MAZAGON DOCK SHIPBUILDERS LIMITED
(Formerly known as Mazagon Dock Ltd.)
CIN : U35100MH1934GOI002079
(A Government of India Undertaking)
Shipbuilders to the Nation
Dockyard Road, Mazagon,
Mumbai 400 010.
INDIA

Conversion of 1st floor Mogul House/SY Canteen to Dormitory & Galley Space.

Preferred Make

&

Technical Specification

TENDER DOCUMENT

FOR

Conversion of 1st floor Mogul House/SY Canteen to Dormitory & Galley Space.

Conversion of 1st floor Mogul House/SY Canteen to Dormitory & Galley Space.

I N D E X

I - GENERAL

i. The detailed specifications given hereinafter are for the items of works described in the schedule of quantities attached herein & shall be guidance for proper execution of work to the required standards.

ii. It may also be noted that the specification are of generalized nature & these shall be read in conjunction with the description of item in schedule of quantities & drawings. The work also includes all minor details of construction which are obviously & fairly intended & which may not have been referred to in these documents but are essential for the entire completion in accordance with standard Engineering practice.

iii. Unless specifically otherwise mentioned, all the applicable Latest codes & standards published by the Indian standard Institution & all other standard which may be published by them before the date of receipt of tenders, shall govern in all respects of dosing workmanship quality & properties of materials & methods of testing, method of measurements etc. Wherever any reference to any Indian Standard specifications occurs in the documents relating to this contract, the same shall be inclusive of all amendments issued to or revisions thereof, if any, up to the date of receipt of tenders.

iv. In case there is no I.S.I specification for the particular work, such work shall be carried out in accordance with the instructions in all respects, & requirements of the Engineers-in-Charge. Materials shall be conforming to Indian Standard / BSI /ASTM Latest codes as applicable. Wherever any reference to any Indian standard specification occurs in the documents relating to this contract, the same shall be inclusive of all amendment issued there to or revisions thereof, if any, up to the date of receipt of tenders.

v. The work shall be carried out in a manner complying in all respects with the requirements of relevant bye-laws of the Municipal Committee/Municipal Corporation/Development Authority/Improvement Trust under the jurisdiction of which the work is to be executed or as directed by the Engineer-in-Charge and, unless otherwise mentioned, nothing extra shall be paid on this account.

vi. Samples of various materials, fitting etc. proposed to be incorporated in the work shall be submitted by the contractor for approval of the Engineers-in-Charge before order for bulk supply is placed.

vii. The contractor shall take instructions from the Engineer-in-Charge regarding collection and stacking of materials in any place. No excavated earth or building materials shall be stacked on areas where other buildings, roads, services, compound walls etc. are to be constructed.

viii. The contractor shall maintain in perfect condition all works executed till the completion of the entire work allotted to him. Where phased delivery is contemplated, this provision shall apply to each Phase.

ix. The contractor shall give a performance test of the entire installation(s) as per

standard specifications before the work is finally accepted & nothing extra whatsoever shall be payable to the contractor for the test.

x. The contractor shall clear the site thoroughly of all scaffolding materials & rubbish etc. left out of his work & dress the site around the building to the satisfactions of EIC & his decision in writing shall be final & binding on all concerned.

xi. **Post construction inspection and testing:** After completion of the work and during maintenance period liability of the contractor, the work shall also be subjected to 'Post construction inspection and testing'. In case the materials or articles incorporated in the work are found to be inferior, though the sample collected for the same might have been passed at the time of execution, it shall be the responsibility of the contractor to replace the same at his own cost, failing which the Department may rectify the same at the risk and cost of the contractor or Department may accept the work as sub-standard, and cost be adjusted from the outstanding security deposit, as per the terms and conditions of the contract for the work.

xii. The MDL, shall be the sole deciding authority as to the meaning, interpretations and implications for various provisions of the specifications and his decision in writing shall be final and binding on all concerned.

xiii. In case any different or discrepancy between the specification & the description in the schedule of quantities, the schedule of quantities shall take precedence. In case of any difference or discrepancy between specification & drawing; the latest working drawing shall generally Govern. But prior to resolving all the above and any other discrepancy it shall be brought to the notice of Engineer In Charge, resolved mutually prior to implementation of that work. All works shall be carried out as per the Latest working drawings, specification, Indian standard codes & work done to the satisfaction of EIC.

xiv. The flooring after installation shall be protected by temporary Plaster of paris with a bottom layer of HDPE sheet/ cheaper soft puf Mat , which shall be removed after all other works in the room is completed as required by EIC and unless otherwise mentioned elsewhere in Tender document, nothing extra shall be paid on this account.

xv. Temporary Barricading and safety nets horizontally along Periphery of the building, temporary handrail at elevated openings etc. shall be installed by the contractor, based on site requirement and unless otherwise mentioned elsewhere in Tender document, nothing extra shall be paid on this account.

xvi. Mortar Mixing shall be done mechanically. Hand mixing if permitted by EIC for mortar shall be carried out in clean (unrusted) Galvanised steel side closed tray.

xvii. Sand should not be stacked adjacent to constructed walls, but away if in rooms while tiling, internal plastering or conducting other works.

xviii. Sample tiles, Granite, stones, laminate or any other finishing material which requires Architects /E.I.C approval after being approved shall be kept with the Engineer-in-Charge in the Site mock up room for reference till the completion of the work; nothing extra shall be paid on this account. All finishes which are to be incorporated in the work shall strictly conform to the approved

samples.

A. Pricing

The rate for each item of work shall, unless expressly stated otherwise, include the following (but not limited to the list given below) for the completion of works in all respects as per conditions of Contract, technical specifications, drawing:

1. All taxes such as GST, Royalties, Transportation, Freights, Packing and forwarding charges Insurance , local taxes and all the prevailing taxes etc.
2. All requirements and expenses for completion of work/item as per Rules and Regulations of Local Bodies, State Government and Central Government of India.
3. All materials, equipment, accessories, consumable, controls and instruments, tools, tackles, plants, scaffolding/double scaffolding, labour, maintenance, fixing, cleaning, , making good hauling, hoisting etc., for carrying out the item/work.
4. Waste on material and labour.
5. Loading, Unloading, handling/double handling, setting out protection from weather, temporary supports, platforms, construction of temporary godown/store for keeping of store etc., and the maintenance, of the same, dismantling of temporary works, disposal of debris and all other labour necessary for the execution of works.
6. Testing the installation as often as necessary, Contractors to arrange for all special instruments and tools required for such testing or getting it tested at approved lab.
7. Painting of all equipment, pipes, and supports etc., as per color codes to be decided for various systems.
8. Fees for testing the materials, equipment or overall installation by appropriate authorities as approved by MDL as per the latest version of IS. The testing lab will be decided by MDL/Consultant. Cost of the testing of materials shall be borne by the contractor.
9. Necessary coordination with all concerned agencies/persons involved in the completion of work.
10. All requirements of specification and drawings. Description of work given in the schedule of quantities is a brief description and shall be read in conjunction with specifications and drawings whether specifically mentioned or otherwise.
11. Removal of wrappings/ covering and carting away all unwanted material including POP.

The rates quoted by the tenderer will be deemed to be for the finished work complete in all respects with accessories, fitting, mounting arrangements normally provided with such equipment and/or needed for execution, completion, safe operation of equipment as required though they may not have been specifically mentioned in technical specifications, drawings and/or schedule of equipment.

All minor Masonry, Carpentry and Civil works such as cutting opening in Masonry Walls, Internal Partitions, Chasing on walls, etc. and making good the same to match existing works shall be provided by the contractor, whenever, asked for by the Consultant.

Mode of measurement shall be based on Schedule of Quantities/ as mentioned in this specification or as per E.I.C.

II – LIST OF INDIAN STANDARDS:

Following are the various pertinent Indian Standards, relevant to buildings work:

(All Latest Versions of I.S. codes shall be referred)

I. S. CODE NO.	**S U B J E C T**
A. CIVIL WORKS	
1. CARRIAGE OF MATERIALS	
4082-1996	Recommendations on stacking & storage of construction materials and components at site.
2. MORTAR	
196-1966	Atmospheric conditions for testing (Reaffirmed – 2006)
269-2015	Ordinary Portland cement Specification. (Sixth Revision)
383-2016	Coarse and fine aggregates from natural sources for concrete.
455-2015	Portland slag cement
650-1991	Standard sand for testing of cement
712-1984	Building Limes
1489--2015	Portland pozzolana cement Fly ash based
1514-1990	Methods of sampling & Test for Quick Lime & Hydrated Lime. (Reaffirmed - 2010)
1542-1992	Sand for Plastering. (Reaffirmed – 2009)
1727-1967	Methods of tests for pozzolanic materials(Reaffirmed – 2008)
2250-1981	Code of practice for preparation and use of masonry mortar. (Reaffirm- 2010)
2386-1963	Methods of Test for Aggregates for Concrete
2386 Pt.I-1963	Particle size and shape(Reaffirm- 2016)
2386 Pt. II-1963	Estimation of deleterious materials and organic impurities(Reaffirm-2016)
2386 Pt.III-1963	Specific gravity, density, voids, absorption and bulking(Reaffirm- 2016)
3025-1987	Methods of sampling & test (Physical & Chemical) water used in industry. (Reaffirmed-2014)
3812-2013 (Part1)	Pulverized Fuel Ash - For Use as Pozzolana in Cement, Cement Mortar and Concrete
4031-1996	Methods of physical tests for hydraulic cement (Reaffirmed – 2016)
4032-1985.	Method of chemical analysis of hydraulic cement (Reaffirmed - 2009)
4098-1983	Lime pozzolana mixture (Reaffirmed - 2009)

