CONTENTS

16 Building and Architectural Works (whereever applicable).....1

16.1 SCOPE OF WORK 1

16.1.1 SUBMITTALS 2

16.1.2 NOMINAL SIZES 3

16.1.3 FINISHING WORKS 3

16.1.4 GENERAL REQUIREMENTS 3

16.1.5 CODES AND STANDARDS 4

16.2 APPROVAL OF SAMPLES, INSPECTION, TESTING OF MATERIALS AND FINISHED WORK, QUALITY SCHEME 4

16.2.1 MATERIALS..... 4

16.2.2 SAMPLING AND TESTING..... 5

16.2.3 QUALITY ASSURANCE SCHEME 5

16.3 Masonry and Allied Works..... 6

16.3.1 SCOPE OF WORK 6

16.3.2 GENERAL REQUIREMENTS 6

16.3.3 CODES AND STANDARDS..... 6

16.3.4 MODULATIONS AND CORNICES..... 8

16.3.5 DAMP PROOF COURSE (DPC)..... 8

16.3.6 DISMANTLING AND DEMOLITION 9

16.3.7 SAMPLING, TESTING AND QUALITY CONTROL 10

16.3.9 RATES..... 14

16.3.10 MEASUREMENT..... 16

16.4 PLASTERING AND ALLIED FINISHES TO MASONRY AND CONCRETE18

16.4.1 SCOPE OF WORK 18

16.4.2 PREPARATION OF SURFACE..... 18

16.4.3 PLASTERING 19

16.4.4 WALL PLASTER..... 19

16.4.5 CEILING PLASTER 19

16.4.6 CHICKEN WIRE MESH IN PLASTER 20
16.4.7 GROOVES IN PLASTER 20
16.4.8 APPLICATION OF PLASTER 20
16.4.9 WATER PROOFING ADMIXTURES 21
16.4.10 FINISH 21
16.4.11 ACCEPTANCE CRITERIA 23
16.4.12 RATES 23
16.4.13 METHOD OF MEASUREMENT 23

16.5 FLOOR FINISHES AND ALLIED WORKS 24
16.5.1 SCOPE OF WORK 24
16.5.2 INSTALLATION 25
16.5.3 METALLIC HARDENERS LIKE “IRONITE” FINISH 26
16.5.4 GLAZED TILE FINISH 27
16.5.5 RUBBERISED PVC TILE / SHEETS FINISH 29
16.5.6 ACID / ALKALI RESISTANT LINING 31
16.5.7 MATERIALS FOR ACID / ALKALI RESISTANT LINING 33
16.5.8 LAYING OF ACID / ALKALI RESISTANT LINING 34
16.5.9 LAYING OF ACID / ALKALI RESISTANT TILE / BRICKS ON FLOORING & SKIRTING 37
16.5.10 RATES AND MEASUREMENTS 38

16.6 METAL DOORS, WINDOWS, VENTILATORS, LOUVERS, ROLLING SHUTTERS AND GRILLS, ETC. 39
16.6.1 SCOPE OF WORK 39
16.6.2 INSTALLATION 40
16.6.3 FABRICATION OF STEEL DOORS, WINDOWS, VENTILATORS LOUVERS ETC. 41
16.6.4 HANDLING & STORAGE OF FABRICATED MATERIALS 47
16.6.5 ASSEMBLY & ERECTION AT SITE 47
16.6.6 ACCEPTANCE CRITERIA 48
16.6.7 INFORMATION TO BE SUBMITTED 50
16.6.8 RATES 50
16.6.9 METHOD OF MEASUREMENT 51

16.7 GLASS AND GLAZING 52
16.7.1 SCOPE OF WORK 52
16.7.2 INSTALLATION 52
16.7.3 IS: CODES 52
16.7.4 MATERIALS 52
16.7.5 ACCEPTANCE CRITERIA 54
16.7.6 RATES 54
16.7.7 METHOD OF MEASUREMENT 55

16.8 ROOF WATER PROOFING 55
16.8.1 SCOPE OF WORK 55
16.8.2 INSTALLATION 55
16.8.3 ACCEPTANCE CRITERIA 58
16.8.4 METHOD OF MEASUREMENT 59
16.8.5 CODES AND STANDARDS 60

16.9 SUSPENDED CEILING 60
16.9.1 SCOPE OF WORK 60
16.9.2 SUSPENSION SYSTEM 61
16.9.3 CEILING PANEL 62
16.9.4 ACCEPTANCE CRITERIA 62
16.9.5 RATES 63
16.9.6 METHOD OF MEASUREMENT 63

16.10 FALSE / RAISED FLOORS 63

16.11 PAINTING, LIME WASHING AND ALLIED WORKS 65
16.11.1 SCOPE OF WORK 65
16.11.2 MATERIALS 65
16.11.3 PREPARATION OF SURFACE 68
16.11.4 APPLICATION 69
16.11.5 PAINTING OF METAL WORK 73
16.11.6 ACCEPTANCE CRITERIA 75
16.11.7 RATES 75
16.11.8 METHOD OF MEASUREMENT 75

16.12 GENERAL SPECIFICATIONS..... 76

16 BUILDING AND ARCHITECTURAL WORKS (WHEREEVER APPLICABLE)

16.1 SCOPE OF WORK

i. The work under this section includes all labour, materials and equipment, and performance of all operations required for the execution of the finishing and architectural works inside or outside of buildings, rooms or chambers to be constructed under this contract.

ii. This section covers the following items:

a. Masonry walls,
b. Wall, floor and roof finishes,
c. Tile works,
d. Suspended ceilings,
e. Bituminous waterproofing membranes,
f. Doors and louvers,
g. Windows and sunblinds,
h. Glass and glazing,
i. Painting works,
j. Carpentry and joinery,
k. Caulking and damp-proofing,
l. Perforations and cuts in the finished concrete and masonry,
m. Temporary closures and protection.

iii. The building and architectural works not specified herein shall be defined by the contractor during the course of the work.

iv. All materials and equipment which will become a part of the permanent works shall be new and of good quality.

v. If the specification and annexure do not contain particulars of materials and works which are obviously necessary for the proper completion of the

work and the intention to include such is nevertheless to be inferred, all such materials and works shall be supplied and executed by the contractor.

vi. Similarly, the contractor shall supply, place and attach to the structure all timber, metal or other accessories necessary for the proper completion of the work.

vii. The contractor shall provide and fix all incidental flashings, damp proofing, weather seals or other approved materials necessary to render the buildings completely watertight and weatherproof.

viii. The contractor shall furnish, erect and maintain during the work as required all scaffolding, walkways and other temporary structures required for the execution of the works.

ix. The contractor shall collect and dispose of all material, debris and rubbish as it accumulates from time to time as the work proceeds. On completion of this work, the contractor shall thoroughly clean interior and exterior of the buildings and the other works.

16.1.1 SUBMITTALS

i) The contractor shall submit drawings to the Project Manager, which will indicate the design of the various buildings together with the door and window schedules and internal and external finishes. Shop and detail drawings shall be prepared by the contractor and submitted to the Project Manager for approval to suit the construction of the works.

ii) The contractor shall prepare and submit for approval at least 28 days prior to the date he wishes to place or confirm purchase order:

a. Two sets of drawings indicating the design intent together with the door/window schedule and finishes,

b. Two sets of shop drawings where necessary, showing details of various parts, method of placing or anchoring and any other pertinent details,

c. Lists and schedules of materials to be purchased,

d. Manufacturers' catalogues for the various items specified in this section,

e. Samples of materials and hardware with specimens of workmanship,

f. Colour and finish for the various items specified in this section.

16.1.2 NOMINAL SIZES

The contractor shall allow for variations between nominal sizes and actual sizes where such variation is within the required tolerances or is normal trade practice.

16.1.3 FINISHING WORKS

i) Finishing work shall not commence until each or all of the following conditions have been met to the satisfaction of the Project Manager:

a) The area concerned and such adjacent areas which may affect the finishing work have been weatherproofed,

b) All construction including installation of permanent plant, fittings and equipment has been completed,

c) The concrete or other materials have dried out sufficiently. The Project Manager may request a test for dryness to be performed by the Contractor.

16.1.4 GENERAL REQUIREMENTS

i) The Contractor shall furnish all skilled and unskilled labour, plant, equipment, shuttering & scaffolding, materials, etc. required for complete execution of the work in accordance with the drawings and as described herein and/or as directed by the Project Manager.

ii) All workmanship shall be in accordance with the latest standards and best possible well established good practice.

iii) The Contractor shall carry out all works for setting out the building lines, locating the co-ordinates and establishing the reduced levels (RL's) on the basis of reference benchmark, which shall be furnished by the OWNER, at one or more locations.

iv) Any approval, instructions, permission, checking, review, etc. whatsoever by the Project Manager shall not relieve the Contractor of his responsibility and obligation as mentioned herein but not limited to regarding adequacy, correctness, completeness, safety, strength, quality, workmanship, etc.

16.1.5 CODES AND STANDARDS

i) All applicable standards, acts and codes of practice referred to shall be the latest editions including all applicable official amendments and revisions. A complete set of all these documents shall generally be available at site, with the Contractor.

ii) In case of conflict between this specification and those (IS Codes etc.) referred to in clause 18.3.3, the more stringent of the two shall prevail.

16.2 APPROVAL OF SAMPLES, INSPECTION, TESTING OF MATERIALS AND FINISHED WORK, QUALITY SCHEME

16.2.1 MATERIALS

i) List of materials (bought out items) required for civil and architectural work which the tenderer proposes to use in executing the work shall be submitted along with his tender indicating in detail the full description of the materials, name of the manufacturer, brand name and enclosing manufacturer's catalogues etc. all in accordance with the specifications, schedule of items and relevant drawings.

ii) All the bought out items shall be procured from renowned manufacturers of standing repute. "Renowned manufacturer" means that he should have complete testing facilities and exercise strict quality control measures during

production and his materials have already been successfully used in different places.

iii) Representative of Project Manager shall visit the premises of the manufacturers for inspection and testing before dispatch of the materials to site. However, it shall be the responsibility of the Contractor to bring the materials at site as per specifications on the basis of approved sample and store in good conditions. Contractor shall have to arrange for such inspection and testing.

iv) The Contractor shall submit samples of materials to the Project Manager for his inspection and approval.

v) After the relevant bulk supplies are approved, the Project Manager will release the approved samples at the time of actual installation for their inclusion as part of the total supply by the Contractor.

vi) The cost of supply of samples, retaining the approved samples by the Project Manager, cost of testing of samples at the manufacturer's premises or in an independent laboratory etc. shall not be paid and these shall be covered by the unit rate of the items in the schedule of items.

16.2.2 SAMPLING AND TESTING

i) Sampling (frequency and numbers) and testing of all materials including finished work shall be according to relevant Indian Standard and Clauses stipulated in this specification.

16.2.3 QUALITY ASSURANCE SCHEME

i) Tenderer shall submit a proposed quality scheme along with the tender for all the materials and item of work according to the specifications, drawings and schedule of items. Successful tenderer should finalise the scheme of quality assurance with the representative of Project Manager within 30 days of award of the Contract. This scheme shall be followed for execution of all construction work within stipulated time as per contract document.

16.3 Masonry and Allied Works

16.3.1 SCOPE OF WORK

i) This section of the specification covers furnishing, installation including handling, transporting, batching, mixing, laying, scaffolding, centering, shuttering, finishing, curing, protection and repairing till handing over of brick masonry, stone masonry/precast CC blocks and allied works including DPC, plinth protection and dismantling.

16.3.2 GENERAL REQUIREMENTS

i) The Contractor shall furnish all skilled and unskilled labour, plant, equipment, scaffolding, materials, etc. required for complete execution of the work in accordance with the drawings and as described herein and/or as directed by the Project Manager.

ii) All workmanship shall be in accordance with the latest standards and best possible practice. Masonry work shall be true to line & level as shown on drawing. All such masonry shall be tightly built against structural members and bonded with dowels, anchors, inserts, etc. as shown on the drawings.

iii) The Contractor shall carry out all works for setting out the building lines, locating the co-ordinates and establishing the reduced levels (RL's) on the basis of reference benchmark, which shall be furnished by the Corporation, at one or more locations.

iv) Any approval, instructions, permission, checking, review, etc. whatsoever by the Project Manager shall not relieve the Contractor of his responsibility and obligation including but not limiting to regarding adequacy, correctness, completeness, safety, strength, quality, workmanship, etc.

