS:8183	Bonded mineral wool
IS:8869	Washers for corrugated sheet roofing.
IS:11769	Guidelines for safe use of products containing asbestos.
IS:12093	Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets.

4.00.00 **METAL WALL CLADDING (SANDWICH THERMALLY INSULATED)**

4.01.00 **Inner Sheet**

The inner sheeting shall consist of profiled sheeting, 0.6 mm thick (TCT) permanently coated galvanised steel. The coating shall be minimum 120 g/sm zinc coated as per IS:513. The sheeting shall have wide pans with 750 to 800 mm cover width & minimum 30 mm crests at 195 mm centres in length upto

12M manufactured out of galvanised (cold rolled) steel, 240 MPa yield strength with hot dip metallic coating of zinc (180 gm/sq m total of both sides) and finally coated with organic coatings of 20 microns exterior coat of regular modified polyester (RMP) paint system over 5 micron primer and 5 micron polyester back coat over 5 micron primer fixed to supports with approved fasteners as per the manufacturer's recommendations or as shown on approved drawings. The steel supports shall be zinc coated or painted.

4.02.00 **Outer**

The outer skin (sheeting) shall consist of Hi-Rib 0.5 mm thick (TCT) troughed sheeting manufactured out of zinc-aluminium alloy high tensile steel (550 MPA) coated with fluoro polymer (PVF2 or equivalent) paint system having life span sustenance against aggressive weather condition. The coating class shall be AZ:150 (min 150 gms/sq.m zinc aluminium alloy coating mass, total of both sides). The sheetings shall have wide pans 750 to 800 mm cover width & minimum 30mm rib depth manufactured out of organic colour coated steel fixed to supports with approved fasteners as per the manufacturers' recommendations or as shown on approved drawings. The steel supports shall be zinc coated or painted.

4.03.00 **Thermal Insulation**

For thermally insulated, sandwiched wall cladding, Bonded mineral wool blanket conforming to IS:8183 shall be used. Thickness of the insulation shall be as shown in the drawing subject to a minimum of 25mm. Minimum co-efficient for thermal conductivity (k) shall be 0.49 mw/cm deg C (at 50 deg C). Minimum density of the material shall be 32 kg/cu.m for glass wool and 48 kg/cu.m. for rock wool unless otherwise specified.

4.04.00 a) **Fasteners and Fixings**

All nuts, bolts, hooks, washers, etc. shall be made of stainless steel (Austenitic grade) and shall conform to IS:1367 (Part-14). Aluminium alloy fasteners shall be used only when specifically permitted by the Engineer and shall conform to IS:6113. Self tapping screws shall conform to IS:7178. All bolts and screws shall be fitted with either an integral plastic head or with separate "snap on" plastic caps in colours to match the cladding and be complete with a EPDM sealing washer. Unless otherwise specified, stainless steel fasteners shall only be used.

All fixings to sheeting rails shall be stainless steel self tapping screws not less than 6mm diameter. Self tapping screws shall have separate or integral galvanised steel load spreading washers not less than 16 mm diameter. Self tapping screws used to secure wall cladding sheets to sheeting rail shall have the load spreading washers with integral EPDM sealing washers to ensure adequate weather resistance.

Sealed end pop rivets, wherever used with specific approval, for securing wall cladding sheets to 'Z' spacers, shall have a nominal diameter not less than 7mm. Sealed end pop rivets for side lap fixings of wall cladding sheets shall have a nominal diameter not less than 4.5mm.

All rivets shall have integral load spreading washers and EPDM sealing washers to ensure adequate weather resistance. Fixings shall be accurately located at a position in the centre of the profile/corrugations to ensure that the heads of the screws, nuts and washers bear squarely down on the surface of the sheeting and are not located at the edge or on the joints of supporting members. Rivets used as main fixings of troughed wall cladding sheets to `Z' spacers shall be located in each corrugation at all `Z' spacers. Self tapping screws for securing `Z' spacers and lining panels to sheeting rails shall be at a maximum pitch of 300 mm on all sheeting rails.