I. S. CODE NO.	S U B J E C T
3. BRICK WORK:	
1077-1992	Common burnt clay building bricks(Reaffirmed – 2011)
1200 (Pt.III)-1976	Method of measurements of brick work. (Reaffirmed - 2007)
2116-1980	Sand for masonry mortars. (Reaffirmed - 2007)
2212-1991	Code of practice for brick work(Reaffirmed - 2009)
2250-1981	Code of practice for preparation & use of masonry mortar. (Reaffirmed 2010))
3495 (Pt.ItoIV)-1992	Methods of tests of burnt clay building bricks: Part 1 Determination of compressive strength Part 2 Determination of water absorption Part 3 Determination of efflorescence Part 4 Determination of warpage(Reaffirmed - 2011)
5454-1978	Method for sampling of clay building bricks. (Reaffirmed - 2010)
2185 (Part 3) 1984	Auto claved cellular (Areated) Concrete Blocks(Reaffirmed - 2010)
4. STONE WORK:	
1121 (Pt.I)-2013	Methods of test for determination of strength properties of natural building stones: Part I Compressive strength
1122-1974	Method of test for determination of true specific gravity of natural building stones
1123-1975	Methods for identification examination of natural building stones
1124-1974	Method of test for determination of water absorption, apparent specific gravity and porosity of natural building stones(Reaffirmed - 2013)
1125-2013	Determination of weathering of Natural building stones - Method of Test
1126-2013	Determination of durability of natural building stones - Method of test
1129-1972	Recommendation of dressing of natural building stones (Reaffirmed - 2013)
1200 (Pt.IV)-1976	Method of measurement of stone masonry. (Reaffirmed - 2007)
1597-1992	Code of practice for construction of stone masonry
1597. (Pt.I)-1992	Code of practice for construction of Rubble stone masonry. (Reaffirmed -2011)
1597 (Pt.II)-1992	Code of practice for construction of ashlar masonry(Reaffirmed - 2011)
1805-1973	Glossary of Terms relating to stone Quarrying and dressing. Reaffirmed - 2008))
4101 (Pt.I)-1967	Stone facing. (Reaffirmed - 2010)

I. S. CODE NO.	SUBJECT
5. MARBLE WORK:	
1122-1974	Methods for determination of specific gravity and porosity of natural building stones(Reaffirmed - 2008)
1124-1974	Method of test for determination of water absorption, apparent specific gravity and porosity of natural building stones (Reaffirmed - 2013)
1130-1969	Marble (blocks, slabs and tiles) (Reaffirmed - 2008)
6. WOOD WORK:	
204-1991/92	Tower bolts (Part I-1991: ferrous metals; Part II - 1992: Non ferrous metals).
205-1992	Non-ferrous metal butt hinges(Reaffirmed - 2012)
206-2010	Tee and strap hinges (Reaffirmed - 2012
207-1964	Gate and shutter hooks and eyes. (Reaffirmed - 2011)
208-1996	Door handles(Reaffirmed - 2017)
281-2009	Mild steel sliding door bolts for use with padlocks
287-1993 (Reaf-2008)	Recommendation for maximum permissible moisture contents of timber used for Different purposes.
303-1989	Plywood for general purpose(Reaffirmed - 2013)
362-1991	Parliament hinges(Reaffirmed - 2010)
363-1993	Hasps and staples(Reaffirmed - 2008)
364-1993	Fanlight catch(Reaffirmed - 2008)
401-2001	Code of practice for preservation of timber(Reaffirmed - 2011)
419 - 1967	Putty for use on window frame (Reaffirmed - 2009)
451-1999	Technical supply condition for wood screws(Reaffirmed - 2010)
452-1973	Door springs, rat-tail type(II Rev.) (Reaffirmed 2010)
453-1993	Double acting spring hinges. (Reaffirmed – 2008)
723-1972	Steel counter sunk head wire nails. (Reaffirmed - 2011)
729.1979	Drawer locks, cupboard locks, and box locks (III Rev.) (Reaffirmed 2012)
848-2006	Synthetic resin adhesive for plywood (phenolic and amino plastic) Reaffirmed – 2011)
851-1978	Synthetic resin adhesive for construction work (Non-structural) in wood (I-Rev.) (amt)(Reaffirmed 2009)
852-1994	Specifications for animal glue for general wood working purposes. (Reaffirmed 2009)
1003-1994	Timber panelled and glazed shutters
1003(Pt.I)-2003	Door shutters (Reaffirmed – 2008)

I. S. CODE NO.	S U B J E C T
1003(Pt.II)-1994	Window and ventilator shutters (Reaffirmed - 2011)
1019-1974	Rim latches. (Reaffirmed - 2012)
1141-1993	Code of practice for seasoning of timber (Reaffirmed 2009)
1200	Method of measurement of Building and Civil Engineering works
1200(Pt.XIV)-1984	Glazing. (Reaffirmed - 2007)
1200(Pt. XXI)-1 973	Wood work and joinery. (Reaffirmed - 2007)
1322-1993	Bitumen felts for water proofing and damp proofing. (Reaffirmed – 2008)
1328-1996	Veneered decorative plywood (Reaffirmed -2011)
1341-1992	Steel Butt hinges (Reaffirmed - 2012)
1378-1987	Oxidized copper finishes. (Reaffirmed - 2016)
1568-1970	Wire cloth for general purposes. (Reaffirmed - 2013)
1658-2006	Fiber hard board. (Reaffirmed 2011)
1659-2004	Block boards (Reaffirmed 2014)
1823-1980	Floor door stoppers. (Reaffirmed - 2012)
1868-1996	Anodic coating on Aluminium & its alloy (II Rev.) (Reaffirmed 2016)
875-1987 Part1	Dead loads – Unit not of bldg. & stored materials
2191-1983	Wooden flush door shutter (cellular and hollow core type). (Reaffirmed - 2011)
1837 - 1966	Fan light pivots (Reaffirmed 2010)
2095-2011	Plain Gypsum Plaster Boards
3828 - 1968	Ventilator chains (Reaf. 1990)
4835 - 1979	Polyvinyl acatete dispssion base adhasive for wood (2009)
2191 (Pt.I)-1983	Plywood face panels. (Reaffirmed - 2011)
2191 (Pt.II)-1983	Particle board face panels and hard board face panels. (Reaffirmed-1991)
2202-1999	Wooden flush door shutters (solid core type)
2202 (Pt.I)-1999	Plywood face panels for wooden flush door shutters (Reaffirmed - 2016)
2202 (Pt.II)-1983	Particle board face panels for wooden flush door shutters. (Reaffirmed - 2011)
2209(Pt.I)-1976	Mortise locks (vertical type) (Reaffirmed 2012)

I. S. CODE NO.	S U B J E C T
2380 part -22 & 23 1981/1977 Part 1-21	Method of test for wood particle board and boards from lignocellulosic materials (Reaf. 2013)
2681-1993	Non ferrous metal sliding door bolts(aldrop) for use with pad locks Reaffirmed - 2008
2835-1987	Flat transparent sheet glass (3rd Revision). (Reaffirmed - 2018)
3087-2005	Wood particle boards (medium density) for general purpose (Reaffirmed -2010
3097-2006	Veneered particle boards (Reaffirmed -2011)
3400 (Part I)-1987	Method of test for vulcanized rubbers (1991)
3400-(Pt.II)-2014	Hardness (1981)
3400-(Pt.IV)-2012	Accelerated aging & Heat resistance
3400 (Pt.IX)-2014	Determination of density.
3564-1995	Door closers (Hydraulically regulated) (Reaffirmed – 2008)
3618-1966	Phosphate treatment of iron and steel for protection against corrosion. (Reaffirmed - 2007)
3818-1992	Continuous (Piano) hinges (Reaffirmed – 2012)
3847-1992 4020-1998 (1 to 16)	Mortise night latches (Reaffirmed – 2012) Door shutters –Methods of Test (Reaffirmed – 2008)
4021-1995	Timber door, window and ventilator frames (Reaffirmed – 2016)
4948-2002	Welded steel wire fabric for general use. (Reaffirmed - 2017)
4992-1975	Door Handles for mortise locks (vertical type). (Reaffirmed - 2010)
51 87-1972 5523-1983	Flush bolts (2010) Method of testing anodic coating on aluminium & its alloys. (Reaffirmed -2016)
5930-1970	Mortise latch (vertical types) (2010)
6318-1971	Plastic window stays & fasteners (Reaffirmed - 2010)
6607-1972	Rebated mortise locks (vertical type) (Reaffirmed - 2010)
6760-1972	Slotted countersunk head wood screws. (Reaffirmed - 2010)
71 96-1974	Hold fasts (Reaffirmed -2012)
71 97-1974	Double action floor springs (without oil check) for heavy doors(Reaffirmed - 2010)