16.3.3 CODES AND STANDARDS

i) All applicable standards, acts and codes of practice referred to shall be the latest editions including all applicable official amendments and revisions. A

complete set of all these documents shall generally be available at site, with the Contractor.

ii) In case of conflict between this specification and those (IS Codes etc.) referred to in the preamble to the technical specifications, subclause Standards and Codes, the more stringent of the two shall prevail.

iii) Some of the applicable Indian Standards, Codes, etc. are referred to here below:

IS: 1127	Recommendations for Dimensions and Workmanship of Natural Building Stones for Masonry Work.
IS: 1200	Method of measurement of building and civil engineering works. Part-3, Brick Work Part-4, Stone masonry
IS: 1597	Code of practice for construction of Stone Masonry.
IS: 1905	Code of Practice for Structural Safety of Buildings – Masonry walls.
IS: 2116	Specification for sand for masonry mortars.
IS: 2185	Specification for Hollow Cement Concrete Blocks.
IS: 2212	Code of Practice for Brickwork.
IS: 2250	Code of Practice for Preparation and Use of Masonry Mortar.
IS: 2572	Code of Practice for Construction of Hollow Concrete Block Masonry.
IS: 3414	Design and installation of joints in buildings.
IS: 3696	Safety code for scaffolds and ladders.
IS: 4130	Safety code during demolition of buildings.
IS: 4326	Code of practice for earthquake resistant design and construction of buildings.
SP: 20	Explanatory handbook on masonry code.

iv) All the above standards/codes should be of latest revision.

16.3.4 MODULATIONS AND CORNICES

i) The relevant clauses of the specifications described above shall also apply. The bricks or stones shall be cut and dressed to the required shape as shown on architectural drawings. If no subsequent finish is envisaged, these shall be rubbed to correct profile with carborundum stone.

16.3.5 DAMP PROOF COURSE (DPC)

i) All walls in a building shall be provided with a damp proof course generally immediately below the underside of the ground floor or as shown on the drawings. This shall run without break throughout the length of the wall, even under door or other openings.

ii) Damp proof course shall be 50 mm thick (unless, otherwise specified) consisting of cement concrete in proportion 1:1.5:3, (1 cement: 1.5 sand: 3 graded stone aggregate 10 mm nominal size) mixed with water proofing cement additive as approved by the Project Manager. The additive shall be used in proportion recommended by the manufacturer.

iii) The surface of masonry work shall be levelled and prepared before laying the cement concrete. Edges of DPC shall be straight and even. The side shuttering shall consist of wooden forms and shall be strong and properly fixed so that it does not get disturbed during compaction and properly fixed so that it does not get disturbed during compaction and mortar does not leak through. The concrete mix shall be of workable consistency and shall be tamped thoroughly to make a dense mass. When the side shutterings are removed the surface should be smooth without any honeycombing. The top surface shall be double chequered and cured by ponding for at least 7 days. The cement concrete shall be allowed to dry for at least 24 hours after curing and hot bitumen of grade 85/25 conforming to IS: 702 at the rate of 1.7 kg/m^2 shall be applied over the dried up surface of cement concrete after being properly cleaned with brushes and finally with a cloth soaked in

kerosene oil. The bitumen shall be applied uniformly so that no blank spaces are left anywhere.

16.3.6 DISMANTLING AND DEMOLITION

i) The term 'Dismantling' implies carefully removing without damage (up or down). This shall consist of dismantling one or more part of the building as specified or shown on the drawings.

ii) The term 'Demolition' implies breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown on the drawings.

iii) General Requirements

a) All materials obtained from dismantling or demolition shall be the property of the Owner, unless otherwise specified and shall be kept in safe custody until handed over at Owner's stores to the Project Manager. Demolition shall be carried out in the shape and profile shown on the drawings or as directed by the Project Manager,

b) The dismantling or demolition shall always be planned before hand and shall be done in reverse order of the one in which the structure was constructed. The scheme shall be getting approved from the Project Manager before starting the work.

iv) Precautions:

a) Necessary propping, shoring and under pinning shall be provided for the safety of the adjoining work or property before dismantling or demolition is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining work or property. Wherever specified, temporary enclosures or partitions shall also be provided,

b) All demolition work shall be carried out in conformance with the local safety regulations, ensuring the safety of men and materials,

c) Necessary precautions shall be taken to keep down the dust nuisance,

d) All materials, which are likely to be damaged during the operation, shall be carefully removed first,

e) Dismantling shall be done in a systematic manner. The dismantled articles shall be passed by hand, where necessary, lowered to the ground (and not thrown) and then properly stacked as directed by the Project Manager,

f) Where fixing is done by nails, screws, bolts and rivets etc. dismantling shall be done by taking out the fixing with proper tools and not by tearing or ripping off,

g) All serviceable materials obtained shall be separated out and stacked properly as directed by the Project Manager, up to a lead of 500 m or handed over at Owner's stores. All unserviceable materials, rubbish etc. shall be disposed off, as directed by the Project Manager, up to a lead of 2 km

16.3.7 SAMPLING, TESTING AND QUALITY CONTROL

i) General:

a) The contractor shall carry out all sampling and testing in accordance with the relevant Indian Standards and/or International Standards and shall conduct such tests as are called for by the Project Manager. Where no specific testing procedure is mentioned, the tests shall be carried out as per the prevalent accepted engineering practice to the directions of the Project Manager. Tests shall be done in the field and at a laboratory approved by the Project Manager and the Contractor shall submit to the Project Manager, the test results in triplicate within three days after completion of a test. The Project Manager may, at his discretion, waive off some of the stipulations for small and unimportant operations,

b) Material/work found unsuitable for acceptance, shall be removed and replaced by the Contractor. The works shall be redone as per specification requirements and to the satisfaction of the Project Manager.

ii) Quality Assurance Programme:

a) The Contractor shall submit and finalise a detailed field Quality Assurance Programme within 30 days from the date of award of the Contract according to the requirements of the specification. This shall include setting up of a testing laboratory, arrangement of testing apparatus /equipment, deployment of qualified/experienced manpower, preparation of format for record, field quality plan etc. On finalised field quality plan, the Owner shall identify the points beyond which work shall not proceed without written approval from the Project Manager.

iii) Frequency of sampling and testing including the methods for conducting the tests are given in Table-1. The testing shall be done at site. The testing frequencies set forth are the desirable minimum and the Project Manager shall have the full authority to carry out or call for tests as frequently as he may deem necessary to satisfy himself that the materials and works comply with the appropriate specifications. Some of the type tests and performance tests, which are not included in the table shall be carried out at the manufacturer's premises or at an independent Government approved laboratory.

Table - 1

Sl No.	Type of Material	Nature of Test/ characteristics	Method of Test	No. of Samples and frequency of test	Remarks Acceptance Norms
1	**Burnt clay bricks**	a) Dimensions	---		
		b) Comprehensive Strength	IS:3495 (part-1)		
		c) Water absorption	IS:3495 (part-2)	A set of 20 bricks (min) for each lot of 50'000 or part there of for all tests (a to e).	
		d) Efflorescence	IS:3495 (part-3)		Moderate, however for face brick nil.
		e) Warpage	IS:3495		For face brick 2.5 mm (max.)
II	**Stone**	a) Type of stone by Petrographic Examination	IS: 1123	One set of stones of each type and from each source	As specified
		b) Shape and size	Physical measurement	Random	As specified
		c) Crushing strength	IS: 1121 (Part I)	One set of stones of each type and from each source	As specified
		d) Water absorption	IS: 1124	One set of stones of each type and from each source	As specified
		e) Durability	IS: 1126	One set of stones of each type and from each source	As specified
III	**Water**	a) Harmful substances	IS: 3025 PH value	Once a month for each source	No separate testing is required in case water is tested for concrete mix

Sl No.	Type of Material	Nature of Test/ characteristics	Method of Test	No. of Samples and frequency of test	Remarks Acceptance Norms
		b) Initial setting time	IS: 4031	Once a month for each source	No separate testing is required in case water is tested for concrete mix
		c) Compressive Strength	IS: 516	Once a month for each source	No separate testing is required in case water is tested for concrete mix
IV	**Mortar**	a) Compressive Strength	IS: 2250 Append. A	One sample (consisting of min. 3 specimens)	Table-1 of IS: 2250
		b) Consistency	IS: 2250 Append. B	One sample for each type of mix	Clause 7.2 of IS: 2250
		c) Water Tetentivity	IS: 2250 Append. C	One sample for each type of mix	Clause 7.3 of IS: 2250

16.3.8 All masonry shall be built true and plumb within the tolerance prescribed as below. Care shall be taken to keep the perpends properly aligned.

i) Deviation in verticality in total height of any wall of a building more than one storey in height shall not exceed +/- 12.5 mm,

ii) Deviation from vertical with a storey shall not exceed +/-6 mm per 3 m height,

iii) Deviation from the position shown on the plan of any brickwork more than one storey in height shall not exceed 12.5 mm,

iv) Relative displacement between load bearing walls in adjacent storeys intended to be in vertical alignment shall not exceed 6 mm,

v) Deviation of bed joint from horizontal in any length up to 12 m shall not exceed 6 mm, and in any length over 12 m it shall not exceed 12.5 mm total,

vi) Deviation from the specified thickness of bed-joints, cross-joints or perpends shall not exceed +/-3 mm.

16.3.9 RATES

i) The various items of work in Bill of Quantities describe the work in brief. It shall be read in conjunction with the corresponding sections in the technical specifications including amendments and additions, if any. For each item in the Schedule of Items, the bidder's quoted rate shall include the activities covered in the description of the item as well as all necessary operations described in the specifications.

ii) Bidder's quoted rate for each item shall include minor details which are obviously and fairly intended, and which may not have been included in descriptions in these documents but are essential for completion of the work. Quoted rate for each item shall also include for taking all safety measures as required by provisions of applicable codes, local regulations/acts, etc. and for execution to the satisfaction of the Project Manager.

iii) Bidder's quoted rate for each item shall be inclusive of providing all plant, equipment, men, materials, skilled and unskilled labour, making observations, supervision and establishing the ground level and coordinates at location of each work by carrying levels from bench mark furnished by the Corporation.

iv) Bidder's quoted rate for each item shall also include for all sampling, testing, quality assurance requirements, inspection, etc. The rates shall be all inclusive of providing temporary works, wastage, addition of extra cement if required, overheads, profits and all such requirement. No extra shall be payable over and above the quoted rate.

v) No claim shall be entertained if the details, shown on the released for construction drawings differ in any way from those shown on the drawings enclosed with the tender documents, unless the nature of work is different.

vi) Bidder's quoted rates for masonry work shall include the following:

a) Providing brick-on-edge in top courses of all plinth, parapet, steps and top wall below R.C.C. including cut bricks radiated and keyed into position in top courses and ends of walls,

b) Racking out joints for plastering or pointing or finishing the joints flush as the work proceeds,

c) Preparing tops and sides of existing walls for joining old work with new work,

d) Providing, dismantling and removing the scaffolding,

e) Filling and making good with cement concrete, the holes left in masonry work for supporting scaffolding,

vii) Bidder's quoted rates for exposed brickwork and stonework shall include the following:

a) Rubbing down (including with carborundum stone where specified) & washing clean,

b) Providing, dismantling and removing the double scaffolding.

viii) Quoted rates for DPC shall be inclusive of formwork, addition of water proofing compound and bitumen painting.

ix) Quoted rate for plinth protection shall be inclusive of excavations in all types of soil, disposal of surplus earth, broken stone filling, and brick laying with cement mortar including pointing.

x) Bidder's quoted rate for demolition shall include the following:

a) Separating out and stacking properly the serviceable materials up to a lead of 500 m or handing over to Owner's stores and disposing off unserviceable materials up to a lead of 2 km,

b) Necessary propping, shoring and underpinning for the safety of portions not required to be pulled down or of adjoining property and

providing temporary supports and enclosures or partitions where specified, including safety of men and materials,

c) Providing, dismantling and removing the scaffolding.