Six samples of each type of fixing, used to attach the `Z' spacers to the wall cladding sheets, internal lining panel and sheeting rails shall be tested for the designed load with pull out tests before use. Failure of a fixing, under test, shall be deemed to have occurred as soon as any of the following events occur :

- i) Visible evidence of tearing or permanent deformation of the `Z' spacer, cladding sheet, lining panel or washer.
- ii) Pull through of the washer.
- iii) Following the release of the load, if there is movement of any component of the cladding system along the shank of a fixing, indicating permanent deformation of the `Z' spacer, cladding sheet, lining panel or fixing.
- iv) A fixing slips.
- v) A fixing breaks or pulls out of the `Z' spacer, cladding sheet, lining panel or sheeting rail.

The fasteners/fixings shall be capable of resisting its permissible load without failure. The Contractor shall submit the methodology for carrying out the pull out tests to the Engineer for approval.

b) Sealants

The cladding shall be constructed to ensure that the lining panels provide a moisture barrier (air seal) on the internal face by the use of sealants or gaskets in all the side and end lap joints of the lining panels.

All sealants used shall be butyl based, two parts polysulphide or equivalent approved, non-staining material and be flexible enough not to interfere with fit of the sheets. All sealants shall be non hardening and suitable for use in the relevant site conditions and should provide an effective weather tight seal throughout the life of the building. Two parts polysulphide shall conform to IS:12118. Butyl sealant shall be one part sealant, based on butyl rubber and inert fillers. The material shall generally meet the stipulation of ASTM C2085. Solid content shall be minimum 80 percent. Off white or any approved colour shall be used.

All surface required for the application of gaskets and sealants shall be prepared in accordance with the requirements of the sealant supplier. All surplus sealant shall be removed and the sheet cleaned with an approved solvent.

c) **PVC Tape**

Where the aluminium cladding/decking is in contact with structural steel work or steel lining panels, a self adhesive water proof heavy duty PVC tape of not less than 0.25 mm thickness shall be used on the contact surface. PVC insulation tape shall also be provided over the area of contact of aluminium with other dissimilar materials to avoid the possibility of bimetallic corrosion due to formation of galvanic cell. PVC tape shall cover the full width of contact surface plus 10 mm. Coated surfaces of the steel work shall be cleaned and tape shall be applied on the steel surface in accordance with the recommendations of the tape manufacturer. Tape shall have minimum 75 mm end laps and 25 mm side laps. Stipulation of IS:7809 (part-3) for PVC tape shall generally be followed.

d) **'Z' Spacers**

Zed spacers (sub girt) shall be of galvanised pressed steel. Minimum thickness of the section shall be 2 mm.. The material shall conform to requirement of IS:513. Any other shape of spacer element may be approved by the Engineer.

Rate of total galvanisation shall be 450 g/sq m. (min). The outstanding leg of Z-spacer shall be 30 mm (min).

e) **External Trough Fillers**

Filler blocks shall be used to seal cavities formed between the profiled sheet and the support of flashing. The filler blocks shall be manufactured from black synthetic rubber having following properties :

- i) It shall be fairly compressible (i.e. 30 to 50% by finger pressure).
- ii) It shall have closed cell structure to avoid leakage.
- iii) The material shall be fire retarding type & shall withstand long term temperature of about 80 deg C.

f) **Earthing Strip**

25x3 mm size aluminium earthing strips shall be fixed to the aluminium sheets at various elevation.

4.05.00 Detailed design

The Contractor, in association with the manufacturer, shall be responsible for the detailing of the cladding system with internal lining panel & insulation, fitting & fixture based on typical details wherever furnished by the Owner. This shall include provision of supporting members for fixing of doors and windows.

The Contractor shall also carry out detailed design including supporting system (purlins, runners, etc) wherever called for on the basis of following :

- i) The loads and load combinations shall be as per IS:875. Different factors for computing wind load shall be as applicable to the relevant site as per IS:875.
- ii) Design of light structural steel shall be as per IS:801. However, for design of supporting structural steel members IS:800 shall be used.

The Engineer shall verify the correct interpretation of his requirements but may not necessarily check the design and details, and the Contractor shall be entirely responsible for the accuracy of the drawings and the correctness of the design and the suitability of the details.