I. S. CODE NO.	SUBJECT
7534-1985	Sliding locking bolt for use with padlocks. (Reaffirmed – 2010)
8756 - 1978	Mortice ball catches for use in wooden almirah (Reaffirmed -2012)
14856-2000	Glass fibre reinforced plastic (GRP) panel type door shutters for internal use – Specifications (Reaffirmed -2016)
7. STEEL WORK	
63-2006	Whiting for paints & putty. (Reaffirmed - 2010)
198-1978	Varnish, gold size. (Reaffirmed - 2009)
12406 - 2003	Medium density fibre board for general purpose - (Reaffirmed -2013)
277-2018	Specification for galvanised steel sheets (plain and corrugated)
278-2009	Galvanised steel barbed wire for fencing. (Reaffirmed - 2015)
800-2007	Code of practice for use of structural steel in general building construction(Reaffirmed - 2013)
806-1968	Code of practice for use of steel tube in general building construction(Reaffirmed - 2013)
813-1986	Scheme of symbols for welding. (Reaffirmed – 2008).
814-2004	Covered electrodes for metal arc welding of structural steel (Reaffirmed 2010)
817-1966	Code of practice for training and testing of metal arc welders. (Reaffirmed – 2008)
818-1968 (Reaf-03)	COP for safety & healthy requirements in electric & gas welding & cutting operation. (Reaffirmed – 2008)
1038-1983	Steel doors, windows and ventilators(Reaffirmed - 2011)
1081-1960(Reaf-2011)	COP for fixing & glazing of metal (steel & aluminium) doors, windows & ventilators
1148-2009	Hot rolled steel rivet bars (upto 40 mm diameters)for structural purposes
1161-2014	Steel tubes for structural purposes
1182-1 983	Recommended practice for radiographic examination of fusion welded butt joints in steel plates.
1200 (Pt-VIII)-1993	Method of measurements of steel work and iron works(Reaffirmed – 2007)
1363-2002 (Pt. 1- 3)	Hexagon bolts, nuts & lock nuts (dia. 6 to 39 mm) & black hexagon screws (dia. 6 to 24 mm).(Reaf-2018
1599-2012	Metallics materials – Bend Test (reaffirmed 2015).
1608-2005	Mechanical testing of metals –tensile testing (Reaffirmed 2011
1821-1987	Dimensions for clearance holes for metric bolts. (Reaffirmed - 2008)
1852-1985	Rolling and cutting tolerance for hot rolled steel products. (Reaffirmed - 2013)

I. S. CODE NO	SUBJECT
2062-2011	Hot Rolled Medium and High Tensile Structural steel (Reaffirmed – 2016)
4351-2003	Steel door frames. (Reaffirmed – 2008)
4736-1986	Hot-dip zinc coatings on Mild steel tubes. (Reaffirmed – 2016)
6248-1979	Metal rolling shutters and rolling grills (Reaffirmed – 2011)
7452-1990	Hot rolled steel sections for doors, windows & ventilators. (Reaffirmed – 2013)
SSPC-SP3 (SSI-St3)	Surface Preparation of Structural steel surface -Power Tool Cleaning– Swedish standard ST 3
SSPC-SP10(SSI-Sa2 ½)	Surface Preparation of Structural steel surface – Shot Blasting - Swedish standard Sa 2 1/2
8. FLOORING:	
210-2009	Grey iron casting (Reaffirmed 2014)
653-1992	Sheet linoleum (Reaffirmed 2016)
809-1992	Rubber flooring materials for general purpose(Reaffirmed 2016)
1122-1974	Methods for determination of specific gravity of natural building stones (Reaffirmed – 2008)
1124-1974	Method of test for water absorption of natural building stones(Reaffirmed – 2013)
1130-1969	Marble (blocks, slabs and tiles). (Reaffirmed – 2008)
1197-1970	Code of practice for laying of rubber floors. (Reaffirmed – 2016)
1198-1982	Code of practice for laying and maintenance of linoleum floors(Reaffirmed – 2016)
1200 (Pt.XI)-2013	Method of measurements of pavings and floor finishes.
1237-2012	Cement concrete flooring tiles. (Reaffirmed – 2016)
1443-1972	Code of practice for laying and finishing of cement concrete flooring tiles(Reaffirmed – 2016)
1661-1972	Code of practice for application of cement and cement lime plaster finishes(Reaffirmed – 2016)
2114-1984	Code of practice for laying in situ terrazzo floor finish(Reaffirmed – 2016)
2571-1970	Code of practice for laying in situ cement concrete flooring(Reaffirmed – 2016)
3400-(Part 1 to 22)	Method of Test of vulcanized rubbers.
3400 (Pt.II)-2014	Hardness
3400 (Pt.X)-1977	Compression set at constant strain. (Reaffirmed – 2008)
3462-1986	Unbacked Flexible P.V.C. Flooring. (Reaffirmed – 2016)

I. S. CODE NO.	S U B J E C T
4631-1986	Code of practice for laying of epoxy resin floor toppings (Reaffirmed – 2016)
5318-1969	Code of practice for laying of flexible P.V.C. sheet & tiles flooring(Reaffirmed – 2016)
5389-1969	Code of practice for laying of hardwood parquet and wood block floors. (Reaffirmed – 2007)
9197-1979	Specifications for epoxy resin, hardeners and epoxy resin compositions for floor topping (Reaffirmed – 2016)
73-2013	Paving Bitumen
9. FINISHING	
75-1973	Linseed oil, raw and refined. (Reaffirmed – 2010)
77-1976	Linseed oil, boiled, for paints. (Reaffirmed - 2009)
104-2017	Specification for ready mixed paint, brushing, zinc chrome, priming.
133-2013	Enamel, interior (a) under coating (b) finishing colour as required
137-2017	Ready mixed paint, brushing, matt or egg-shell flat, finishing, interior, to Indian Standard Colour, as required.
158-2015	Ready mixed paint, brushing, bituminous, black lead free acid alkali, water and heat resisting for general purposes. (Reaffirmed – 1999)
168-1993	Ready mixed paint, air drying for general purpose.(Reaffirmed 2012)
217-1988	Cut back bitumen (reaffirmed 2009)
218-1983	Creosote and anthracene oil for use as wood preservatives (Reaffirmed 2009)
337-1975	Varnish, finishing interior. (Reaffirmed – 2009)
341-2016	Black Japan, types A, B, and C
347-1975	Varnish, shellac for general purpose. (Reaffirmed – 2012)
348-1968	French polish. (Reaffirmed – 2009)
419-1967	Putty for use of window frames. (Reaffirmed – 2009)
427-2013	Distemper, dry, colour as required.
428-2013	Washable distemper
524-1983	Varnish, finishing, exterior, synthetic;air drying. (Reaffirmed – 2015)
525-1968	Varnish, finishing, exterior and general purposes. (Reaffirmed –2009)
533-2007	Gum spirit of turpentine (oil of turpentine)
712-1984	Specification for building limes. (Reaffirmed - 2009)
1200 (Pt. XII)-1976	Method of measurements of plastering and pointing(Reaffirmed - 2007)

I. S. CODE NO.	S U B J E C T
1200 (Pt.XIII)-1994	Method of measurements of white washing, colour washing, distempering and other finishes(Reaffirmed - 2007)
1200 (Pt.XV)-1987	Methods of measurements of painting, polishing & varnishing. (Reaffirmed - 2007)
2095-2011-Pt.I; 2001-PT	Gypsum plaster boards
14862-2000	Fibre Cement Flat Sheets - (Reaffirmed - 2010)
2339-2013	Aluminium paint for general purposes
2547-1976 (Pt I & II)	Gypsum building plaster (Reaff. 2007)
2933-1975	Enamel, Exterior (a) Under coating (b) Finishing(Reaff. 2009)
5410-2013	Cement paint
6278-1971	Code of practice for white washing & colour washing. (Reaffirmed -2016)
14276-1995	Cement particle board(Reaffirmed -2009)
10. DEMOLITION AND DISMANTLING:	
1200(Pt.XVIII)-1974	Method of measurements of demolition and dismantling(Reaffirmed -2007)
11. SAFETY CODES	
818-1968	Safety and healthy requirements in Electric and gas welding and cutting operations. (Reaffirmed -2008)
3696 (Pt.I)-1987	Safety code for scaffolds(Reaffirmed -2012)
3696 (Pt.II)-1991	Safety code for ladders(Reaffirmed -2012)
3764-1992	Safety code for Excavation works (Reaffirmed -2012)
4081-2013	Safety code for blasting and related drilling operation
4130-1991	Safety code for Demolition of Building(Reaffirmed -2012)
5916-2013	Safety code for construction involving use of hot bituminous materials
6922-1973	Structural subject to underground blasts code of practice for safety and design of structure subject to underground blasts.
7293-1974	safety code for Working with construction machinery (Reaffirmed -2012)
12. ANTI TERMITE	
6313 (Part 2) 2013	Anti Termite Measures in Buildings Part – 2 Pre-constructional chemical treatment .
6313 -Part 3 -2013	Code of Practice for Anti-termite Measures in Buildings - Treatment for Existing Buildings(Reaffirmed -2011)

III – MANDATORY TESTS

NOTES:

The mandatory tests shall be carried out when the quantity of materials to incorporated in the work exceeds the minimum quantity specified.

Optional tests specified or any other tests, shall be carried out in case of specialised works or important structures as per direction of the Engineer-in-Charge.

Testing charges, including incidental charges and cost of sample for testing shall be borne by the contractor for all tests.

In case of non-IS materials, it shall be the responsibility of the contractor to establish the conformity of material with relevant IS specification by carrying out necessary tests. Testing charges including incidental charge and cost of sample for testing shall be borne by the contractor for such tests.