16.3.10 MEASUREMENT

i) Brickwork in walls of half brick thickness or less shall each be measured separately in square metres stating the wall thickness and more than half brick thickness shall be measured by volume. Brick walls from one brick thickness up to and including three bricks in thickness shall be measured in multiple of half bricks which shall be deemed to be inclusive of mortar joints. Where fractions of half-brick occur due to architectural or other reasons, measurement shall be made for half brick. For the purpose of this measurement, nominal brick thickness shall be considered.

ii) For Brickwork, which is more than three bricks in thickness, actual thickness of wall shall be measured.

iii) Stone masonry work shall be measured by volume in cubic metres and actual thickness shall be considered.

iv) No deductions shall be made nor any extra payment made for the following:

a) Opening up to 0.1 m2 each in area,

b) Drainage holes and recesses for cement concrete blocks to embed hold fast for doors, windows etc.,

c) Necessary holes/recesses etc. for embedded fixtures and pipes up to 300 mm diameter. Nothing extra shall be paid for the mortar used for fixing of these fixtures and pipes,

d) Forming chases in masonry each up to a section of 350 m2,

e) Voids with in the concrete blocks.

v) Reinforcement in masonry work shall be measured by weight in kilograms correct to two places of decimal and paid separately according to items of reinforcement work.

vi) RCC in bands shall be measured and paid separately under the item of RCC. Full deduction for volume of RCC in bands shall, however, be made from the measurement for masonry work. Bed blocks shall be measured and paid separately under items of plain/reinforced concrete work.

vii) Pointing in exposed masonry shall be measured in m2 of surface area and paid separately if not included in the Schedule of Items.

viii) For measurement of mouldings and cornices, their sectional periphery (excluding the portion contact with wall) shall be measured in centimetres and length in metres. The girth and length shall be measured correct to a centimetre. No deduction shall be made from the masonry of wall for the bearing of the moulding and cornices.

ix) Plinth protection shall be measured in square metres correct to second place of decimal. No deduction shall be made nor any extra paid for any openings up to 0.1 m2 in area.

x) Damp proof course shall be measured in square metres correct to second place of decimal. No deduction shall be made nor any extra paid for any openings up to 0.1 m2 in area.

xi) Demolition of masonry work/reinforced masonry work shall be measured in m3 No extra payment shall be made for removing mortar and cleaning bricks, cutting of reinforcement bars and scraping, cleaning and straightening of reinforcement bars from reinforced masonry work. While measuring thickness of plastered walls, the thickness of plaster shall be ignored.

xii) Measurements of all work, except hidden work, shall be taken before demolition and no allowance for increase in bulk shall be allowed. Stipulations for deduction of voids, openings etc. shall be on the same basis as that employed for masonry construction.

16.4 PLASTERING AND ALLIED FINISHES TO MASONRY AND CONCRETE

16.4.1 SCOPE OF WORK

i) This specification covers furnishing, installation, repairing, finishing, curing, testing, protection, maintenance till handing over of plastering and allied finishes to masonry and concrete. This shall also include the work to be done to make surfaces suitable for receiving the finishing treatment and any further finishing treatment over base finishing treatment.

ii) Before commencing work on the finishing items the Contractor shall obtain the approval of the Project Manager regarding the scheduling of work to minimise damage by other contractors. He shall also undertake normal precautions to prevent damage or disfiguration to work of other contractors and other installations.

16.4.2 PREPARATION OF SURFACE

i) 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 brushes to remove all loose dust from joints and thoroughly washed with water. All laitance shall be removed from concrete to be plastered.

ii) 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.

iii) 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 to the required level shall be brought to the notice of the Project Manager and his approval shall be taken regarding the method and extent of rectification work required.

iv) Prior to commencement of actual finishing work, the approval of the Project Manager shall be taken as to the acceptability of the base.

16.4.3 PLASTERING

i) Mortar for plastering shall be as specified in the drawings and in the Schedule of Items.

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

iii) 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.

16.4.4 WALL PLASTER

i) The wall plaster shall be laid in a single coat of 12 mm thickness on the even surface of brickwork and 15 mm on the rough surface of the brickwork. The mortar shall be dashed on the prepared surface with a trowel and finished smooth by trowelling on the surface. The standard of finish expected is high and shall conform to IS: 2394. Internal wall plaster shall be carried out on jambs, lintel and sill faces, top and undersides, etc. as shown in the drawing or as directed by Project Manager. Rate quoted for plasterwork shall be deemed to include plastering of all those surfaces. However, if the item of work includes plaster finish, no separate payment would be made under ‘plastering work’. Wall plaster shall commence at top and work downwards.

16.4.5 CEILING PLASTER

i) Ceiling plaster shall be done in the areas shown in drawings and wherever required by Project Manager, in a manner similar to internal wall plaster and applied before wall plaster. The thickness of mortar and its grade shall be as per the “Schedule of Items”.

16.4.6 CHICKEN WIRE MESH IN PLASTER

i) Where specified in drawings, chicken wire mesh of 18 gauge shall be provided in junctions between masonry, RCC work etc. with minimum width of mesh of 150 mm along the length of the junctions, a butting of minimum of 75 mm onto masonry, RCC surface etc. and fixed in position with suitable M.S. nails spaced at not greater than 150 mmc/c, and then plaster as specified applied over the mesh works as directed by Project Manager.

ii) Drip courses as indicated in drawings shall be provided at the time of plastering.

16.4.7 GROOVES IN PLASTER

i) Where specified in drawings rectangular grooves as per drawings shall be provided in external plaster by means of timber battons fixed on plaster when plaster is still in green condition. Battons shall be carefully removed after initial set of plaster and broken edges and corners made good. All grooves shall be uniform in width and depth and shall be truly plumb and correctly aligned.

16.4.8 APPLICATION OF PLASTER

i) Plaster, 12 or 15 mm thickness shall be applied in single coat. To ensure even thickness and true surface, wooden screed 75 mm wide and of the thickness of the plaster shall be fixed vertically about 2000 mm to 3000 mm 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, door jambs etc. shall be chamfered or rounded off as directed by the Project Manager. All drips, grooves, mouldings and cornices as shown on drawing or instructed by the Project Manager 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.

ii) Curing of plaster shall be started as soon as the applied plaster has hardened enough so as not to be damaged. The decision as to when the plaster has hardened will be given by the Project Manager. Curing shall be done by continuously applying water in a fine spray and shall be carried out for at least 7 days. Whenever the specification or the item of work calls for - waterproofing, the Contractor shall provide the percentage of water proofing compound as specified in the items of work.

16.4.9 WATER PROOFING ADMIXTURES

i) If directed by the Project Manager, the Contractor shall use approved water proofing admixtures made by reputed manufacturer in the mortar for plasterwork. The quantity to be used etc. shall be in accordance with the manufacturer's instructions subject however to the approval of the Project Manager. These admixtures shall not contain calcium unless specifically allowed by Project Manager and shall conform to IS: 2645 (Latest Revision).

ii) Payment shall be made for actual quantity of such admixture used unless it is already covered in the rates for the work concerned.

16.4.10 FINISH

i) General:

a) The standard finish shall be used unless otherwise shown on drawing or directed by the Project Manager. 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 Project Manager regarding the texture, colour and finish.

ii) Standard Finish:

a) The interior plaster shall be finished to a smooth surface. The exterior surface shall be finished with a wooden float.

iii) Neat Cement Finish:

a) 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 1 (one) kg. per m^2 and rubbed smooth with a trowel.

iv) Rough – Cast – Finish:

a) 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 Project Manager) shall be thrown on to the wall by means of plaster's trowel and left in the rough condition. The mix shall again be dashed over the vacant spaces, if any, so that the surface represents homogeneous surface of sand mixed with gravel.

v) Pointing:

a) Pointing shall be of the type such as 'ruled', 'cut' or 'weather struck' etc. as indicated in the drawing. Following general specifications shall apply to all types of pointing. All joints shall be raked to such a depth that the minimum depth of the new mortar measured from either the sunk surface of the finished pointing or from the edge of the brick shall not be less than 12 mm. The mortar shall be pressed into the raked out joints with a pointing trowel either flush, sunk or raised according to the type of pointing required. The mortar shall not spread over the corners, edges and surfaces of masonry. The pointing shall then be finished with the proper tool as required for the particular kind of pointing specified. The superfluous mortar shall then be cut off from the edges of the lines and the surface mortar shall then be cut off from the edges of the lines and the surface finish shall be such that the pointing is to be exact size and shape as stipulated.

16.4.11 ACCEPTANCE CRITERIA

i) Finish to masonry and concrete shall fully comply with the drawings specifications, approved samples and instructions of the Project Manager 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 drawing.

16.4.12 RATES

i) Rates shall be for the complete work as detailed out in the specification unless any particular portion is specifically excluded in the Schedule of Items. Rates shall include for sacffolding, curing, finishing etc.

16.4.13 METHOD OF MEASUREMENT

i) All surface finish shall be measured in m^2 on actual area laid correct to the second place of decimal. Deductions for openings jambs, soffits, reveals, sills etc. are plastered shall be made as stated hereunder:

a) For openings up to 0.5 m2 each, no deductions shall be made and no additions shall be made for reveals, soffits, jambs, sill etc.,

b) For openings exceeding 0.5 m2 but not exceeding 3.0 m2 each, deductions shall be made for half the area of the openings and no additions shall be made for reveals, soffits, jambs, sills etc.,

c) For opening exceeding 3.0 m2 each, deductions shall be made for the whole area and additions shall be made for reveals, soffits, jambs, sill etc.,

d) For openings, sleeves, pipes etc. whose sides are not plastered, no deduction shall be made for openings up to 0.1 m2 in area each and full deductions shall be made for openings above 0.1 m2 each,

e) Sides of plasters, projections etc. shall be measured for actual size,

f) No measurement shall be made for rounding and chamfering junctions, corners etc.

ii) Unless separate item is provided for special corner or edge finish, drip course, grooves, mouldings, curbs etc. these shall not be measured separately. Where separate item is provided in the Schedule of Items, such work shall be measured for length.

iii) No separate payment shall be made for finishing round openings, sleeves, pipes etc. No separate payment shall be made for formwork templates etc. required for achieving true lines and profiles as shown on drawing.

iv) Finishes applied integrally with walls, floors, steps and ceilings shall be measured separately and paid under relevant items.

v) Any reinforcement incorporated in the finish shall be measured and paid separately under relevant items.

vi) Unless otherwise mentioned in the Schedule of Items, hangers, supports, chicken wire mesh shall be measured and paid separately under relevant items.

vii) Drip course shall be measured and paid for in running metres.

viii) Grooves in plaster shall be measured and paid for in running metres.

16.5 FLOOR FINISHES AND ALLIED WORKS

16.5.1 SCOPE OF WORK

i) This specification covers furnishing, installation, finishing, curing, testing protection, maintenance till handing over various type of floor finishes and allied items of work.

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

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

16.5.2 INSTALLATION

i) Special Materials:

a) Special materials required for individual finishing items are specified under respective items. In general, all materials shall be as per relevant IS Codes where available. In all cases these materials shall be of the best quality available indigenously unless specified otherwise,

b) The materials for finishing items must be procured from well reputed specialised manufactures and on the basis of approval of samples by the Project Manager. The materials shall be ordered, procured and stored well in advance to avoid compulsion to use sub standard items to maintain the construction schedule. The materials shall be as per the following:

- White cement shall be white port land cement in accordance with IS: 8042 (Latest edition),
- Sand shall be coarse screened, washed, free from organic materials in accordance with IS: 2116 (Latest edition),
- Marble shall be standard quarry product or machine crushed of size 3 mm or above and of specified colour and uniform grade,
- Colour pigments, as selected shall be pure mineral pigments, lime proof and non-fading.

ii) Workmanship:

a) Only workers specially experienced in particular items of finishing work shall be engaged.

iii) Preparation of the Base Surface:

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

b) 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 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 the specification under individual items,

c) To prevent absorption of water from the finishing treatment, the base shall be thoroughly soaked with water and all excess water mopped up,

d) The surface shall be done dry where adhesives are used for fixing the finishes,

e) Prior to commencement of actual finishing work the approval of the Project Manager shall be taken as to the acceptability of the surface.

16.5.3 METALLIC HARDENERS LIKE "IRONITE" FINISH

i) This will consist of a sub grade 38 mm thick of cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 stone aggregate, 20 mm nominal size) and a topping (incorporating iron particles) to bond with the sub grade while the latter is green.

ii) Thickness:

a) The total average thickness including the finish shall be 50 mm (38 + 12). In case only topping is applied to existing base PCC/RCC then the thickness of the topping only shall be 12 mm.

iii) Material:

a) 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 Project Manager actual samples shall be tested.

iv) Mix:

a) 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.

v) Laying:

a) The concrete subgrade floor shall be laid and levelled up to 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,

b) 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 subgrade. Just when the initial set starts, the surface shall be finished smooth with a steel trowel. The finished floor shall be cured for 7 days by keeping it wet.