4.06.00 Erection and fixing

a) Storage and Handling

For proper handling and storage, manufacturer's instructions shall be followed including transportation from manufacturer's place. All panels shall be lifted into position. Where these are hoisted into position, the edges shall be protected to ensure that the pressure across the sheets does not cause distortion. All panels shall be carefully removed from a stack by lifting preferably at each end and shall not be dragged from the stack. For permanently coated sheet a suitable film or similar material shall be provided as protection during handling/transportation. All stacks shall be stored in a clean, dry and well ventilated shelter providing protection from the weather. Sheets in store shall be stacked clear off the ground on a slight inclined position and separated by suitable spacer elements. The stack height shall be limited.

b) Installation

All cladding shall be laid strictly in accordance with the manufacturer's recommendations and instructions of the Engineer.

Expansion joints shall be provided in the cladding system according to details shown in the drawing to take care of movements due to temperature variations.

c) Sequence of Erection

All material forming wall cladding shall be erected using an arrangement of sheets & joints to conform to the requirements of this specification.

Cladding erection for each elevation shall commence at the bottom and proceed towards the top, in order to ensure tight fitting laps.

d) **Protection during Construction**

Precautions shall be taken during the erection of insulated cladding to ensure that partially erected cladding and insulation (pending placing of external cladding sheet) are protected during inclement weather to prevent the ingress of water and damage at all times.

e) **Position and Location of Laps**

Side and end laps of wall cladding sheets shall be located and positioned in such a manner as to provide, the maximum weather protection taking into account the direction of the prevailing wind. The lines formed by horizontal laps and fixing, shall, where possible be continuous and coincide with the edges of large openings for windows, doors and other major features.

f) **Alignment of Sheets and Fixings**

All wall cladding sheets and lining panels shall be fixed plumb and level with all fixing evenly spaced and accurately lined. All dirt and grease shall be removed from the surface of the sheets and lining as the work proceeds.

g) **Site cutting**

Approval from the Engineer must be obtained before wall cladding sheets, lining panel sheets are cut at site. Generally cutting of sheets to size shall not be permitted. Only special cutting and trimming to small openings shall be allowed. Where possible, site cut edges shall be concealed at laps behind flashings.

h) **Flashings**

Aprons, closers, flashings and other similar fittings shall be formed at works before delivery to site. Site forming or dressing of these items will be approved only in special locations.

i) **Damaged Sheets**

Distorted, blemished or water stained sheets, shall not be used for any work including aprons, closers, flashings, etc.

j) **Laps**

End and side laps to wall cladding sheets shall be sufficiently large to ensure that the cladding complies with the weather tightness and other requirements of this specification. In no case, shall end laps be less than 100 mm.

Wall cladding sheets for insulated cladding shall bear on the leg of the

`Z' spacers for the full width of the spacer leg.

End laps of lining panels (other than tray form) shall be not less than 100 mm. The top edges of the lining panel at an end lap is to be levelled with the top of the cladding rail, the lower panels being fixed first.

k) **End Lap Fixing**

End lap fixings using pop rivets shall be located at least 25 mm from the end of each sheet.

l) **Side Lap Fixing of Cladding Sheets**

The spacing of the side lap fixing using pop rivets shall ensure compliance with this specification, regarding weather-tightness. The spacing shall not exceed 250 mm. The fixing shall be located in the top flat of the corrugation/profile.

m) **PVC Tapes**

PVC tapes used on the contact faces of steel sheeting rails and purlins shall cover the full width of the contact surface. Coated surfaces of the steel work shall be clean and tapes shall be applied in accordance with the recommendations of the tape manufacturer. Tapes shall have minimum 75 mm end laps and 25 mm side laps.

n) **Gaskets and Sealants**

Gaskets and other components of the cladding and insulation shall be provided and surfaces shall be prepared in accordance with the requirements of the component suppliers.