THE MANDATORY TESTS SHALL BE AS FOLLOWS:

Material	**Test**	**Field / laboratory test**	**Test procedure**	**Minimum quantity of material / Work for carrying out the test**	**Frequency of testing**
Reinforced cement concrete work					
Water for Construction purposes	Ph value Limits of Acidity Limits of Alkality Percentage of solids Chlorides Suspended matter Sulphates Inorganic solids Organic solids	Lab	IS 3025	Water from each source	Before commencement of work & thereafter: Mandatory – Once in one year from each source; Optional: once in 3 months from each source; Municipal supply - optional.
Note : for all other small items and where RCC done in a day is less than 5 cum, test may be carried out as required by Engineer-in-Charge.					
Mortars:					
Material	**Test**	**Field / laboratory test**	**Test procedure**	**Minimum quantity of**	**Frequency of testing**
Sand	Bulking of Sand	Field		20 CU.M.	Every 20 cu.m or part thereof or more frequently as decided by Engineer-In-Charge

	Silt content	Field	IS:383	20 CU.M.	Every 20 cu.m or part thereof or more frequently as decided by Engineer-in-Charge
	Particle size and distribution	Field Laboratory decided by Engr - in-Charge	IS:383	40 CU.M.	Every 40 cu.m. of fine aggregate / sand required in RCC. work only.
	Organic Impurities	Field	.. DO..	20 CU.M.	Every 20 cu.m. or part thereof or more frequently as decided by the Engineer-in-Charge
	Chloride & sulphate content tests		Optional		Once in three months.
Cement	Test requirement	Fineness (m^2/kg)	IS 4031 (Part-II)	Each fresh lot	Every 50 MT or part Thereof
		Normal consistency	IS 4031 (Part-IV)		
		Setting time (minutes) a) Initial b) Final	IS 4031 (Part-V)		
		Soundness a)Le-Chat expansion (mm) b) Autoclave (%)	IS 4031 (Part-III)		
		Compressive Strength (Mpa) a) 72+/-1 hr b) 168+/-2hr	IS 4031 (Part-VI)		
Stone Aggregate	a) Percentage of soft or deleterious materials	General visual inspection / Lab test where required by the Engr-in-Charge	IS 2386 Part II	One test for each source	One test for each source
	Particle size distribution	Field / Lab	-	10 cu.m	Every 40 cum. Or part thereof and
Material	**Test**	**Field / laboratory test**	**Test procedure**	**Minimum quantity of material /**	**Frequency of testing**
	Once in three months for each source for coarse and fine aggregates required in RCC works, for a minimum quantity - 10 cum for coarse aggregate and 40 cum for fine aggregate.				

	) Estimationof Organic impurities	Field / Lab	IS 2386 Part II	10 Cum	-do-
	b) Specific Gravity	Field / Lab	IS 2386	10 Cum	-do-
	Bulk Density	Field / Lab	IS 2386	10 Cum	-do-
	b) Aggregate crushing	Field / Lab	IS 2386	10 Cum	-do-
	c) Aggregate impact value	Field / Lab	IS 2386	10 Cum	-do-
Timber	Moisture	Field (by moisture meter) Laboratory test as required by Engineer-in-Ch.		1 Cu.M.	Every one Cum or part thereof
Flush Door	End immersion test Knife test Adhesion test	Laboratory	IS: 2202 (Part 1) & (Part II)	26 shutters	As per sampling and testing as instructed by the Engineer-in-Charge.
Bricks	Testing of bricks / brick tiles for dimensions Compressive strength Water absorption Efflorescence	Laboratory	IS 3495 Part I to IV	No. of bricks to be selected & bricks lot 20 : 2001 to 10000 32 : 10001 to 35000 50 : 35001 to 50000 20 : for every addl. 50000 or part thereof. If < 20000, As per decision of EIC.	Permissible defective bricks in the sample 1 2 3 1

Material	Test	Field / laboratory test	Test procedure	Minimum quantity of material / Work for carrying out the test	Frequency of testing
Concrete Blocks	Dimensions of block Block Density Compressive strength Water absorption Drying shrinkage Moisture movement Retest – Drying shrinkage & Moisture movement if required	Field Laboratory	IS 2185 – Part 1	20 blocks from every consignment of 5000 blocks.	As per sampling and testing as instructed by the Engineer-in-Charge.
Steel for RCC	Physical tests a) Tensile strength b) Retest c) Re-bound test d) Nominal mass e) Bend test f) Elongation test g) Proof stress	Lab / field	IS 1608 IS 1786 IS 1786 IS 1786 IS 1599 IS 1786 IS 1786	Each lot from each source from each diameter of bar	Below 100 Tonnes Dia < 10 mm one sample for each 25 tonnes or part thereof If dia is >10 mm but less than 16 mm: One sample each 35 tonnes or part thereof. If dia >16 mm one sample for each 45 tonnes Above 100 Tonnes Dia < 10 mm one sample for each 40 tonnes or part thereof If dia is >10 mm but less than 16 mm One sample for each 45 tonnes or part thereof. If dia >16 mm one sample for each 50 tonnes.

	Chemical Tests: 1 .Carbon Constituent 2.Sulphur 3.Phosphorus		IS 1786			For every fresh lot of one truck or less as directed by the Engineer-in-

OTHER MANDATORY TESTS: Soil core tests; Testing aggregate - particle size distribution; Ceramic tiles, Mosaic tiles

CI pipes: Dimensional, mass, Hydrostatic; GI pipes; Lead; RCC hume pipes; Stoneware pipes

OPTIONAL TESTS: Testing aggregate-surface moisture, impact value pectrographic; alkali reaction; Dimensional tests of bricks; Testing the mass of zinc coating on GI door frame, steel windows, test for chemical and physical properties; Anodic coating on aluminium fittings and aluminium sections, Unit weight of aluminium sections;

Testing structural steel; Chequered plate, Unit weight, Thickness, Chemical and physical properties

Presence of preservative on factory made panelled door, kiln seasoned chemically treated wood products, Moisture content in wood products.

TESTING, TOLERANCE, ACCEPTANCE AND MODE OF PAYMENT:

a) The material should pass all tests and tolerance in dimensional, chemical, physical properties should be within the limit as stipulated in relevant IS for acceptance. Such materials shall be accepted as standard.

b) Payment shall be restricted to standard unit mass, or as specified in the schedule of work, without making any cost adjustment towards mass or any other properties, provided the material pass all the tests and tolerances are within the specified limits. In case of non-standard materials, materials not covered under any IS Specifications, such as aluminium sections, the payment shall be made based on the actual unit weight basis as determined by testing at random sampling.

III – CIVIL & INTERIOR WORKS

1. BRICK WORK:

a. SCOPE OF WORK :

The work covered under this specification pertains to procurement of well burnt clay bricks of class 35 unless otherwise specified and workmanship in building walls of various thickness, in strict compliance with the specifications and applicable drawings.

b. MATERIALS:

Brick shall be well burnt clay bricks of designated class and shall satisfy the strength criteria and shall be got approved by the Engineer-in-Charge before incorporation in the work. The bricks shall be hand moulded or machine moulded and shall be free from nodules of free lime, visible cracks, flaws, warpage and organic matter.

In general, the nominal size of bricks (F.P.S.) shall be 22.9 x 11.4 x 7 cm. (9"x4.5"x2.75"). Permissible tolerance on dimensions shall not be more than (+/-) 8%. The contractor shall get approved the sample and source of bricks from Engineer-in-Charge before procurement on large scale and shall maintain the same for the entire work. The bricks shall have smooth rectangular faces with sharp corner and shall be uniform in colour.

Bricks for Mumbai / Pune and surrounding areas, unless otherwise specified, shall be as per relevant IS of class designation 35 of size 22.5 x 11.1 x 7 cm. Permissible tolerance on dimensions shall not be more than (+/-) 8%.

Unless otherwise specified, bricks for Eastern Zone works (Kolkata / Bhubneshwar / Shillong etc.) shall be of class designation 75 of size 25 x 12.5 x 7.5 cm. Permissible tolerance on dimensions shall be as per relevant IS.

In case the size of bricks used in the work is found lesser than the specified one but within the permissible tolerance i.e. {-} 8%, the following shall apply:

i. Extra cement consumed due to more number of joints and due to additional thickness of plaster than the specified in the tender to match with adjoining columns and beams, shall be borne by the contractor without any extra cost to the department.

ii. If the plastering to be done is more than the specified thickness to maintain the plaster surface to perfect line, level and plumb with adjoining columns, beams, walls etc., the contractor shall be responsible to provide more thickness of plaster at his own cost and nothing extra will be paid on this account.

In case the size of bricks used in the work is found more than the permissible, the contractor shall chip out the exposed edges of bricks upto the required level of wall to receive specified thickness of plaster.

Bricks shall generally conform to I.S. 1077-1992. In any case minimum crushing strength shall not be less than 35 kg/cm^2 and water absorption shall not be more than 25% by weight. The Engineer-in-Charge shall have the right to reject bricks

obtained from any field where the soil has an appreciable quantity of sulphates and chlorides. The specifications for cement, sand and water shall be same as described herein before under cement concrete. Bricks shall be thoroughly soaked in water before using till the bubbles ceases to come up. No half or quarter brick shall be used except as closer. The closer shall be cut to required size and used near the end of the walls. The walls shall be raised truly to plumb. The type of bond to be adopted shall be decided by the Engineer-in-Charge, but vertical joints shall be laid staggered.

c. WORKMANSHIP :

Four courses of brick work with four joints should not exceed by more than 40 mm., the same bricks piled one over the other without mortar.

Brick work shall not be raised more than 10 courses a day unless otherwise approved by the Engineer-in-Charge. The brick work shall be kept wet for at least 7 days. Brick work shall be uniformly raised alround and no part shall be raised more than 1.0 metre above another at any time.

All joints shall be thoroughly flushed with mortar of mix as specified in the schedule of quantities, at every courses. Care shall be taken to see that the bricks are bedded effectively and all joints completely filled to the full depth.

The joints of brick work to be plastered shall be raked out to a depth not less than 10 mm. as the work proceeds. The surface of brick work shall be cleaned down and watered properly before the mortar sets.