16.5.4 GLAZED TILE FINISH

i) This finish shall be composed of glazed earthen coarse tiles with an underbed laid over a concrete or masonry base.

ii) Thickness:

a) The total thickness shall be minimum 17 mm 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.

iii) Tile Glazed:

a) The tile shall be of earthenware, covered with glaze, white or coloured, plain or with designs, of size as indicated on drawings and as directed by the Project Manager and 5 mm thick unless otherwise specified. The tolerances shall be +/- 1.5 mm for length and breadth and +/- 0.5 mm for thickness. Specials like internal and external angles, beads, covers, cornices, corner pieces etc., shall match. The top surface of the tile shall be glazed with floss or matt unfading stable finish as desired by the Project Manager. The tiles shall be flat and true to shape. The colour shall be uniform and fractured section shall be fine grained in texture, dense and homogeneous. The tile shall be strong and free from flaws like cracks, chips craze, specks, crawlings etc. and other imperfections. The edges and the underside shall have ribs or indentations for better anchorage with the fixing mortar. The coloured tiles, when supplied shall preferably come form one batch to avoid difference in colour.

iv) Mix of Underbed:

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

v) Laying:

a) Same as for terrazzo tiles.

vi) Finishing:

a) 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.

vii) Acceptance Criteria:

a) The finish shall be checked specially for:

- Level, slope, plumb as the case may be,
- Pattern and symmetry,
- Alignment of joints, dividing strips etc.,
- Colour, texture,
- Surface finish,
- Thickness of joints,
- Details at edges, junction etc.,
- Performance,
- Precautions specified for durability.

viii) Rates:

a) Rates shall be for the complete finishing work including necessary forms, underbed, sticker and preparation of the surface including cutting and chipping to receive the finish but exclusive of the base unless specially mentioned in the schedule of items,

b) The dividing strips in case of in-situ terrazzo finish shall be included in the rate. Similarly indentations, lying in desired patterns and in panels shall be inclusive in the rates,

c) All necessary cuttings of tiles, slabs etc. and the cost of specials, if any, shall be included in the rates. No extra shall be paid for rounding corners and edges.

ix) Method of Measurement:

a) The finished surface shall be measured for area. Any opening less than 0.1 m2 shall not be taken into account, neither shall any extra be paid for it,

b) For terrazzo finish, either in-situ or pre-cast tiles shall be paid at the same rate unless mentioned separately in Schedule of Items.

16.5.5 <u>RUBBERISED PVC TILE / SHEETS FINISH</u>

i) This shall include various types of tiles / sheets manufactured from rubber set with an adhesive on a concrete of masonry base. An underbed maybe required to obtain a satisfactory surface and grade.

ii) Thickness:

a) The thickness of the tiles shall be mentioned in the Schedule or in the drawings. The total thickness including underbed shall be 50 mm for floors and 30 mm for walls, unless otherwise specified.

iii) Tiles:

a) Unless otherwise required the tiles shall be square and of approved dimensions. The tolerance in dimensions shall be + 1.5 mm,

b) The face of the tiles shall be free from porosity, blisters, cracks, embedded foreign matter or other physical defects which affect appearance or serviceability. All edges shall be cut true and square. The colour shall be non-fading and uniform in appearance, insoluble in water and resistant to alkalis, cleaning agents and all usual floor polishes,

c) Each tile shall be marked on the back, legibly and indelibly, with the manufacturer's trademark, the thickness, size, batch number and date of manufacture,

d) Tiles shall be delivered securely packed and stored in a clean, dry well ventilated place at a temperature near to that which the tiles shall ultimately be called upon to withstand,

e) The 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.

iv) Mix of Underbed:

a) The underbed for floors and similar horizontal surfaces shall be 1 part of cement, 2 parts of coarse sand and 4 parts of stone aggregate by volume, mixed with sufficient water to form a stiff workable mass. For skirtings and dados and all vertical surfaces it shall be composed of 1 part of cement and 3 parts of coarse sand by volume.

v) Laying:

a) 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 executed,

b) 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 it shall be cured for at least 7 days by keeping it moist, and then fully dried,

c) 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,

d) The adhesive shall be applied to a fully dry surface in accordance with the manufacturer's instructions. 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 up weights shall be used to keep the edges down. Special care shall be taken to avoid the formation of air pockets under the tiles. The joints shall be very fine. Any adhesive squeezed out through the joints shall be removed immediately.

vi) Finishing:

a) If any adhesive marks are present on the surface a soft cloth soaked with insolvent shall be used to wipe them off. The surface shall be cleaned with soft soap, dried and polished or sealed with an approved type of polish or sealant just before handing over.

16.5.6 <u>ACID / ALKALI RESISTANT LINING</u>

i) General

a) This section covers the supply and furnishing of all labour, materials, and equipment, performance of all operations necessary to complete the acid/alkali resistant lining in accordance with the specifications given herein,

b) The acid/alkali resistant lining shall be provided broadly in the battery room and other items of work requiring similar protection from corrosive action of chemicals,

c) The scope of work also covers the acid/alkali resistant painting for surfaces exposed to acid fumes.

ii) General Requirements:

a) The Contractor shall furnish all skilled & unskilled labour, plant, equipment, materials, etc required for complete execution of the work in accordance with the drawings and as described herein and/or as directed by the Project Manager,

b) The structure on which acid/alkali resistant treatment is to be provided shall be leak proof & dry before starting of the work. The contractor shall take the specific clearance from the Project Manager regarding leak proofness and damp proofness,

c) The Contractor should have adequate experience in execution of such works, alternatively, he should engage a Specialised Agency for executing the work after obtaining approval from the Project Manager.

iii) Codes and Standards:

a) All standards, acts & codes of practice referred to shall be the latest editions including all applicable official amendments & revisions,

b) In case of conflict between this specification & those of standards, Codes etc. referred to, the most stringent of the two shall prevail,

iv) List of IS Codes:

IS: 158	Ready mixed paint, brushing bituminous, black, lead free, acid, alkali & heat resisting.
IS: 412	Specification for expanded metal steel sheets for general purpose.
IS: 2395	Code of practice for use of silicate type chemical resistant mortars.

IS: 4443	Code of practice for use of resin type chemical resistant mortars.
IS: 4456	(Part I & II) Method test for chemical unglazed vitreous acid resistant tiles
IS: 4457	Specification for ceramic unglazed vitreous acid resistant tiles.
IS: 4832	Specification for chemical resistant mortars Part I Silicate type, Part II Resin type, Part III Sulphur type.
IS: 4860	Specification for acid resistant bricks.
IS: 9510	Specification for bitumastic, Acid resisting grade.

16.5.7 MATERIALS FOR ACID / ALKALI RESISTANT LINING

i) A.R. Bricks shall conform to relevant IS standards.

ii) A.R. Tiles shall conform to IS: 4457 (Latest Revision). The surface of the tiles shall be free from any burnt patches. The colour of the tile shall be approved by the Project Manager.

iii) Mortar used for bedding shall be Potassium Silicate type conforming to IS:4832 (Part I) (Latest Revision). For joints, resin type of mortar conforming to IS: 4832 (Part-II) (Latest Revision) shall be used. Unless specified otherwise Epoxy/Furane type mortar shall be used for jointing. Selection of jointing mortar shall be based on the resistance to the type of the chemical to be encountered. In case CNSL is used all the properties of CNSL shall be comparable with the properties of Epoxy/Furane as specified in IS Codes.

iv) Bitumen Paint, Acid & alkali resistant bitumastic ready mixed paint, used as a primer, shall conform to IS: 158 (Latest Revision).

v) Bitumastic used as a lining shall be ready mixed material of acid resisting grade conforming to IS: 9510 (Latest Revision).

vi) Wherever specified, bitumastic layer shall be reinforced with diamond pattern expanded metal steel sheets conforming to IS: 412 (Latest Revision) having mesh size of 20 mm x 50 mm, width of strained as 2.5 mm and thickness as 1.25 mm.

vii) Epoxy Coating:

a) Ready Made Epoxy Paint shall be a two pack material with suitable pigments as approved by the Project Manager. Epoxy resin content shall not be less than 65%. The curing agent shall be polyamide. This paint shall not be used on surfaces directly exposed to sun rays. The painting shall be done as per manufactures specification. The paint shall have the following properties:

- Water resistant,
- Resistance to splash, spillage & acidic environment,
- Drying time: Touch dry in 2 to 3 hrs. & hard dry in 48 hrs.

b) Solvent Free Epoxy Coating shall be two pack material without pigment. It shall not be used on surfaces directly exposed to sun rays. The coating shall be done in accordance with the manufacture's specification. The epoxy shall be resistant to water, acid fumes etc.

viii) Shelf Life and Safety Precautions:

a) All materials shall be used within the stipulated storage periods only. Resin mortar/paint contain hazardous ingredients. Hence proper safety precautions shall be taken while handling the same.

16.5.8 <u>LAYING OF ACID / ALKALI RESISTANT LINING</u>

i) Preparation of Surface:

a) The surface shall be prepared in accordance with IS: 2395 (Latest Revision). The surface on which acid/alkali resistant lining is to be given shall be levelled smooth, dry and clean. The entire surface shall be tapped by wooden hammer in order to determine hollows, if any. If hollows are found by the above test, they shall be suitably

sealed with concrete or other material as the case may be. In other to match the floor levels, screed concrete shall be laid over the RCC floor after accounting for the bedding mortar & acid/alkali resistant tiles/bricks wherever required.

ii) Repair & Replacement of Unsatisfactory Concrete:

a) Concrete, which in the opinion of the Project Manager is unsatisfactory shall be cut and replaced by new concrete as soon as practicable after removal of forms. Anchors, keys, extra reinforcement, if necessary shall be provided to ensure proper bond between the new and old concrete. Surface to be prepared shall be wetted for 24 hours prior to the commencement of operations. Clearance shall be taken from the Project Manager before undertaking any repair work,

b) The use of epoxy resins for binding fresh concrete during repairs shall be permitted only on the written approval of the Project Manager and application of such epoxy resins shall be strictly in accordance with the manufacturer's instructions,

c) Small holes shall be filled by dry pack filling. All patched areas shall be properly cured by sprinkling water for a period of not less than 3 days,

d) All materials, procedures and operations necessary for repair of concrete or other surface on which lining has to be provided shall be subject to prior approval of the Project Manager and repair work shall be done to the satisfaction of Project Manager.

iii) Application of Primer for Bitumastic Lining:

a) The surface after preparation as mentioned above shall be applied with a coat of bitumen primer conforming to IS: 158 (Latest Revision) before application of bitumastic lining,

b) If the bedding material is epoxy resin, the tiles or bricks may be laid directly on the surface without application of bitumen primer.

iv) Laying of Acid Proof Bitumastic Treatment:

a) Acid resistant Bitumastic for inside surface shall consist of an acid-proof filler and blended bitumen. Bitumastic compound shall conform to IS: 9510 (Latest Revision). Bitumen primer shall be provided on the surface before application of bitumastic treatment. Hot molten mastic only is to be applied and proper joining shall be made by keeping correct temperature. The specified thickness of acid resistant lining shall be made up by coating in the above manner in layers of 6 mm thickness each. The thickness of bitumastic treatment shall not be less than 12 mm. The joints of bitumastic at the edges of floors & walls must be properly sealed with blow lamp,

b) Where specified and where the height of bitumastic layer along vertical surface exceeds 2.0 m, the bitumastic layer shall be reinforced with diamond pattern expanded metal steel sheets conforming to IS: 412 (Latest Revision). About 35 mm deep holes shall be made in the concrete walls at 150 mm centre to centre using rawal jumper bit (6 mm dia). Fibrous rawal plugs of suitable size shall be inserted inside the holes,

c) Expanded metal sheet shall be cleaned to make free of dust and rust. One coat bitumen paint shall be applied on the expanded metal. Fixing of the sheet shall be done with 30 mm long screw and 25 mm dia metal washer by tighting the screw into the fibrous plugs. After fixing work is done external surface of the sheet shall also be painted with coat of bitumen paint before commencing of application of bitumastic treatment. Overlapping of expanded metal at joint shall not be less than 75 mm. Whenever specified, acid resistant tiles/bricks shall be provided over bitumastic treatment using bedding mortar of 6 mm thick potassium silicate.

16.5.9 LAYING OF ACID / ALKALI RESISTANT TILE / BRICKS ON FLOORING & SKIRTING

i) Mortar application with different bedding & joining materials:

a) On floors, the bedding mortar for bricks/tiles shall be potassium silicate based mortar as per IS: 4441 (Latest Revision). The mortar shall be spread on the back & two adjacent sides of the tile or bricks. The mortar shall be pressed against the floor, until the thickness of joint between the two tiles/bricks is not less than 6 mm. This shall be achieved by employing the spacers before mortar sets completely. The joints shall be raked to a depth of 20 mm by removing the material. After the bedding mortar is properly set joints shall be cured with acid as described below and filled with resin type mortar taking special care to fill up the entire length and depth of the joint. Excess mortar shall be trimmed off to make the joints smooth & plane. Seal coat shall then be applied over the mortar joint to cover up porosity that may be left in mortar wherever specified. Ends of brick/tile works shall be sealed with bitumastic wherever required,

b) On Walls, potassium silicate based mortar shall be spread on to the back & two adjacent sides of the tile or bricks. The tiles or brick shall be pressed against the wall and with the adjacent tile or bricks until the joints in each case are not less than 6 mm thick (joint width also to be 6 mm) maintained by employing spacers. Only one course of tiles or bricks shall be laid during the initial setting time to avoid the joints at the bottom getting disturbed & the tile or brick getting slided. Before the potassium silicate mortar sets completely, the jointing material shall be removed (raked) to a depth of 20 mm. After the bedding mortar has properly set, the joints shall be cured with acid as described below and filled with resin type mortar taking care to fill-up the entire length and depth of the joint. Excess mortar shall be trimmed off to the joints smooth & plane. A seal coat shall

then be applied over the mortar joints to cover up porosity that maybe left in the mortar joints wherever specified. Ends of bricks/tile works shall be sealed with bitumastic wherever required.

ii) Acid - Curing:

a) Acid- curing shall be carried out in accordance with the manufacturer's directions, using the safety precautions normally follows when handling acids. The operators shall be provided with suitable gloves, boots etc. The mortar may be cured with 20 to 25 percent hydrochloric acid or with 30 to 40 percent sulfuric acid no sooner than 2 days and not later than 6 days after the masonry units have been bonded with the mortar. The curing time shall be at least 60 minutes.