Tapes, gaskets & other components and coatings shall not be damaged during the erection of the cladding insulation and liners.

o) **Drilling Holes**

Holes in wall cladding sheets, lining panels shall be drilled and the use of punches for forming holes will not be permitted. All drilling swarf shall be removed from the surfaces of supporting steel work, `Z' spacers wall cladding sheets, lining panels.

p) **Holes for Self-Tapping Screws**

Holes for self-tapping screws shall be drilled to the sizes recommended by the manufacturer. If self-tapping screws shear while being driven, the shank of the sheared fixing shall be drilled out and replaced by a sound fixing.

q) **Fixing for `Z' spacers (sub girt)**

Holes for self tapping screws and rivet fixing shall be accurately drilled relative to the correct position of fixings in the legs of `Z' spacers. Jigs or other methods to the approval of the Engineer shall be used to ensure that the deviation of fixing from the true alignment does not exceed $\pm 2\text{mm}$.

r) **Self-tapping fixings**

Self-tapping screws shall be driven in accordance with the screw manufacturer's recommendations by means of suitable hand or power tools.

s) **Rivet Fixing**

Rivets shall be installed in accordance with the rivet manufacturer's recommendations using tools approved by the rivet manufacturer which do not damage by coating of the cladding sheets. The diameter of holes for rivets shall comply with the requirements of the rivet manufacturer.

t) **Location and Spacing of Fixings**

Fixing shall be accurately located in position in the centre of the corrugations to ensure that the heads of screws, nuts and washers bear squarely down on the surface of the sheetings and are not located at the edge or on the joints in sheeting rails or other supporting steel work.

Rivets used as main fixings of troughed wall cladding sheets to `Z' spacers shall be located in each corrugation at all `Z' spacers (i.e. not more than 125 mm pitch). Self-tapping screws for securing `Z' spacers and lining panels to sheeting rails shall be at a maximum pitch of 300 mm on all sheeting rails. Self-tapping screws as main fixing of non-insulated troughed wall cladding sheets shall be located in each corrugation on all sheeting rails.

u) **Fixing of External Trough Fillers**

The black synthetic rubber external trough fillers are to be secured by the mechanical fixing to the flashings or parapet capping.

v) **Temporary Fixing of Insulation**

The method used for securing insulation slabs to the lining panels, prior to the erection of the outer cladding sheets, shall be to the approval of the Engineer. Cold applied adhesive shall be applied as per manufacturer's recommendations. In addition, for securing the insulation, galvanised wire not less than 1.2 mm dia shall be used in crisscross fashion.

w) **Flashings**

For inner as well as outer sheeting, the flashings shall be provided from like or compatible materials. The cover to the sheets shall be min 100 mm. Attachments & joints shall be made with mechanical fasteners & sealants suggested by the cladding manufacturers & approved by the Owner.

4.07.00 **Acceptance Criteria**

The installation upon completion shall present a neat and clean appearance and shall be weather proof and watertight.

The following shall be checked :

- a) Side and end laps fixed properly.
- b) Absence of damage or scratches in sheets.
- c) Conformity of fixings with the approved design.
- d) Proper installation of flashings etc.
- e) Correct installation of lining and installation.

5.00.00 **ROOF DECKING**

5.01.00 **General Requirements**

The Contractor shall furnish all labour, equipment and materials as required for the design, fabrication, coatings, erection and fitting of the decking over purlins, painting and for the complete performance of the work in accordance with the construction drawings and as described herein.

5.02.00 **Detailed Design of Roof Decking**

The Contractor, in conjunction with the manufacturer, shall be responsible for the detailing of the profiled decking, fittings and fixtures and shall submit with his tender, particulars of the proposed manufacturer and of the particular product proposed for use.

Not less than four weeks before any orders are placed, the Contractor shall submit to the Engineer-in-Charge, two copies of the general arrangement and detailed working drawings for the proposed design, together with all calculations necessary to verify the adequacy and completeness of the design and detailing of decking sheets, fixtures, flashings and trims. After approval he shall further supply adequate copies.

The Engineer-in-Charge will verify the correct interpretation of his requirements but may not necessarily check the design and details and the Contractor shall be entirely responsible for the accuracy of the drawings, correctness of the design and suitability of the details. Work shall not commence until the necessary approval of the Engineer-in-Charge has been obtained.

5.03.00 **Roof Decking Sheets**

The roof decking shall consist of cold rolled light gauge mild steel sheets/decks conforming to IS:513 having a troughed profile and a minimum thickness of 0.8 mm. The troughed profile of the sheet shall be such that the depth of the valley is minimum 44 mm and centre to centre of the valley is about 130 mm. The decking sheets are to be phosphated on both sides conforming to IS:3618. The phosphating shall be medium duty B Class conforming to the above code. Over the phosphating, the decking sheets shall be coated with one coat of zinc chromate primer conforming to IS:2074 applied on both faces at the manufacturer's work.