The adhesion between the brick masonry surface and the concrete surface of columns, beams, chajjas, lintels etc. should be proper by ensuring that the concrete surface coming in contact with brick masonry is hacked/ chipped/ keyed, cleaned and cement slurry is applied so that a proper bond is achieved between the two dissimilar materials. It is the responsibility of the contractors to ensure that there will not be any cracks/ fissures anywhere in the brick masonry.

In case the cracks appear subsequently in those areas, they should be made good by cement grouting or epoxy putty grouting/ poly sulphide compound grouting or as per standard modern specifications/ methods with the prior approval of the Engineer-in-Charge, at the cost of the contractor.

All the courses shall be laid truly horizontal and all vertical joints shall be truly vertical. Specified mortar of good and approved quality shall be used. Lime shall not be used where reinforcement is provided in brick work. The mortar should completely cover the bed and sides of the bricks. Proper care should be taken to obtain uniform mortar joint throughout the construction. the walls should be raised uniformly in proper, approved bond. In construction of the wall, first of all two end corners are carefully laid to line and level and then in between portion is built, with a cord stretching along the headers or stretchers held in position at the ends. This helps in keeping the alignment of the courses and maintaining them in level. Similarly all other courses are built. Care shall be taken to keep the perpends properly aligned within following maximum permissible tolerances :

a. Deviation from vertical within a storey shall not exceed 6 mm per 3 m height.

b. Deviation in verticality in total height of any wall of building more than one

storey in height shall not exceed 12.5mm.

c. Deviation from position shown on plan of any brick work shall not exceed 12.5 mm.

d. Relative displacement between load bearing wall in adjacent storeys intended to be vertical alignments shall not exceed 6 mm.

e. A set of tools comprising of wooden straight edge, masonic spirit levels, square, 1 meter rule line and plumb shall be kept on the site of work for every 3 masons for proper check during the progress of work.

No brick work shall be carried on during frosty weather except with the written permission of the Engineer-in-Charge, who will give special directions as to the manner in which the work is to be performed. All brick work laid during the day, shall, in seasons liable to frost, be properly covered up at night as directed by the Engineer-incharge. Should any brick work be damaged by frost, the brick work shall, at the discretion of the Engineer-in-Charge, be pulled down and made good, at the cost of the contractor.

Concrete surfaces of columns, beams, lintels, chajjas etc. coming in contact with masonry work shall be wire brushed and shall include cleaning brickwork covered with fungus or deleterious materials.

Brick work shall be well watered/ cured throughout the day for at least a week from the date of building and the work shall be protected from sun and rain.

2. HALF BRICK WORK:

Materials and workmanship for a half brick or brick on edge partition wall shall be as specified above. The wall shall be stiffened by R.C.C. stiffeners of size 115 mm. wide x 80 mm. thickness to the full length of wall and shall be provided with 2 Nos. 6 mm. diameter M.S. bars or as specified in the schedule as bottom reinforcement (only the M.S. reinforcement will be paid separately under relevant item). These bars shall be securely anchored at their end where the partition end. The free ends of the reinforcement shall be keyed into the mortar/P.C.C bed block of the main brick work to which the half brick work is joined. Overlaps in reinforcement, if any, shall not be less than 30 cm.

The rates for brick work shall include the cost of the following:

i. Providing and fixing necessary single or double scaffolding and removing the same after the work is completed.

ii. Form work for stiffeners concrete as required.

iii. Watering, curing, lifting of materials to any height.

iv. Raking out of joints to receive plaster.

v. Forming slab sittings, cutting or leaving holes for lugs of windows, doors, sills, switch boxes etc.

vi. Making good all holes, chases, etc. to any depth due to conduit pipes, holdfasts, bolts, switch & plug boxes etc.

vii. Bedding and pointing precast lintels, sills etc. in or on walls. For the purpose of measurements, the thickness of one brick wall and over shall be taken in terms of multiples of half brick.

SAMPLING AND TESTS:

Samples of bricks shall be subjected to the following mandatory tests :

a) Dimensional tolerance b) Water absorption c) Efflorescence d) Compressive strength

Note : 1. Cost of above tests shall be borne by the contractor.

2. Frequency of test shall be as per relevant IS specifications.

MODE OF MEASUREMENT :

a) For Brick Work Measured in Cubic Metres :

The contract rate shall be for a unit of one cubic metre of brick masonry as actually done. 230 mm. thick (or as specified in schedule) brick walls shall be taken as one brick thick.

All openings in brick work for doors, windows and ventilators shall be deducted to get the net quantity of actual brick work done.

Openings or chases required for P.H. or electrical inserts less than 0.1 sqm. and bearing of precast concrete members shall not be deducted.

No extra payment shall be made for any extra work involved in making the above openings or placements.

For brick work measured in square metre :

Half brick thick masonry walls shall be measured in sqm. All openings in brick work for doors and windows and ventilators shall be deducted to get the net quantity of actual work done. Openings or chases required for P.H. or Electric inserts less than 0.1 sqm. and bearing of precast concrete members shall not be deducted. No extra payment shall be made for extra work involved in making the above openings or placements.

3. AUTOCLAVED CELLULAR (AREATED) CONCRETE BLOCK MASONRY

Scope of Work : The work covered under this specifications pertains to procurement of best quality locally available or locally manufactured precast AAC concrete solid block and workmanship in building walls of various thickness in strict compliance with the specifications and applicable drawings.

Material: Precast cement concrete solid blocks shall be of best quality locally available/ manufactured at factory and should be approved by the Engineer-in-Charge before incorporation in the work. The ingredient and the cement concrete used shall confirm to relevant I.S. as stipulated in specification for cement concrete works herein before.

Minimum crushing strength of the AAC blocks shall be 5 N/ sqmm. at 28th day after curing and dry density shall be not less than 651-750 kg/cum. The type of the bond to be adopted will be decided by the Engineer-in-Charge but vertical joints shall be staggered. The thickness of the blocks shall be 100 mm, 150 mm & 200 mm and the proportion used in making the blocks shall be as per IS code. The blocks shall be cured well at least for 14 days before incorporation in to the work. The cement mortar for concrete blocks masonry shall be 1:4 and joints shall not be more than 10 mm. thick.

Workmanship and Mode of Measurement: The workmanship and mode of measurement shall be as stipulated in the specification for brick work as applicable stated earlier and AAC block masonry with 140 mm. thick block shall be measured in sqm. nearest to two places of decimals of a meter. The rate quoted shall include cost of all materials, labour including form work in casting the blocks, curing, transporting, handling, hoisting the blocks to proper level, curing masonry etc. complete.

Mode of measurement: All AAC blocks masonry walls shall be measured in Sqm. All opening in AAC block work for doors, windows and ventilators shall be deducted to get the net quantity of actual work done. Opening or chases required for P.H. or electrical inserts less than 0.1 sqm. And bearing of precast concrete members shall not be deducted. No extra payment shall be made for extra work involved in making the above opening or placement.

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4. GENERAL NOTE FOR ALL TILING WORKS:

Where the size of flooring tiles and height of risers, skirting or dado does not admit full size of other finished size tiles, the tile(s) are to be cut / sawn to the required size and nothing extra shall be paid for the same.

KOTAH STONE FLOORING/ SKIRTING/ FACIA / SHELVES :

MATERIALS : . The stone shall be hard, sound, durable, homogeneous in texture and resistant to wear. These shall be without any soft veins, cracks or flaws and shall have uniform colour. They shall have natural surface free from broken flakes on top. Hand cut/ machine cut for exposed edges and machine polished. Kotah stone shall be of the best quality and of the specified thickness, size and the shade, which shall be got approved by the Engineer-in-charge. The contractor shall get it one time polished at vendor shop and only the similar colour & texture Kota stones shall be sorted and delivered at site. The final polishing to finish as required by E.I.C shall be done at Site after installation of floor.

The slabs / tiles shall be rectangular or square in shape or as per pattern shown in drawing and as directed by the Engineer-in-charge. The sizes given in schedule of quantities are tentative and can vary only slightly as per the availability in the market. The thickness of the slab after it is dressed shall be 20, 25, 30 or 40 mm as specified in the item. Tolerance of (+/-) 2 mm shall be allowed for the thickness. In respect of length & width, tolerance in length & width shall be permissible upto (+/-) 5

mm for hand cut slabs & (+/-) 2 mm for machine cut slabs. At its thinnest, no stone shall be thinner than the specified thickness.

Uniformity of size and colour / shade shall generally be maintained for the stones used in any one room. The exposed surface shall be machine polished to a smooth, even and true plane and the edges hand cut and dressed true and squares. The evenness of the surface of slabs and edges of the slab shall not be marred by careless dressing or handling and no patching up shall be allowed for the slab. The edges shall be quite straight. The under face may be left as required or rough dressed. Before taking up the work, samples of stone slabs to be used and their dressing and polishing shall be got approved by the Engineer-in-charge and kept in his office as approved sample and the stone slabs to be used shall conform to the same.

BEDDING/ BACKING COAT: In case of flooring / skirting / dado, the mortar bedding / backing shall be of cement mortar of thickness and mix specified in the schedule of work.

CEMENT MORTAR: Cement mortar bedding shall be as specified under relevant specification for terrazzo / plain cement tile flooring.

CONSTRUCTION DETAILS: Cement mortar as specified for bedding shall be uniformly mixed. The amount of water added shall be the minimum necessary to give just sufficient plasticity for laying and satisfactory bedding. Care shall be taken in preparing the mortar to ensure that there are no hard lumps that would interfere with the even bedding of the stones. Before spreading the mortar, the sub-floor or base shall be cleaned of all dirt, set mortar scum or laitance and of loose materials by hacking and brought to original levels and then well wetted without forming pool of water on surfaces.