16.5.10 RATES AND MEASUREMENTS

i) Rates:

a) The items of work in the Bill of Quantities describe the work in brief. The various items of the Bill of Quantities shall be read in conjunction with the corresponding sections in the technical specifications including amendments and additions, if any. For each item in the Bill of Quantities, the bidders rate shall include the activities covered in the description of the item as well as all necessary operations described in the specifications,

b) The bidder's quoted rates shall cover cost of all minor details which are obviously and fairly intended, and which may not have been included in the description in these documents but are essential for the satisfactory completion of work. Quoted rates shall also include for taking all safety measures as required by Codal provisions, local regulations, etc. and for execution to the satisfaction of the Project Manager,

c) The bidder's quoted rate for each item shall be inclusive of providing all plant, equipment, men, materials, skilled and unskilled labour, making observations, etc.,

d) Rates shall also include for all testing, quality control requirements, arranging inspection, providing temporary works, wastage, overheads, profits and all such requirements. Rates shall include for all leads and lifts, preparation and rectification of defects etc. including the following:

- Application of primer coat, bitumastic layer, raking out joints for pointing and finishing with mortar in case of brick/tile lining,
- Providing wire mesh in bitumastic lining wherever included in the item of work.

e) The rates shall also include bitumastic end sealing of primer & seal coat,

ii) Measurement:

a) All measurements shall be in SI units,

b) Brick/epoxy/bitumastic lining (directly exposed) work of specified thickness shall be measured in m^2 of the actual area covered correct up to second place of decimal. Seal coat shall not be measured separately,

c) Brick plasters shall be measured in m^2 up to second place of decimal,

16.6 METAL DOORS, WINDOWS, VENTILATORS, LOUVERS, ROLLING SHUTTERS AND GRILLS, ETC.

16.6.1 SCOPE OF WORK

The work in general shall consist of supply and/or erecting installing of all metal doors, windows, ventilators, louvers, glazed partitions etc. as shown on drawings with all materials complete excluding supply of glass

and glazing. Supplying and/or fixing of all door and window accessories and hardware is also included in the scope.

16.6.2 INSTALLATION

i) Materials:

a) 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 in drawing and schedules,

b) Steel sheets for frames, shutters, louver blades etc. shall be of a gauge mentioned in the specification,

c) Hardware and fixtures shall be as specified in “Schedule of Fixtures” 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. “Schedule of Fixture” is for the purpose of standing the minimum requirement and 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 closers shall conform to IS: 3564 (Latest Revision) and shall be as stated in Schedule of Items. Each closer shall be guaranteed against manufacturing defect for one year and any defects found within this period shall be rectified or the closer replaced free of charge,

d) Aluminium sections for fabrication doors, windows, partitions etc. shall be extruded sections conforming to IS: 1948 (Latest Revision) and IS: 1949 (Latest Revision) or as manufactured by Indian Aluminum Company Ltd., or approved equivalent. The alloy used shall conform to IS Designation HE-9-WP of IS: 733 (Latest Revision). Heavy duty double acting floor springs where specified shall conform to IS: 6315 (Latest Revision), shall be suitable for door shutters weighing up to 125 kg, shall be hydraulically

regulated, shall be constructed of cast brass casting cover and shoe, gun metal piston player and all other parts of mild steel,

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

f) The mastic for caulking shall be of best quality from a manufacturer approved by the Project Manager. In general the mastic for fixing of metal frames shall be as per IS: 1081 (Latest Revision) and/or as approved by the Project Manager.

16.6.3 FABRICATION OF STEEL DOORS, WINDOWS, VENTILATORS LOUVERS ETC.

i) Doors Frames

a) Frames shall be fabricated from 16 G 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 striking jamb. Loose “T” masonry anchors shall be provided. Frames shall finish flush with floor and adjustable floors shall be supplied. Frames shall be brought to site with floor ties/weather bars.

ii) Double Plates flush Door Shutters

a) Door shutters shall be 45 mm thick completely flush designed and shall comprise of two outer sheets of 18 G steel sheets, rigidly connected and reinforced inside with continuous vertical 20 G stiffeners, spot welded in position at not more than 150 mm 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 by

steel channels running full width of door. Doors shall not have more than 2.5 mm clearance at jambs and head, shall have proper bevel on lock stiles and rails to operate without binding, and shall be reinforced at corners to prevent sagging or twisting. Where shown on drawing or called for in the schedule of items, the doors shall be sound deadened by filling the inside voids with mineral wool or other suitable approved materials,

b) Doors shall be mortised, reinforced, drilled and tapped in shop for hinges, locks and bolts. They shall also be reinforced for closers, pushplates and other surfaces, hardwares where necessary. Any drilling and tapping required for surface hardwares shall be done at site. Where shown in drawings, provision shall be made for fixing glazing, vision panels, louvers etc. Glazing moulding shall be of 18 G steel or extruded aluminium sections with profiles shown in drawing and suitable for fixing glass. Louvers blades shall be V or Z shaped and made out of 16 G sheets.

iii) Single Sheet Door Shutters:

a) 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 semi-tubular edge and central stiffening rail, which shall convey the lock and other fixtures. The frames shall be made from best quality 16 G mild steel sheets,

b) Wherever required as shown on drawings, provision for fixing glass panes, louvers etc. shall be made. Manufacturing shall be done as specified for double plate flush steel doors.

iv) Sliding Doors:

a) Sliding doors shall be either double plate or single plate construction as called for in the drawings and schedules, made out of 18 G steel sheets with adequate stiffeners. The contractor shall specify the weight of the door in the shop drawings and submit the manufacturer's catalogue of the sliding gear he proposes to use.

Where shown on the drawings or called for in schedules of Items, the contractor shall make provisions for openings in the door for monorail beams. Doors shall close positively to exclude rainwater from seeping in. When called for in the schedule, sliding doors shall withstand specified wind loads without buckling or jamming. The door shall slide freely under all ambient conditions.

v) Door Threshold:

a) Door thresholds shall be provided as shown on drawing. Door without threshold shall have bottom tie of approved type.

vi) Steel Windows, Sashes, Ventilators etc.:

a) They shall conform in all respects to IS: 1038, IS: 7452 & IS: 1361(Latest Editions) and/or as shown on drawings. The details as called for in the above codes shall be applicable for coupling, mullions, transom weather bars, pivot arrangements for ventilators etc. or as shown on drawings or called for in the Schedule of Items,

b) Metal rolling shutters and rolling grills shall conform in all respects to. IS: 6248 (Latest Revision),

c) All welds shall be dressed flush on all exposed and contact surfaces,

d) All windows shall be outside glazed fixed with metal glazing beads as shown on the drawing and/or as specified under Bill of Quantities. 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 in drawings. Aluminium beads shall be given one coat of zinc chromate primer before fixing to windows.

vii) Rolling Steel Shutters / Grills:

a) The specification covers the design supply of material, fabrication, delivery and erection of Rolling Shutter/grills with motor driven and/or manual operation including all accessories as hereinafter

specified. All Electrical work shall be in strict accordance with the latest Indian Electricity Rules,

b) For rolling shutters shall be made from tested bright cold rolled, annealed M.S. strips, not less than 0.9 mm thick for shutters up to 3.5 mm 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,

c) Rolling grills shall be constructed out of a 6 mm dia rods at 35 mm on centres running horizontally, flexibly connected with vertical links spaced not more than 200 mm centres. Alternatively, rolling grills shall be made from perforated slates of approved design reinforced with 6 mm dia rods,

d) End locks shall be heavy type M.C./C.I. and shall be provided at each end of alternate slates,

e) Guides shall be of such depth as to retain the shutter under a wind pressure of 150 Kg/m^2 The minimum thickness of guide to be of 12G,

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 operations,

g) Bottom bars shall be finished with two angles not less than 6 mm thick external shutters. When shown on drawings a flexible weather strip shall be applied to make tight contact with the floor,

h) Hoods shall be formed of not less than 20 gauge steel, suitably reinforced to prevent sag,

i) Locks shall be sliding bolts and hasp or cylinder lock operable from one or both sides. Provision to securing hand chain with padlock, provision for removable handle for hand cranks etc. shall be made as desired by the Project Manager,

j) Power unit shall be suitable for 3 phases, 50 cycles, 400 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 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,

k) 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,

l) Operating chains shall be of tested quality, heavily galvanised and with all ends rounded to assure smooth operation and hand protection,

m) Reduction gears shall be high strength gray cast iron, machine moulded from machine cut patterns,

n) Manually operated shutters/grills 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 up to 9 m^2 in area. Larger shutters shall be either chain or gear operated. The crank handle shall be removable. All shutters shall be lockable from one or both sides as desired by the Project Manager,

o) Power operated shutters/grills shall be operable from a push button station conveniently located beside the door or as shown on drawings. On emergency hand chain/crank operation shall be provided for use in case of failure of the electric system.

viii) Welding:

The joints for steel doors, windows, ventilators etc. shall be electrically flash butt welded joints at all corners and junctions to form a solid fused right angle joint.

ix) Fabrication of Aluminium Doors, Windows, Frames etc.:

a) Extruded sections shall have a minimum 3 mm wall thickness. All sections shall be approved by the Project Manager before the fabrication is taken up. Doors, windows, frames, etc. shall be anodised in bath of sulfuric acid to provide a clear coating of minimum 10 micrometer. The anodised 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,

b) Fabrication drawings shall be submitted by the contractor, which shall also include the weights of the materials used and got approved from the Project Manager.

x) Shop Coat of Paint:

a) The shop paint for steel doors, windows, etc. shall be best 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,

b) Where called for in the Schedule of Items, all steel door, windows etc. shall be hot dip galvanized to give a coating weight of 460 to 610 gr/m^2. One coat zinc chromate primer coat shall then be applied as shop paint,

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

d) Rolling steel shutters and grills shall be painted with one coat of red lead or zinc chromate primer. Where specified, doors shall be galvanised and subsequently painted one coat of zinc chromate for adhesion of field coat.

16.6.4 HANDLING & STORAGE OF FABRICATED MATERIALS

i) 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.

ii) When taking delivery of items supplied by Owner, the Contractor shall satisfy himself that the items supplied are up to the specified standard. Any defect shall promptly be brought to the notice of the Project Manager.

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

16.6.5 ASSEMBLY & ERECTION AT SITE

i) In general, the fixing of steel doors, windows, ventilators, louvers etc. shall conform to IS: 1081 and/or as shown on drawings. The Contractor shall assemble and install all steel doors, windows sashes, fixed metal louvers etc. in respective places as shown on drawings, 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 Project Manager. If required by the Project Manager, 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, chasms, etc. required for fixing shall be made by the contractor and made good again as per original, after installation, without any extra change.

ii) After installation of steel door, 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.

iii) The contractor shall bring to the site the mastic cement in original sealed container of manufacturer and shall apply it as per the instruction, for all frame supplied by the Contractor and caulking done properly as per drawings, specifications and as per instruction of the Project Manager.

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

16.6.6 ACCEPTANCE CRITERIA

i) For Fabricated Items:

a) Overall dimensions shall be within +/- 1.5 mm of the size shown on drawings,

b) 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,

c) Door leaves shall be undercut where shown on drawings,

d) Doors, windows, frames, etc. shall be on a true plane, free form warp or buckle,

e) All welds shall be dressed flush on exposed and contact surfaces,

f) Correctness of location and smoothness of operation of all shop installed hardwares and fixtures,

g) Provision for hardwares and fixtures to be installed at site,

h) Glazing beads shall be cut with mitred corners,

i) Glazing clips, fixing devices etc. shall be supplied in adequate numbers,

j) Shop coats shall be properly applied,

k) Exposed aluminium surface shall be free from scratches, stains and discolouration. Anodized surfaces shall present a uniform and pleasing look.

ii) For Installed Items:

a) Installation shall be at correct locations, elevations 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 at gaskets, weather strips etc. complete,

d) All frames on external wall shall be mastic caulked to prevent leakage through joint between frames and masonry,

e) All operable sections shall operate smoothly without jamming,

f) Lock, 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 stains or discolouration.

iii) For rolling shutters and grills:

iv) Shop Inspection: After completing the manufacture of the different components of the rolling shutters, an arrangement for shop inspection by the Project Manager shall be made to check the conformity with approved shop drawings,

v) Field Inspection: After installing the shutters, the Contractor shall test the performance of the shutter in the presence of the Project Manager. The doors shall be smoothly operable under all ambient conditions. All control and locking devices shall give fault free performance,

vi) The Contractor shall give one year guarantee for the successful operation of the shutters.