5.04.00 **Fixing**

Roof deck shall be installed strictly in accordance with manufacturer's recommendations and erection drawings and as specified herein. Each sheet shall span three or more purlin spacings, single fashion, with ends lapped a minimum of 50 mm over bearings and with side ribs interlocked or lapped.

Ends of adjacent deck units shall be preferably be staggered on supporting members so that ends are not terminated on any one supporting member except at roof edges or at roof openings.

Panels shall be in direct contact with supporting members before welding. 2.50 mm thick batten plates shall be welded to steel to bridge joint where ribs of deck occur at joints in the supporting steel.

The roof decking sheets can also be fixed to the purlins with the help of 7 mm dia. electro-galvanised 'L' or 'J' hook bolts in place of welding. These hooks shall be provided at about 390 mm c/c along the length of the purlins. The bolts shall be located preferably in the valley. The bolts shall be provided with washers, nuts and lock nuts.

Decking shall be carefully cut and fitted on the job to suit conditions. The ribs of each unit shall interlock with the adjacent unit. Decking shall be fastened to structural supports and each other by welding in accordance with manufacturer's latest printed specifications and approved erection layouts. Sufficient anchorage shall be provided to resist a net uplift of 120 kg/sq.m.

The tongue and groove side joints of adjoining panels of decking shall be fastened together by button punching or galvanized sheet metal screws at points over 1.0 m apart. This shall be in addition to the welding of decking to purlins as herein specified. Care shall be taken not to button punch or screw the joints with one panel depressed below adjoining panels. The method of fastening shall be submitted for approval.

Cant strips shall be welded at roof openings, closure plates, etc. to decking and structural steel as required on drawing. Roof openings shall be provided in deck for framed roof openings as shown on the drawings. Holes shall be cut neatly without ragged edges.

The deck shall be reinforced at all roof openings larger than 300 mm square on the under side with two stiffener angles of sufficient length to extend two ribs beyond each side openings weld angle to each rib.

After installation, all badly scarred spots on both top and bottom surfaces of the decking, including scars from welding, shall be cleaned and touched up with the previously mentioned primer by the Contractor.

Metal cant strips for parapet walls, and metal sumps pans and plate for drains attached directly to the decking panels shall be furnished by the Contractor.

Pressed fillers for closing the hollow spaces between the webs of decking panels resting on walls on partitions shall be provided by the contractor.

5.05.00 **Holes**

Holes in MS decking sheets shall be punched. In case of drilled holes, it shall be ensured that the holes do not go oversize due to the small thickness of the sheeting. All drilling swarf shall be removed from the surfaces of decking, supporting steel work, purlins etc.

5.06.00 **Fixing of Roof Decking Sheets**

The tenderer shall submit with his tender details of the proposed method for securing the roofing sheets to the metal purlins.

Underside of the sheet shall be finally painted with 2 coats of synthetic enamel paint after erection.

5.07.00 **Acceptance Criteria**

The installation shall present a neat appearance and shall be checked for water-tightness. The following shall be checked :

- a) Side and end laps.
- b) Absence of damage in the sheeting.
- c) Conformity of fixing with the approved design.

6.00.00 **IS CODES**

List of some of the applicable Indian Standards are given below. Latest editions of these codes shall be followed :

IS:277	Galvanised steel sheets (plain or corrugated)
IS:513	Cold rolled carbon steel sheets
IS:730	Specification for fixing accessories for corrugated sheet roofing.
IS:737	Wrought aluminium and aluminium alloys (for general engineering purposes).

IS:801	Code of practice for use of cold formed light gauge steel structural members in general building construction.
IS:1254	Corrugated aluminium sheet.
IS:1573	Electroplated coatings of zinc on iron and steel.
IS:2676	Dimensions of wrought aluminium and aluminium alloys.
IS:3618	Phosphate treatment of iron and steel for protection against corrosion.
IS:3676	Pressure sensitive adhesive PVC tapes.
IS:6113	Aluminium fasteners for building purposes.
IS:7178	Technical supply conditions for tapping screw.
IS:8147	Code of practice for use of aluminium alloys in structures.
IS:8183	Bonded mineral wool
IS:12118	Two parts poly-sulphide