FIXING THE STONE SLAB/ TILE : Before laying, the stone shall be thoroughly wetted with clean water, neat cement grout (2.75 kg/ sqm.) of honey like consistency shall be spread on the mortar bed over as much areas as could be covered with the slabs within half an hour. The specified type of stone shall be laid on the neat cement float and shall be evenly and firmly bedded to the required level and slope in the mortar bed. Each stone shall be gently tapped with wooden mallet till it is firmly and properly bedded.

There shall be no hollows left. If there is a hollow sound on gently tapping off the slab, such slab shall be removed and reset properly. The joints shall be grouted with matching cement slurry. Approved pigment shall be used in cement slurry to match with shade of stone. Pigment required to match the shade of stone shall be supplied by the contractor at no extra cost. The stone adjoining the wall shall go about 12mm. under the plaster, skirting or dado for the wall. All stone slabs, tiles shall be so laid as to have continuous lines from various rooms to the corridors. No change of lines shall be permitted at junction between rooms and corridors. Only one piece machine cut, Kotah stone shall be used for treads and risers, unless otherwise specified in the tender schedule..

CURING : The work shall be kept well wetted with damp sand or water for seven days.

POLISHING AND CLEANING: When the bedding and joints have completely set and attained required strength, the surface shall be machine polished to give smooth, even and true plane to the flooring. All flooring shall be thoroughly cleaned and handed

over free from any mortar stains etc. Polishing shall be done as per relevant IS and IS-14223 (Specification for polished building stones).

SKIRTING AND DADO/ FACIA : The quality and type of stone shall be same as mentioned for flooring except of their height and thickness or backing coat which shall be as mentioned in item schedule. The backing shall conform to the specifications for cement mortar specified for item of terrazzo tiles. Contractor should take into consideration the fact that touching up of the plaster at the junction of skirting / dado is invariably done after the skirting/ dado/ facia work is completed and quote rates accordingly. Nothing extra for the same shall be entertained.

Fixing, curing, polishing and cleaning shall be as specified herein before under cement/ terrazzo tile skirting. Polishing may be done by hand, but a smooth surface and fine polishing shall be obtained. Joints shall be finished in white cement with addition of colour pigment matching tile. The junction of plaster and the upper edges of the dado/ skirting shall be finished smoothly as directed by the Engineer-in-charge without any extra cost.

MODE OF MEASUREMENTS : Flooring, skirting and dado/ facia shall be measured same as that for terrazzo cement tile, flooring/ skirting/ dado. Unless otherwise specified, shelves shall be paid on area basis in sqm. calculated to two places of decimal, where length and breadth shall be measured inclusive of bearings correct to a cm. The permissible tolerance in the specified thickness shall be (+/-) 2 mm.

Note : Wastage in obtaining the required machine cut, hand cut sizes as specified from the commercial sizes available in market shall be taken into consideration by contractor while quoting the rate for work and no extra claim on this account shall be entertained.

TANDUR STONE / CUDDAPPA STONE / POLISHED SHAHABAD STONE / BLUE WADI STONE FLOORING / SKIRTING / DADO:

The specifications for these items shall be similar to those for Kotah stone as above.

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6. GLAZED TILE FLOORING, DADO/ SKIRTING/ FACIA.

MATERIALS :

White Glazed Tiles : The tiles shall be of approved make and shall generally conform to IS : 13712. They shall be flat and true to shape and free from cracks, blisters, welts, crawling, crazing spots, chipped edges, corners or other imperfections detracting from their appearance. The glazing shall be of uniform shade.

The tiles shall be of square or rectangular of nominal sizes such as 300x200mm, 150x150mm, 100x100mm, 100x200mm or other as directed by the EIC. The length of all four sides shall be measured correct to 0.1 mm and average length-breadth shall not vary more than (+ / -) 0.8 mm from specified dimensions. The variation of individual dimensions from average value of length/breadth shall not exceed (+ / -) 0.5 mm. Tolerance in thickness shall be (+ / -) 0.4 mm. Size of tiles different form the specified one, may be allowed to be used with prior approval of the EIC.

The thickness of the tiles shall not be less than 5 mm or as specified in the items and shall confirm to I.S. 13712 in all respects. Samples of tiles shall be got approved by the Engineer-in-charge before use on the work. Top surface of tile shall be glossy or matt as specified. The underside of tiles shall not have glaze on more than 5% of the area in order to have proper adherence to the back.

PREPARATION OF SURFACE & LAYING :

Sub grade concrete or RCC slab or side brick wall/ or plastered surfaces on which tiles are to be laid shall be cleaned, wetted and mopped as specified for terrazzo tile flooring.

The bedding/backing for the tile shall be of C.M. 1.3 or as specified and shall be applied and allowed to harden. The mortar shall be roughened with wire brushes or by scratching diagonal lines 1.5mm. deep at 7.5mm. centre both ways.

The back of tiles shall be buttered with a coat of grey cement slurry paste and edges with white cement slurry and set in the bedding mortar. The tiles shall be tapped gently with wooden mallet and corrected to proper planes and lines. The tile shall be butt jointed in pattern and joints shall be as fine as possible. The top of skirting/ dado shall be truly horizontal and joints truly vertical.

After a period of curing of 7 days minimum, the tiles shall be cleaned and shall not sound hollow when tapped.

The surface during laying shall be checked with a straight edge 2 m. long. Where full size tiles cannot be fixed, these shall be cut/sawn to the required size & their edges rubbed smooth to ensure straight and true joints.

Tiles shall enter not less than 10mm. under side skirting.

After the tiles have been laid, surplus cement grout shall be cleaned off.

MORTAR AND BEDDING :

Cement mortar for bedding shall be of proportion specified in items schedule and shall conform to the specification for materials, preparations etc. as specified under cement mortar. The amount of water added while preparing mortar shall be the minimum necessary to give sufficient plasticity for laying. Care shall be taken in preparation of the mortar to ensure that there are no hard lumps that would interfere withe even bedding of the tiles. Before spreading the mortar bed the base shall be cleaned of all dirt, scum or laitance and loose materials and well wetted without forming any pools of water on the surface. The mortar of specified proportion and thickness shall then be even and smoothly spread over the base by use of screed battens to proper level or slope.

Cement mortar of thickness and proportion as specified in the schedule for dado shall be applied to the wall after preparing the wall surface as specified under cement plaster 20mm. thick and brought to correct line and plumb and the surface left rough to receive the tiles.

FIXING OF TILES FOR FLOORING :

The tiles before laying shall be soaked in water for atleast 2 hours. The tiles shall be laid on the bedding mortar when it is still plastic but has become sufficiently stiff to offer a fairly firm cushion for the tiles. Tiles which are fixed on the flooring adjoining the wall shall be so arranged that the surface on the round edge tiles shall correspond to the skirting or dado. Neat cement mortar grout 1:2, using fine sand (table III, zone-IV and as per I.S. 383) of honey like consistency shall be spread over the bedding mortar just to cover as much area as can be tiled within half an hour. The joints of the tiles shall be filled with neat white cement mixed with colour pigment and fixed in this grout one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints shall be kept as close as possible and in straight line. The surface of the flooring during laying shall be frequently checked with a straight edge about 2M long to obtain a true surface with the required slope. The joints between tiles shall not exceed 1.00 mm. in width. The joint shall be grouted with white cement mixed with tile colour matching colour Pigment. After fixing the tiles, finally in an even plane or slope, the flooring shall be covered with plastic sheet with POP layer and allowed undisturbed for 14 days.

FIXING TILES FOR DADO & SKIRTING/FACIA :

The dado work, shall be done only after fixing the tiles/slabs on the floor. The approved white/coloured glazed tiles before laying shall be soaked in water for atleast 2 hours. Tiles shall be fixed when the cushioning mortar is still plastic and before it gets very stiff.

The back of the tile shall be covered(full area of the tile) with this layer of cement mortar 1:2 using fine sand (table III, zone IV, I.S. 383-1963) and the joint of the tile with neat white cement mixed with colour pigment (to match tile colour). The tile shall then be pressed in the mortar and gently tapped against the wall with a wooden mallet. The fixing shall be done from bottom of wall upwards without any hollows in the bed of joints. Each tile shall be as close as possible to one adjoining. The tiles shall be jointed with white cement slurry. Any thickness difference in the thickness of the tiles shall be arranged out in cushioning mortar so that all tiles faces are in one vertical plane. The joints between the tile shall not exceed 1.00 mm. in width and they shall be uniform.

While fixing tiles in dado work, care shall be taken to break the joints vertically. The top of the dado shall be touched up neatly with the rest of the plaster above, height of the dado depending on architectural drawing / EIC requirement.

After fixing the dado/skirting etc. they shall be kept continuously wet for 7 days.

If doors, windows or other openings are located within the dado area, the corners, sills, jambs etc. shall be provided with true right angles without any specials. The contractor will not be entitled to any extra claims on this account for cutting of tiles if required.

CLEANING :

After the tiles have been laid in a room or the days fixing work is completed, the surplus cement grout that may have come out of the joints shall be cleaned off before it sets. After the complete curing, the dado or skirting over shall be washed thoroughly clean. In the case of flooring, once the floor has set, the floor shall be

carefully washed clean and dried. When dry, the floor shall be covered with oil free dry saw dust. It shall be removed only after completion of the construction work and just before the floor is used.