It shall be responsibility of the Contractor to see that the material is protected from mortar, paint and plaster.

16.6.7 INFORMATION TO BE SUBMITTED

i) With Tender:

a) Name of manufacturers for doors, windows, rolling shutter etc.,

b) Manufacture's catalogue for all hardware and fixtures proposed to be used.

ii) After Award:

a) Before starting fabrication of all metal doors, windows etc., the Contractor shall submit detailed fabrication drawing to the Project Manager for approval. The fabrication shall be started only after approval of drawings,

b) The Contractor shall submit a programme of work to be done for approval of the Project Manager,

c) Before bulk supply, he shall submit for the approval of the Project Manager, samples of all bought out items and samples of each type of fabricated item. The samples shall be retained by the Project Manager for comparison of bulk supply and returned to the contractor towards the end for final incorporation in the job.

16.6.8 RATES

i) Shall be unit rates for items described in Schedule.

ii) Roller shutters and grills:

a) Rates shall be unit rates for complete items for supply and/or erection of rolling shutters, including all drives, accessories, hardware etc. or as per Schedule of Items. No extra payment shall be made for cutting, drilling, welding, grounding etc. to structures for installing the shutters,

b) The rates shall include the mounting of controls, wiring from the nearest junction box, conduit and other electrical connections.

16.6.9 METHOD OF MEASUREMENT

i) Supply and installation of doors shall be measured in net outer-to-outer area of frames of each type used. The type and sizes shall be as shown on drawings and described in Schedule of Items.

ii) Supply of window shall be measured in net outer-to-outer area of frames of each type of unit used either single or in combination excluding any holdfasts etc.

iii) Installation including assembly and erection of windows shall be measured in net outer-to-outer area of frames of combinations mentioned in the Schedule of Items.

iv) Supply and installation of louvers shall be included in rate for steel door, windows and, ventilators. No extra payment shall be made for end of cover plates.

v) Vision panels, louvers to doors and insulation between door faces shall be measured for actual area and paid separately over the basic rate of doors, if specified in the Schedule of Items.

vi) Glazing beads, weather stripping, fixing devices etc. shall not be measured separately but shall be included in the supply rate of respective items.

vii) Any curing or grouting to concrete and masonry or welding and drilling to steel required for installation shall be included in the installation rate. No separate payment shall be made for caulking and jamming of frames or making good concrete or masonry.

viii) Glass and glazing shall be measured and paid under relevant items.

ix) Doors and Windows fixtures, locks, door closers etc. shall be measured in actual numbers used.

x) Rolling shutters or grills shall be measured for area of opening in which they shall be installed. Alternatively, shutters shall be measured for actual number of different size used.

16.7 GLASS AND GLAZING

16.7.1 SCOPE OF WORK

i) The work in general shall consist of supplying and fixing of all glass and glazing including all clips, putty, mastic cement etc. wherever required as shown on drawings.

16.7.2 INSTALLATION

i) The Contractor shall supply and install all glass and glazing as required for various doors, windows, sashes, ventilators and fixed louvers, miscellaneous glazing and partitions, unless otherwise stated 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.

16.7.3 IS: CODES

i) The following are important IS Codes (Latest Edition) applicable to this section:

IS: 3548	Code of practice for glazing in buildings.
IS: 1081	Code of practice for fixing and glazing metal doors, windows and ventilators.
IS: 419	Putty for use on window frames.

16.7.4 MATERIALS

i) Glare reducing, tinted, or heat absorbing glass shall be “Calorex” of Hindustan Pilkington or approved equivalent and special care shall be taken to grind smooth and round off the edges before fixing.

ii) Clear glass shall be flat drawn sheet glass and shall be at least 4 mm thick conforming to IS: 2835 (Latest Revision). Sheet glass for doors shall be minimum 6.3 mm thick.

iii) Wired glass shall be thick rolled glass with centrally embedded 24 G wire mesh of Georgian type. This may be of clear or coloured glass as shown in drawings and shall conform to IS: 5437 (Latest Revision).

iv) Ground (obscure) glass shall have a cast surface on one side.

v) Coloured and figured glass shall be as per approved sample.

vi) Composite double glazing shall be made of double glazing of two 6 mm thick sheet glass either both sheets of tinted glass or one glass tinted and other plain or both sheets of plain sheet glass. Both the glasses shall be separated by an air gap of 6 mm. The trapped air shall be kept dry by means of suitable desiccant. The sealing shall be under strict quality control. The composite glazing shall be procured as finished product from reputed manufacturers. Toughen glass conforming to IS: 2553 (Latest Revision) shall be used.

vii) In general, the putty shall conform to IS: 419 (Latest Revision) and be of best quality from approved manufacturer. It shall be brought to site in manufacturer's original packing. Quick setting putty shall be used for windows and sashes except when glare reducing glass is used where it shall be of non-setting type.

viii) Neoprene gaskets with snap-fit glazing shall be fixed as per manufacturer's instructions and shall fit firmly against the glass to give a leak-proof installation.

ix) Glazing, Setting and Finishing:

a) All glazing clips, bolts, nuts, putty, mastic cement etc. as required shall be supplied by the Contractor,

b) All glass shall be thoroughly cleaned before setting in position. Each glass pane shall be held in place by special glazing clips of approved type. Four glazing clips shall be provided per glass pane except for large panes where six or more clips shall be used as per

the instructions of the Project Manager. All holes that may be necessary for holding the clips glazing beads and all other attachments shall be drilled by the Contractor,

c) Glass panes shall be set without springing, and shall be bedded in putty and back putties, except where moulding or gaskets are specified. Putty, mastic cement etc. shall be smoothly finished to a true even line. Obscure and figured glass shall be set with smooth side out,

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

16.7.5 ACCEPTANCE CRITERIA

i) All installations 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 ungrounded edges.

ii) Glazing shall be carefully done to avoid direct contact with metal frames.

iii) All glasses shall be embedded in mastic or fixed by neoprene gaskets to give a leak proof installation.

iv) At completion, the panes shall be free from dirt, stains, excess putty etc. to the complete satisfaction of the Project Manager.

16.7.6 RATES

i) Rates shall be unit rates for supply and/or installation of different kinds of glass mentioned in the Schedule of Items.

ii) No separate payment shall be made for glazing clips, mastic cement, putty, nails etc. nor for drilling holes, in frames for inserting glazing clips.

iii) No separate payment shall be made for cutting of glass to required size, edge finishing etc. if the glass is supplied by the Contractor.

iv) No separate payment shall be made for cleaning the glass after installation.

16.7.7 METHOD OF MEASUREMENT

i) Measurement for payment shall be based on the area over which glass is to be fixed including the portion covered behind support. For composite double glazing the measurement shall be done as single finalised glass and no separate measurement shall be done for each of the two layers.

16.8 ROOF WATER PROOFING

16.8.1 SCOPE OF WORK

i) This specification covers, furnishing, installation, repairing, finishing, curing, testing, protection, maintenance till handing over of roof water proofing, for buildings and at locations covered under the Scope of the Contract.

16.8.2 INSTALLATION

i) Grading Underbed

a) 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,

b) The underbed shall not be laid under direct sunlight 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,

c) The underbed shall be laid to provide an ultimate run-off gradient not less than 1 in 100 or as specified in the Schedule of items and as directed by the Project Manager. Up to an average thickness of

25 mm the underbed shall usually be composed of cement and sand plaster. For higher thickness the underbed shall be made with cement concrete. However, actual thickness and other details shall be as per drawings and schedule of items,

d) The underbed shall be finished to receive the water proofing treatment direct or insulation as the case may be.

ii) Plaster:

a) The grading plaster (shall have a maximum average thickness of 25 mm shall consist of cement and coarse sand in the ratio 1:4 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,

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

iii) Concrete

a) The concrete shall be used where the sub grade is more than average 25 mm thick. It shall consist of cement concrete 1:2:4 nominal mix by volume with 12.5 mm down stone chips and coarse sand. The aggregate shall be mixed dry and minimum quantity of water should be added to make the mix workable,

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

iv) Water Proofing:

a) Waterproofing treatment shall be laid by a specialist firm with long experience in the particular line,

b) The waterproofing treatment for roofs with Bitumen Felts shall be done as per IS: 1346 (Latest Revision). Bitumen felt shall conform to IS: 1322 (Latest Revision) and Bitumen primer to IS: 3384 (Latest Revision),

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

d) The Contractor shall state the source from where he proposes to procure the materials. Samples of the self, finished felt shall be submitted in advance to the Project Manager along with test certificates for his review. Test Certificate for the bonding materials shall also be submitted and samples, if desired by the Project Manager, shall be provided for confirmatory tests. Samples of Pea sized gravel shall be submitted if instructed by the Project Manager. The stone shall be retained 100% of a 6 mm sieve,

e) 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.

v) 8-Course Bitumen Felt Water-Proofing:

a) Brief description of treatment shall be as follows:

- Hot applied bitumen at the rate 1.2 kg/m^2 Min,
- Hessian-based self finished felt, Type 3 Grade 1,
- Hot applied bitumen at the rate of 1.2 kg/m^2 Min,
- Hessian-based self finished felt, Type 3 Grade 1,
- Hot applied bitumen at the rate of 1.2 kg/m^2 Min,
- Hessian-based self finished felt, Type 3 Grade 1,
- Hot applied bitumen at the rate of 1.2 kg/m^2 Min,
- Hessian-based self finished felt, Type 3 Grade 1,
- Pea sized gravel at the rate of 0.006 m^3/m^2.

b) The surface to receive the water-proofing treatment must be cleaned and dried satisfactorily and the approval of the Project Manager taken before starting the work. If the surface is not having

smooth finish to receive waterproofing treatment, a layer of 12 mm thick 1:6 cement sand mortar shall be laid on the surface and finished smoothly,

c) The Project Manager may instruct the Contractor to lay part of the stipulated courses 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,

d) After completion the surface shall be cleaned taking care that loose gravels, felts cuttings, etc. do not find their way into rainwater down comers.

vi) Flashing:

a) Unless otherwise stated flashing shall be done in the same way as the waterproofing except that the last layer, instead of being finished with pea-sized gravel, shall be finished with two coats of bituminous primer. The flashing shall be extended up to the vertical surfaces as shown on drawings. 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 proofing felt shall be 100 mm,

b) Where specified on drawings or directed by the Project Manager metal flashing shall be provided. The metal flashing shall be done as shown on the drawings. The materials shall be 18 G.G.I. sheets as specified on the drawings and/or as directed by the Project Manager.

16.8.3 <u>ACCEPTANCE CRITERIA</u>

i) 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.

ii) The Contractor shall give a guarantee in writing for all work executed under this specification supplemented by a separate and unilateral guarantee from the specialised agency for the roof water proofing treatment work. The guarantee shall be for materials and workmanship for 5 years. The mode of execution of the guarantee shall be acceptable to the Owner.

16.8.4 METHOD OF MEASUREMENT

i) General:

a) The method of measurement for various items of works shall be in general as per IS: 1200 and in particular, as specified below.

ii) Grading Underbed:

a) For all concrete the actual volume of work shall be measured in m^3 and deductions for openings, conduits, pipes, ducts, etc. made; but no deductions shall be made for openings up to 0.1 m^2 in area. Shuttering shall not be paid for separately,

b) All plastering shall be measured in m^2 on actual area laid correct to the second place of decimal. No deduction shall be made for openings, pipes sleeves up to 0.1 m^2 in area.

iii) Insulation Water Proofing & Flashing:

a) These shall be measured on actual area laid in m^2. No deductions shall be made for openings, pipes, sleeves, etc. up to 0.1 m^2 in area each,

b) No separate payment shall be made for laps in waterproofing, flashing etc.,

c) No separate payment shall be made for finishing round roof drains,

d) No separate payment shall be made for rounding, chamfering, etc. of junctions, corners etc.,

e) No separate payment shall be made for cutting grooves and keying the flashing in the grooves,

f) Metal flashing shall be measured in m2 of finished area done,

g) No payment shall be made for cutting, wastages, materials left over etc. which shall be the property of the Contractor,

h) Fillets shall be measured for actual work done in m',

i) No separate payment shall be made for plastering or similar work required for laying the water proofing felt.