POINTING AND FINISHING :

The joints shall be cleaned off with wire brush to a depth of 3 mm. and all dust and loose mortar removed. Joints shall then be flush pointed with white cement mixed with colour pigment and floor kept wet for 7 days and then cleaned. Finished floor shall not sound hollow when tapped with a wooden mallet.

MODE OF MEASUREMENT :

Dado/flooring/skirting shall be measured in sqm. correct to two places of decimal. Length and breadth shall be measured correct to 1 cm. between the exposed surfaces of skirting or dado. No deductions shall be made nor extra paid for any opening of area upto 0.1 sqm.

The rate shall include all the cost of labour and materials involved.

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7. MARBLE STONE FLOORING, TREADS, RISERS, SILLS, CLADDING, DADO ETC. :

MARBLE STONE SLABS :

The colour and quality of marble slabs shall be of the kind of marble specified in Schedule of item/drawings/as directed by the Engineer-in-charge. The marble from which the slabs are made, shall be of selected quality, hard, sound, dense and homogenous in texture, free from cracks, decay, weathering and flaws. Before starting the work, the contractor shall get the samples of marble slabs approved by the Engineer-in-charge. All slabs which goes into work shall strictly conform to the samples, failing which the entire materials are likely to be rejected.

The slabs shall be machine polished and machine cut to the dimensions specified in items of schedules of quantities/drawings and as directed by the Engineer-in-charge.

DRESSING OF SLABS :

Every stone shall be cut to the required size and shape, fine dressed on all sides to the full depth so that a straight edge laid along the side of the stone is full in contact with it. The top surface shall also be fine dressed to remove all waviness. The top surface of slabs shall be machine polished and exposed edges machine cut, or as specified in the Schedule of item and as directed by the Engineer-in-charge. All visible angles and edges of the slabs shall be true, square or as required, and free from chippings and the surface shall be true and plane.

The thickness of the slabs shall be 25 mm. or as specified in the description of item. The minimum size of stone to be used for various items shall be as mentioned in the schedule of quantities/drawings of this tender. Marble stones of approved smaller sizes other than mentioned in the schedule of quantities, if required for bands, borders, flooring etc. shall be provided and laid as directed by the Engineer-in-charge.

Any opening of required size and shape at any desired place in flooring, bands, borders etc. shall be made in such a way that marble bounded by number of marble stones/slabs. No broken or defaced stone shall be permitted in the work.

BEDDING/BACKING MORTAR :

The bedding/backing shall be of cement mortar/lime mortar of mix and thickness as specified in the description of the item.

Mixing : The mixing of mortar shall be done in mechanical mixer or hand mixing as specified/as directed by the Engineer-in-Charge.

a) **Mixing in Mechanical Mixer :** Cement and sand in the specified proportion shall be mixed dry thoroughly in a mixer. Water shall then be added gradually and wet mixing continued for at least one minute. Care shall be taken not to add more water than that which shall bring the mortar to the consistency of stiff paste.

Only the quantity of mortar, which can be used within 30 minutes of its mixing shall be prepared at a time.

Mixer shall be cleaned with water each time, before suspending the work.

b) **Hand Mixing :** If approved by Engineer-in-Charge, hand mixing shall be allowed. The measured quantity of sand shall be levelled Galvanised steel side closed tray / closed clean Plastered masonry platform and cement bags emptied on top. In hand mixing, the quantity of cement shall be increased by 5% over the approved constant, with no extra cost to the Department. The cement and sand shall be thoroughly mixed dry by being turned over and over, backwards and forwards, several times till the mixture gives an uniform colour. The quantity of dry mix which can be used within 30 minutes shall then be mixed with just sufficient quantity of water to bring the mortar to the consistency of stiff paste.

c) **General :** Mortar shall be used as soon as possible after mixing and before it has begun to set, and in any case within 30 minutes after the water is added to the dry mixture. Mortar unused for more than 30 minutes shall be rejected and removed from the site of work immediately.

LAYING - FLOORING :

Before laying the cement mortar bedding/backing, the concrete/brick, floor/wall surfaces shall be thoroughly hacked, cleaned of all mortar scales, concrete lumps etc., brushed, washed with water to remove mud, dirt etc. from the surface and shall be thoroughly wetted. Until and unless the surface is approved by the Engineer-in-Charge, the flooring shall not be started. A bedding of cement mortar of 20 mm. average thickness with the minimum thickness at any place on the slab not less than 13mm. shall be laid evenly and to the required slopes as directed. The marble slabs shall be thoroughly washed and cleaned and then be laid on the bedding/ backing with cement floating at the rate of 4.39 kg./sqm. All slabs shall be truly and evenly set in a thick cement slurry or paste like consistency applied to the sides and bottom and over the prepared base. The slabs shall then be tamped down with a wooden mallet until they are exactly in true plane and line with adjacent slabs. All slabs shall be extended upto the unplastered surface of masonry walls/RCC columns/RCC walls. The slabs shall be filled at joints with white cement mixed with Pigment (colour to match the colour of tile)& the extra filling shall be immediately

wiped clean. The grains of marble stone shall be matched as shown in drawing or as directed by the Engineer-in-Charge. All slabs shall be so laid as to have continuous lines from various rooms to the corridors. No change of lines shall be permitted at junction between rooms and corridor, if the same flooring is specified in both the places.

MARBLE SILLS, TREADS ETC. :

Marble stone for sills shall be of approved quality. Dressing of stone slab, mortar mix. for bedding/backing, laying etc. shall be similar to as described above as far as applicable. Marble slabs of specified thickness and width shall only be provided. The length of the each slab required for the sill shall be of the pattern which shall coincide with the lines of the mullions of windows where it is laid or as directed by the Engineer-in-Charge. Normally it shall not be less than 1.0 m. length.

MARBLE STONE DADO & CLADDING :

Only machine cut and machine polished marble stone will be used. Brass cramps and brass pins / if connection requires anchors with clips, brackets based on the cladding panel requirement of it shall be done as per Hilti or approved make shall be provided. The brass pins shall be provided at the meeting of two marble slabs both ways horizontally and vertically. The brass cramps shall be provided at the places approved by the Engineer-in-Charge. Marble to be used shall be of approved size, colour, type of veins and laid as specified in schedule of quantities or to the pattern shown in drawings or as directed by the Engineer-in-Charge. Laying of marble stone shall be similar as stated above as far as applicable. Fixing methodology shall be as per design requirement & work shall be done as per approved manufacturer's specification.

POLISHING AND FINISHING :

The polishing and finishing shall be carried out in the similar manner as specified under chapter "TERRAZZO / CEMENT TILES FLOORING, SKIRTING / DADO ETC." as far as it is applicable.

MEASUREMENT :

Marble stone flooring, sills, treads, risers, dado cladding etc. shall be measured in square metre correct to two places of decimal. The length and breadth shall be measured between the finished faces correct to two places of decimal of metre. No deduction shall be made nor extra paid for any opening of area upto 0.05 sqm. Nothing extra shall be paid for working at different levels.

NOTE : Wastage in marble slab cutting to get the required dimensions, as specified in drawing or as directed by the Engineer-in-Charge shall be deemed to be considered by the contractor while quoting the rate for work. The work shall be measured as above and no extra claim will be entertained on this account.

RATE :

The rate shall include the cost of all materials, transport tools, plants, scaffolding and labour involved in all operations described above.

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8. VITRIFIED TILE FLOORING, DADO / SKIRTING / FACIA :

MATERIALS :

Vitrified Tiles: The tiles shall be Fully Vitrified / Marbonite / Granamite/ Fully Polished Vitrified Tiles/ Double charged Vitrified Tiles of approved make like KAJARIA/SOMANY or equivalent and shall generally conform to the approved standards. They shall be flat and true to shape, free from cracks, crazing spots, chipped edges and corners. Unless otherwise specified, the nominal sizes of tiles shall be as under:

The tiles shall be square or rectangular of nominal sizes such as: 600 x 600 mm; 900 x 900 mm or as per tender schedule / drawings or as directed by the Engineer-in-Charge. Thickness shall be as per recommendations of the approved manufacturers. Anti Skid tiles shall be for Toilet areas as per Architectural drawings.

Technical specifications of the tiles shall be generally conforming to the following standards:

TECHNICAL SPECIFICATIONS FOR VITRIFIED TILES

NO	PROPERTY	EXPECTED
1	Deviation in length	(+/-) 0.6%
2	Straightness of sides	(+/-) 0.5%
3	Rectangularity	(+/-) 0.6%
4	Surface flatness	(+/-) 0.5%
5	Water absorption	< 0.50%
6	Mohs. hardness	> 6
7	Flexural strength	> 27 N / mm²
8	Abrasion resistance	< 204 mm²
9	Skid resistance (friction	> 0.4
10	Glossiness	Min. 85% reflection

The tiles shall conform to the relevant standards in all respects. Samples of tiles shall be got approved from the Engineer-in-charge before bulk procurement for incorporation in the work.

PREPARATION OF SURFACE FOR FLOORING: Following procedure shall be followed:

- **Sub grade** concrete or RCC slab or side brick wall / or plastered surfaces on which tiles are to be laid shall be cleaned, wetted and mopped as specified for terrazzo tile flooring.

- **Mortar and bedding:** Cement mortar for bedding shall be prepared of mix 1:4 or as specified in the schedule of items, to a consistent paste and shall conform to the specification for materials, preparations etc. as specified under cement mortar. The amount of water added while preparing mortar shall be the minimum

necessary to give sufficient plasticity for laying. Care shall be taken in preparation of the mortar to ensure that there are no hard lumps that would interfere with even bedding of the tiles. Before spreading the mortar bed the base shall be cleaned off all dirt, scum or laitance and loose materials and well wetted without forming any pools of water on the surface. The mortar of specified proportion and thickness shall then be evenly and smoothly spread over the base by use of screed battens to proper level or slope.