16.8.5 CODES AND STANDARDS

i) Important relevant IS Codes applicable to this specification are:

IS: 73 Paving

IS: 702 Industrial Bitumen

IS: 1203 Method of testing tar

IS: 1322 Bitumen felts for water-proofing of roof.

IS: 1609 Code of practice for laying damp proof treatment using bitumen felt.

IS: 1346 Code of practice for water proofing of roofs with bitumen felts.

IS: 3067 Code of practice for general design details and preparatory works for damp proofing and waterproofing of buildings.

All the above standards/codes should be of Latest Revision.

16.9 SUSPENDED CEILING

16.9.1 SCOPE OF WORK

i) The work under this Section shall include the supply and installation of suspended ceiling together with the suspension system as shown on

drawings or specified in Schedule of Items with all materials, labour and equipment. The work shall also include providing of openings in the ceiling for lighting, air-conditioning diffusers etc. as shown on drawings or as instructed by the Project Manager.

16.9.2 SUSPENSION SYSTEM

i) General:

a) 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 walls, slabs and beams or trusses,

b) All members of the suspension system shall be of sufficient strength and rigidity to carry the ceiling board or sheets in a true and level plane without exceeding a deflection of 1/500th of the span. All joints in ceiling panels shall run straight and cross joint shall be securely fixed to walls. All drillings of structural concrete or welding to steel for installation 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,

c) All wood supports shall be painted with two coats of approved wood preservative before erection.

ii) Metal Grid Suspension System:

a) Aluminium grid ceiling system shall be “Beadlok” as manufacturer by W.A. Beardsell and Co. Pvt. Ltd., or approved equivalent.

b) Angle cleats or other suitable fixing device shall be fixed to the structural beam or slab above for fixing of hangers. Runners shall be hung by M.S. flats, angles or rods as shown on the drawings. Extra hangers shall be provided at light fixtures that are supported from the ceiling system. The spacing of main and cross tees shall be as shown on drawings,

c) The cross tees shall intersect main tees in pattern shown on drawings and positively locked together with intersection clips. All perimeter areas shall have angle mouldings fixed to vertical wall surfaces and suspended ceiling end tees shall rest on the mouldings, unless otherwise shown on drawings.

16.9.3 CEILING PANEL

i) Materials:

a) Ceiling panel shall be of best quality material in properties and thickness called for in Bill of Quantities. The contractor shall submit test certificates to the Project Manager for approval before bulk supply. The ceiling panels may be of phenol bonded teakwood. The ceiling tiles shall be from reputed manufacturer and of thickness as specified in the BoQ.

b) **Installation:**

Installation shall be strictly as per manufacturers instructions. For exposed grid ceilings systems, tile hold down clips shall be used at the rate of minimum one per 1.2 m length and perimeter. These shall, however, be omitted in access panels which shall be located as per the instructions of the Project Manager.

c) For concealed grid ceiling system, tiles shall be fixed to the supporting grid in a manner shown in the drawings or as specified by the manufacturer. Where V Joints in tiles are called for in the drawings, these shall be in true lines. Where a flush surface is required, the joints finished to give a neat uniform surface, special care shall be token to neatly finish the ceiling at junctions with wall, lith fixtures diffusers etc..

16.9.4 ACCEPTANCE CRITERIA

i) Finished ceiling shall be at the correct plane and shall present a pleasing and uniform appearance, free from sags, warps, disfigured or damaged

boards. Joints, exposed grid etc. shall be in true lines and symmetrically placed in a manner shown on drawings. Cut-outs for light fixtures, diffusers etc. shall be of exact dimensions and at exact locations.

16.9.5 RATES

i) Rates shall be unit rates for complete items called for in the "Schedule of Items". No extra payment will be made for arrangements for lighting fixtures, air-conditioning diffusers, accesses panels etc. The rate shall include all cutting and wastage from standard size sheets, boards, runners carriers etc.

16.9.6 METHOD OF MEASUREMENT

i) Actual area of work done shall be measured.

ii) No deduction will made for openings up to 0.25 m^2 in area each.

16.10 FALSE / RAISED FLOORS

i) Removable and raised false-floors shall be constructed in the areas occupied by computer and control room as directed by the Project Manager. The space under the raised floor shall be used for running the various cables

ii) The height of the false floor, from the top of the basic flooring structure to the top of the false-floor slabs, can vary between 0.20 and 0.80 m.

iii) Cut-outs in the false-floor slabs for the uprights of the building frame work resulting from the form of the premises or zone in question or electronic machine and the passage of electric cables, for vertical ducts will form part of the work. The mobile false-floors must be capable of carrying an evenly distributed load of 15 kN/m^2 or a concentrated load on one slab of 4 kN.

iv) The false floor shall comprise series of mobile slabs, resting on a metal framework composed of supports and cross-members in aluminium alloy or galvanized steel section.

v) The false-floor slabs, 80 x 80 cm will each comprise a square of 25 mm plywood, faced on each side with a 0.5 mm sheet of galvanized steel.

vi) The edges of the slabs shall be grooved to take an aluminium ally section. This section will incorporate an outer groove, containing a pvc section; this serves to protect the angles of the covering slabs, and to give the upper surface of the floor an attractive finish, whilst ensuring a perfect seal.

vii) Slab covering shall be in thermoplastic material, such as homogeneous flexible vinyl. These coverings, with a thickness of 3 mm according to their nature, shall be glued to the galvanized steel sheet backing.

viii) The framework shall comprise series of cross-members, totally independent from each other, and telescopic jacks resting on the ground. Each jack shall consist of a steel plate, glued to the floor, to which a threaded round steel billet, diameter 20 mm, is welded and equipped with an adjustment nut and lock ring. The jack head will incorporate a special plate fitted with four clips to connect three or four independent horizontal cross-members. The jacks shall be galvanized. They must be capable of supporting a load of 4 kn without deflection.

ix) In certain zones (change of direction, equipment, expansion joints), the jacks shall be duplicated to receive plates with special dimensions and shape, adapted, cut and shaped to requirements.

x) A flexible plastic section shall be laid on each cross-member under the false-floor slabs for alignment of the slabs improving floor flexibility and acoustic insulation.

xi) Sealing between false-floor and fixed edges of the main structure framework elements and ventilation ducts shall be made by means of plastic skirting. Plastic cover strips of appropriate section shall be fitted over the expansion joints.

xii) For the connection with all masonry elements, special edging members shall be supplied and installed, these elements shall have an additional flat bar on their upper part to form a butt edge for the plates.

xiii) In certain cases, sections and elements in wafered aluminium sheet or galvanized steel shall be provided for edge filling, for example to close the plenum chamber or to form sets of risers between different floor levels.

16.11 PAINTING, LIME WASHING AND ALLIED WORKS

16.11.1 SCOPE OF WORK

i) This specification covers painting, white washing, Distempering, wall finishing etc. of both interior and exterior surfaces of masonry, concrete, plaster, structural and other miscellaneous steel items, external surface of over ground water pipes, rain water down corner, floor and roof drains, soil, waste and service water pipes, and other ferrous and non-ferrous metal items as shown on drawings or as directed by the Project Manager.

ii) If surface to be finished cannot be put in suitable condition for painting by customary preparatory methods, the Contractor shall notify the Project Manager in writing or assure responsibility for and rectify any unsatisfactory finishing that results.

iii) Before commencing painting, finishing, the Contractor shall obtain the approval of the Project Manager in writing regarding the scheduling of work to minimise damage, disfiguration or staining. He shall also undertake normal precautions to prevent damage, disfiguration or staining to work of other installations.

16.11.2 MATERIALS

i) Materials shall be highest grade products of well known approved manufacturer and shall be delivered to the site in original sealed containers, bearing brand name, manufacturer's name, and colour shade, with labels intact and seal unbroken. All materials shall be subject to inspection and approval by the Project Manager. It is desired that the materials of one manufacturer only shall be used as far as possible and paint of particular shade be obtained from the single batch. All paints shall be subjected to analysis from random samples taken at site from painters bucket, if so desired by the Project Manager.

ii) 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.

iii) All unspecified materials such as 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 and recognised manufacturers and shall be approved by the Project Manager.

iv) All colours shall be as per painting/finish schedule and tinting and matching shall be done to the satisfaction of the Project Manager. In such cases, where samples are required, they shall be executed in advance with the specified materials for the approval of the Project Manager.

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

b) Waterproof Cement Paint shall be made from best quality white cement and lime resistant colours with accelerators, water-proofing agents and fungicides. The paint shall conform to IS: 5410 (Latest Revision),

c) Dry Distemper of required colour conforming to IS: 427 (Latest Revision) and of approved brand and manufacturer shall be used. The primer where used shall be cement primer or distemper primer. These shall be of same manufacturer as that of distemper,

d) White Washing shall be done from pure shell lime or fat lime, or a mixture of both as instructed by the Project Manager, and shall conform to IS: 712 (Latest Revision). Samples of lime shall be submitted to the Project Manager for approval, and lime as per approved samples 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 thick 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,

e) Colour Wash shall be done with mineral colours not affected by lime added to white wash. No colour wash shall be done until a sample of the colour wash to the required tint or shade has been approved by the Project Manager. The colour shall be of even tint or shade over the whole surface. If it is blotchy or otherwise badly applied, it shall be redone by the Contractor at his own cost,

f) Acrylic Emulsion Paint shall be water-based acrylic copolymer emulsion with rutile titanium dioxide with 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, should be able to withstand washing with mild soap and water without any deterioration in colour or without showing flaking, blistering or peeling,

g) Oil Bound Distemper shall be as per IS: 428: (Latest Revision) of approved brand and manufacturer. The primer where used should be cement primer or distemper primer. These shall be of same manufacturer as that of distemper. The distemper shall be diluted with prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for day's work shall be prepared,

h) Chemical Resistant Paint shall be as per IS: 157 (Latest Revision) of approved brand and manufacture shall be used. Primer coat to be used shall be as per manufacturer's specifications,

i) Fire Resisting Paint (silicate type) shall be as per IS: 162 (Latest Revision) and of approved brand and manufacture. Primer to be used shall be as per manufacturer's specifications,

j) Oil resistant paint shall be as per IS: 161 (Latest Revision) and of approved brand and manufacturer. Primer coat shall be as per manufacturer's specification.

v) Storage:

The contractor shall arrange for safe and proper storage of all materials and tools. Paints shall be kept covered at all times, and mixing shall be done in suitable containers. All necessary precautions shall be taken by the Contractor against fire hazards.

16.11.3 PREPARATION OF SURFACE

i) General:

Before starting the work the Contractor shall obtain the approval of the Project Manager regarding the soundness and readiness of the surface to be painted on.

ii) Masonry, Concrete and Plastered Surface:

Surface shall be free from oil, grease, efflorescence, loose paint or other foreign and loose materials. Masonry cracks shall be cleared out and patch filled with mortar similar to the original and uniformly textured. Where this type of resurfacing may lead to the finishing paint being different in shade from the original surfaces, the resurfaced 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.

iii) Surface with mildew and efflorescence shall be treated as below:

a) All mildew surfaces shall be treated with an approved fungicide such as ammonical wash consisting of 7 gr of copper carbonate dissolved in 80 ml liquid ammonia and diluted to 1 litre with water, or 2.5 per cent magnesium silico fluoride solution and allowed to dry thoroughly before paint in applied,

b) All efflorescence shall be removed from affected surfaces with a solution of muriatic acid in water (1:6 to 1:8), washed fully with clear water and allowed to dry thoroughly.

iv) Metal:

a) All metal surfaces shall be absolutely clean, dry and free from wax, grease and soap films. All steel and iron surfaces in addition shall be free from rust. All galvanised iron surfaces shall be pre-treated 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.

16.11.4 APPLICATION

i) General:

a) 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 of 1 metre square as per instruction of the Project Manager and obtain his approval prior to application of finishing paints. Proper tools and equipment shall be used. Scaffoldings if used shall be independent of the surface to be painted to avoid shade differences of the freshly repaired anchor holes,

b) Painting shall be done by skilled labours in a workman like 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 paints. All priming undercoats for painting shall be applied by brush only, and rollers, spray equipments etc. shall not be used,

c) 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,

d) All coats shall be thoroughly dry before being sand papered or before the 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 directed by the Project Manager,

e) 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.

ii) Synthetic Enamel Paint:

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

iii) Waterproof Cement Paint:

a) 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,

b) In a similar manner the finished surface shall be kept moist by occasional sprinkling with water for seven days after painting.

iv) Dry Distemper:

a) New plastered surface shall be allowed to dry for at least two months. New lime or lime plastered surface shall be washed with a solution of 1 part of vinegar to 12 parts water or 1:50 sulphuric acid

solution and left 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 gr of zinc sulphate to 1 litre of water and then allowed to dry,

b) 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 marks may result.

v) White Washing:

a) The surface where white washing is to be applied shall be cleaned 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,

b) One coat of white wash 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 dried up completely and similarly third coat shall be applied and in case the Project Manager feels that one or more coats are required the Contractor shall do so without any extra costs to the Owner. No brush marks shall show on the finished surface. The inner plastered surfaces of wall shall be given 3 or more coats of white washing.

vi) Colour Wash:

a) For new work, the priming coat shall be of white wash with lime. Two or more coats shall then be applied on the entire surface till it represents a smooth and uniform finish. The finished dry surface shall not be powdery and shall not readily come off on hand when rubbed. Indigo or synthetic ultramarine blue shall, however, not be added.

vii) 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 Project Manager. Painting shall be strictly as per manufacturer's specification.

viii) Oil Bound Distemper:

a) The patched surface shall be allowed to dry thoroughly before the coat of distemper is applied. One coat of distemper properly diluted with thinner as specified by the manufacturer shall be applied by brushes in horizontal strokes followed immediately by vertical ones which together will constitute one coat. Two or more coats of distemper as found necessary shall be applied to obtain even shade.

ix) Chemical Resistant, Fire Resistant and Oil Resistant Paints:

a) In general, method of application of these paints shall be strictly as per manufacturer's specification.

x) Painting of Iron Work:

a) Paint to be used for various items of work shall be of best quality and shall be obtained ready mixed in sealed containers from approved manufacturer. The Contractor shall obtain the approval of the Project Manager for the make and colour of the paint he proposes to use,

b) All surfaces shall be thoroughly cleaned of all dirt, loose particles and rust and approved prior to application of paint. Workmanship shall conform to IS: 1477 (Part I & II) (Latest Revision),

c) Specified number of coats shall be applied and at least 24 hours shall elapse between the application of successive coats. No painting shall be carried out on exterior work in wet weather or on surfaces, which are not entirely dry,

d) Painting rate shall include all necessary scaffolding, cradles and plant.

16.11.5 PAINTING OF METAL WORK

i) This specification covers painting of metal works supplied and erected either by other agencies or by the Contractor for work under the scope of this contract as far as these work is not already covered under the section Metalwork, Surface Finish and Corrosion Protection.. One shop coat of red oxide zinc chromate primer including necessary touching up has already been completed. One coat of red oxide zinc finishing coats of synthetic enamel paint as described hereunder are only required to be provided under the item for painting steel.

ii) Painting shall be done on all exposed surfaces of metal works (including undersides wherever exposed) of various structural steel members like, trestles, bracings, chequered plates, gratings, brackets, base plates etc. in the Power House as directed by the Project Manager. It should be clearly noted that all structures are already erected/placed in position, hence the quoted rate by Contractor shall account for all aspects involved in painting keeping in view the heights, available access to members etc. It is advised that the Contractor should visit the site and get himself acquainted with the nature of work completely including the extent and type of scaffoldings etc. required, before quoting his rate.

iii) Material:

a) Paint shall be synthetic enamel paint conforming to IS: 2932 (Latest Revision) of approved colour and brand.

iv) Painting:

a) In general, painting work shall be in accordance with IS: 1477 (Part I & II) (Latest Revision),

b) Surface of steel work to be painted shall be thoroughly cleaned of all grease, oil, dirt, rust, foreign matter like cement splashings, etc. by suitable solvent and mild rubbing with abrasive paper/hand scrapping to the full satisfaction of the Project Manager. Cleaning with solvents/scraping shall be limited to the affected area only,

c) In case where the existing primer is removed while cleaning the surface damaged portions shall be provided with a coat of wash or etching primer on suitable chemical pre-treatment solutions and another coat of red oxide, zinc chromate primer. The payment for red oxide primer will be made as per item of Schedule of Items,

d) After the surface is prepared in a manner described above, the primer coat shall be dry cut without scratching or in any way damaging the primer coats and clean the surfaces from dust,

e) Over this dry surface apply an optimum coat of undercoating (synthetic enamel paint) by spray with minimum brush marks. Allow the film to dry hard, wet rub, cutting down to a smooth finish (ensuring that at no place the undercoat is completely removed). Allow the water to evaporate,

f) Finishing coats shall consist of two coats of synthetic enamel paint of approved colour and brand. The second coat, if so directed by Project Manager, shall be applied only after the first coat is hard dry, its gloss is gently removed over the entire surface and dusted off,

g) The total dry film thickness of each shall be not less than 25 microns,

h) The paint shall be applied by brushing/spraying. Spraying shall be adopted with prior approval of Project Manager generally on large surface areas. Paints shall be stirred frequently to keep the pigment in suspension. Paint shall be ready mixed in original sealed containers as packed by the paint manufacturers and no thinners shall be permitted. No painting shall be done in frosty/foggy rainy weather or when humidity is high enough to cause condensation on the surface to be painted. Paint shall not be applied when the temperature of the surface to be paint is 5°C or lower,

i) Contractor shall provide and use sufficient number of drops clothes, covers, tarpaulins and other screens to protect adjacent surfaces

and shall remove all splatter and stains from such surfaces. The Contractor shall also protect his own work,

j) Any and all damage to adjacent work or any part of the premises due to painting carelessness or accidental performance of the Contractor shall be repaired or made good at the Contractor's expense,

k) Painting shall be discontinued when exposed to rain and dust storm and shall not commence until the surfaces are perfectly dry and clean. Wherever practicable, surfaces shall be painted when under shade or when temperature is falling.

16.11.6 ACCEPTANCE CRITERIA

i) All painted surfaces shall be uniform and pleasing in appearance.

ii) The colour, texture, etc. shall match exactly with approved samples.

iii) All stains, splashes and splatters of paint shall be removed from surrounding surfaces

16.11.7 RATES

i) Rates shall be unit rates for complete items described in the Schedule of Items. No extra payment will be made for preparation of surface before painting or for cleaning up after the work is complete.

16.11.8 METHOD OF MEASUREMENT

i) Painting or white washing to concrete or masonry shall be measured and paid on the areas painted. For measurement of openings whose jambs, sill, soffits, etc. are to be painted the following procedure shall be followed.

ii) For openings up to 0.5 m2 each, no deduction shall be made and no additions shall be made for jambs, sills, etc.

iii) For openings exceeding 0.5 m2 but not exceeding 3.0 m2 deductions shall be made for half the area of openings, and no additions shall be made for jambs, sill etc.

iv) For openings exceeding 3.0 m2 deductions shall be made for the whole area, and additions shall be made for jambs, sills soffits, reveals etc.

v) For opening, pipes, sleeves etc. whose sides are not finished, no deductions shall be made for openings, etc up to 0.1 m2 in area each, and full deductions shall be made for all openings above 0.1 m2 in area each.

vi) No extra shall be made for painting, etc. done around openings,, sleeves, pipes, ducts, inserts etc.

vii) No extra payment shall be made for painting, etc. on wall features such as grooves, ducts, beads, projections, cornices, etc. unless given different finish or otherwise specified in the Bill of Quantities. The actual area of the features shall be girthed and included in the wall measurements.

viii) For painting of uneven surfaces in doors, windows, ventilators, louvers, guard boards, balustrades, gratings, railings, etc. equivalent plain area shall be measured as given in Clause 17.2 (Table-II) of IS: 1200 (Latest Revision), or as specified in the Bill of Quantities.

ix) For painting pipes for sanitary and plumbing work, measurement shall be made on actual work done in m' for different diameters. Measurement shall be along the centre lines of pipes laid. No deduction or additions shall be made for valves, fittings etc.

16.12 GENERAL SPECIFICATIONS

Sl No	Material	Application
1	Solid cement mortar blocks masonry made out of 450x230x115mm size.	230 thick external walls and 115 thk. internal walls unless otherwise mentioned in the drawing.

2	External Plaster (1:6) & both sides Internal plaster (1:4) shall be cement plaster finished smooth.	19/15mm thick on external walls and 12mm thk. on int. walls.
3	Damp Proof Course (1cem.:2 sand:4 agg.)	230 thk. external walls
4	Damp Proof Membrane of fabric A-193,to be approved.	Below PCC Floor Slab and RCC slab below 115 thk. partition walls.
5	Imported sub base material G5/ G9 well compacted 90% AASHTO	Apron/Plinth protection.
6	Precast concrete paving slabs 500x500x50 thk.jointed and pointed in cement mortar laid over 50mm thk. sand filling.	Apron/Plinth protection.
7	150x150x5 glazed white/standard colour ceramic tile, make - Johnson or equivalent	Tiles in dado of toilets and kitchen also behind gas stove.
8	330x330x8 Nonslip ceramic tiles of make - Lobaste tile works 'Elba-Beige' or equivalent	Floor tiles for toilet and kitchen areas.
9	Vinyl floor tiles 2mm thk., Kalhari make 'Namib' or equivalent laid over 50mm thk. cement screed finished smooth.	Covered spaces-Rooms/Halls.
10	Synthetic enamel paint shall be provided on all door frames, door shutters, window frames, burglar bars, ms pipe, ms rings, ms railing.	On all exposed MS surfaces.
11	50mm thk. IPS flooring with wax polishing.	Verandah & entrance/steps

12	All rooms shall have Maranti/ equivalent Hardwood skirting, finished with varnish.	Rooms
13	Door shutters of 38mm thk.semi-solid flush door in MS door frame with single or double rebate, of Standard Durowin make. The external doors shall have burglar door shutters also. All external door locks shall be single cylinder locks and all internal doors shall be 3 level mortice lock & thumb turn lock for toilet.	Rooms
14	Burglar door shutter - single cylinder lock	Outer door
15	Standard MS window/ ventilators of Durowin make with 10x10 mm MS solid burglar bars as per Durowin pattern B11 in openable and fixed glazed portion of whole part of windows and with 4mm thick Clear/ Translucent glazing.	Rooms
16	Cupboard - 38mm thk. hollow core flush door with standard Durowin MS door frame with single rebate. The shelves of 19mm thk block board with half round edging finished with gloss paint.	Rooms
17	Wall and floor Kitchen Cabinet units shall be of make - Duracraft or equivalent. All adjacent kitchen floor units shall have jointless one worktop. All worktops shall be finished with Formica, colour/pattern 'Ingot Marble'. All steel kitchen units and doors shall be finished with colour Beige BNG18.	Wall or floor cabinet in Kitchen, pantry & snacketaria

18	Coloured precoated galvalume sheet for roofing including ridges/ flashings.	Roofing sheet for all structures except guest house.
19	Roof tiles shall be mangalore tiles with all necessary accessories OR terracota Romatile of Harvey make or equivalent with all necessary accessories installed in accordance with manufacturers instruction.	Roofing tiles - Guest House
20	False ceiling shall be 6mm thk. rhinoboard fixed to 38x50 Brandering 600c/c both ways.	All the ceilings, unless otherwise mentioned in the drawing.
21	All Internal walls shall have gloss paint upto 1800mm height and PVA paint Interior grade above upto false ceiling and on false ceiling	Internal Walls & ceiling
22	All External walls shall have PVA paint exterior grade.	External Walls
23	All windows shall have Double track curtain rods	Rooms
24	MS ring for securing gas cylinder	Kitchen
25	25mm dia. PVC conduit sleeve built into wall for Gas hose.	Kitchen
26	MS railing 450 high	Verandah
27	Sanitary pipes -PVC	
28	Plumbing	
29	Conduit & wire	
30	Switches/ socket outlets, make - MK	

	England	
31	MS elements - finished with synthetic enamel paint	
32	Toilet fixtures - WC, Wash Basin, Toilet paper holder, soap dish, make Armitage shanks or Vaal or equivalent	Toilets
33	Wash basin shall be Armitage shanks Royalex of size 560x410 with two corner tap holes, CP antitheft waste, captive plug, chain and 80mm slotted tail and bolly stay including Fixing brackets code 7191CVO, complete.	Toilets
34	WC pan shall be Armitage shanks Magnia with Geminy code 68940B1 with plastic seat cover, 7.5l vitreous china cistern with free flow siphon fitting, low level flush bend complete.	Toilets
35	Vitreous China toilet paper holder 150x150 semi-recessed type.	Toilets
36	Vitreous China toilet soap holder150x150 semi-recessed type.	Toilets
37	All pillar taps, kitchen sinks mixer and bath shower mixer shall be Armitage Shanks Fairline.	Toilets
38	Galvanised dustbin with lids shall be provided for each house.	
39	Washline 4000mm long with 4 strings of 3mm dia. GI wire shall be provided for	

	each house.	
40	110 dia. Soil Pipe, 50 dia. Waste pipe, Floor traps shall be of PVC.	
41	Location and provision of Open Gulley traps, manholes shall be as per drawing	