- Once the mix is prepared, no further water be added and the same shall be used within one hour of adding water. Apply on an average 20 mm thick bedding of mortar over an area of 1 sqm. at a time over surface of the area for laying tiles, in proper level and allowed to harden sufficiently to offer a fairly good cushion for the tiles to set..

LAYING OF TILES FOR FLOORING : The tiling work shall be done as per the pattern shown in the drawing or as directed by the Engineer-in-Charge. As a general practice laying of tiles shall be commenced from the along one side of the walls planning to have cut size tile only on other side or if design requirement then as per site requirement all as shown in the Architectural drawing. Cut tiles, if any, shall be laid along wall with necessary border pattern as shown / directed by the Engineer-in-Charge. Tiling work shall be completed by pressing tiles firmly into place along the wall / floor. Cement to the back of the tile to be applied to ensure proper and full bedding. The tiles shall be laid on the bedding mortar when it is still plastic but has become sufficiently stiff to offer a fairly firm cushion for the tiles. Tiles, which are fixed on the flooring adjoining the wall, shall be so arranged that the surface on the round edge tiles shall correspond to the skirting or dado. Press gently the tile with wooden mallet for even adherence at the back of the tile. Do not use an iron hammer or some heavy material to press the tile.

The edges of the tiles shall be smeared with neat white cement slurry and fixed in this grout one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints shall be kept as close as possible and in straight line. Unless otherwise specified, joint-less tiling shall be done butting the tiles with each other. If joint is specified, the same shall not exceed 1.00 mm. in width. The joint shall be grouted with white cement mixed with pigment matching colour of tile. After fixing the tiles, finally in an even plane or slope, the flooring shall be covered with wet sand/ POP and allowed undisturbed for 14 days.

FIXING TILES FOR DADO & SKIRTING / FACIA : : The fixing of tiles on wall surfaces shall be done only after completing fixing of the tiles on the floor. Following procedure shall be followed:

- The back of tiles shall be cleaned off and covered with layer of approved adhesive like ARDEX ENDURA or equivalent if specified in the drawing /specification /BOQ items all as required by EIC with proper trowelling as per manufacturers recommendations.

- The edges of the tiles shall be smeared with the adhesive and fixed on the wall one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly fixed in level with the adjoining tiles. There shall be no hollows on the back or in joints. Unless otherwise specified, joint-less tiling shall be done butting the tiles with each other. If joint is specified, the same shall not

exceed 1.00 mm. in width. The joint shall be grouted with approved adhesive. The joints shall be kept in straight line or as per the approved pattern.

- While fixing tiles in dado / skirting work, care shall be taken to break the joints vertically. The top line shall be touched up neatly with the rest of the plaster above. If doors, windows or other openings are located within the dado area, the corners, sills, jambs etc. shall be provided with true right angles without any specials. The contractor will not be entitled to any extra claims on this account for cutting of tiles if required.

- The fixing shall be done from bottom of wall to upward without any hollows in the bed of joints. Each tile shall be as close as possible to one adjoining. All tiles faces shall be in one vertical plane.

GROUTING OF JOINTS IN FLOOR / SKIRTING / DADO: The joints, if specified, shall be cleaned off and all dust and loose particles removed. Joints shall then be filled with approved adhesive like ARDEX ENDURA or equivalent grouts. After finishing the grouting process, after 15 minute, wipe off excess grout with a damp sponge and polish the tiles with a soft & dry cloth for a clean surface. The Finished work shall not sound hollow when tapped with a wooden mallet.

CLEANING : As directed by the Engineer-in-Charge, the tiles shall be cleaned by mild acid (However, Hydrofluoric acid and its derivatives should not be used). After the tiles have been laid in a room or the days fixing work is completed, the surplus cement grout / adhesive that may have come out of the joints shall be cleaned off before it sets. The dado / skirting shall be thoroughly cleaned. In the case of flooring, once the floor has set, the floor shall be carefully washed clean and dried. When drying, the floor shall be covered with oil free dry sawdust. It shall be removed only after completion of the construction work and just before the floor is used.

MODE OF MEASUREMENT AND RATE: Dado / flooring / skirting shall be measured in sqm correct to two places of decimal. Length and breadth shall be measured correct to 1 cm. between the exposed surfaces of skirting or dado. No deductions shall be made nor extra paid for any opening of area upto 0.1 sqm. The rate shall include all the cost of labour and materials involved.

CLEANING AGENTS FOR VITRIFIED TILES:: Vitrified tiles are resistant to all chemicals (except hydrofluoric acid and its derivatives), hence commercially available detergents and cleaning agents can also be used for regular maintenance. Any spills and stains must be removed immediately. If left dry they may leave stains, which may be difficult to remove completely.

CLEANING AGENTS FOR VITRIFIED TILES

STAINS	**CLEANING AGENT**
Robin Blue	Household detergent / Warm water
Marker ink	Turpentine / Acetone / Trichloroethylene
Pen ink	Acetone / Isopropyl alcohol
Methylene blue	Isopropyl alcohol / Acetone
Sauce	Ammonia solution
Cement	Turpentine / Acetone / Trichloroethylene /
Tea	Hydrochloric acid / Bleaching powder
Coffee	Sodium hydroxide / Potassium hydroxide

Beer Diesel	Sodium hydroxide / Potassium hydroxide Acetone / Petrol
Lab indicator Cement and grouting	Acetone / Isopropyl alcohol Hydrochloric acid
Pencil mark	Benzene or Toluene or Xylene
Plaster of Paris (POP)	Ammonium sulphate solution
Iodine (Tincture iodine)	Sodium hydroxide / Potassium hydroxide
Hair dye	Per chloric acid
Paan	Lemon juice or citric acid
Marker pen	Acetone

9. WOOD WORK IN FRAMES, SHUTTERS AND PANELLING :

WOOD WORK :

All timber mentioned in the item in schedule of quantities shall be from the heart of a sound tree of nature growth entirely free from sap wood. It shall be uniform in texture, straight in fiber and shall be well and properly seasoned. It will be free from large, loose, dead or cluster knots, wedges, injuries, open shakes, borer holes, rot, decay date, discoloration, soft or spongy spot, hollow pockets, pith or centre bore and all other defects or any other damages of harmful nature which will affect the strength, durability, appearance and its usefulness for the purpose for which it is required. Only properly seasoned timber shall be used.

TEAK WOOD:

First Class Teak Wood: Individual hard and sound knot shall not be more than 25mm in diameter and aggregate area of all knots shall not exceed one percent of the area of the piece. Sapwood shall not be allowed.

Second Class Teak Wood: Individual hard and sound knot shall not be more than 40 mm in diameter and aggregate area of all knots shall not exceed one and half percent of the area of the piece. Wood shall be generally free from sapwood, but traces of sapwood may be allowed.

HARD WOOD:

No individual hard and sound knot shall exceed 25mm in diameter and aggregate area of all knots shall not exceed one percent of the area of the piece. Sapwood is very perishable and should not be used.

The samples of species to be used shall be deposited by the contractor with the Engineer-in-Charge before commencement of the work. The contractor shall produce cash vouchers and certificate from standard kiln seasoning plant operator about the timber section to be used on the work having been kiln seasoned by them, failing which it would not be so accepted as kiln seasoned. Seasoning of timber shall be judged from its moisture content as laid down in I.S. 287. The seasoning of timber shall conform to I.S.1141 -1 993. Scantling of all types of timber shall be straight. Warped scantling shall not be used. Before use in works, the scantling shall be kept in covered and well-ventilated place and shall be got approved.

The workmanship shall be of best quality. All wrought timber is to be sawn, planed, drilled or otherwise machine worked to the correct sizes and shall be as indicated in

drawing or as specified. All joinery work shall fit truly and without wedging or filling. Wood work in frames shall be wrought. All frame joints shall be put together with white lead and pinned with hard wood pins securing with corrosion resistant star shaped metal pins as approved by the Engineer-in-charge. If after fixing in position, any shrinking or substandard materials or bad workmanship is detected, the contractor shall, forthwith remove them and replace the same at his own cost, all as directed by the Engineer-in-charge.

Individual members shall be of continuous length. The finished size and sections shall be as per drawing or as specified. The heads and posts of frames shall be through tennoned into the mortises to the full widths as shown in the drawing. All necessary mortising, tennoning, grooving, matching, tonguing, housing rebate and other necessary works for correct jointing shall be carried out, in the best workmanship like manner. Joints not specifically indicated shall be recognised form of approved joints for each position. The door frames shall be provided with 6 nos. approved iron hold fasts, fabricated out of 30 x 3 mm. section, 300 mm. long (150 mm. long for cross partitions) M.S. flats with spliced end in case they are abutting brick masonry works. These M.S. hold fasts shall be embedded in plain cement concrete 1:3:6 block of size 300 x 75 mm. depth (100 x 75 mm. for cross partitions) and for full width of brick masonry. For frames abutting concrete surfaces, 6 nos., 100 mm. long coach screws with sunk heads minimum 10 mm. from face of frames, shall be provided. Each screw shall be secured in concrete with lead wool sufficiently stuffed in the pre-drilled holes to receive the screws. Top member of door frames for opening exceeding 1.25 m. in width, shall be secured with a coach screw 100 mm. long in centre of member. All other T.W. scantlings shall be fixed to structural openings with wood screws of suitable size & rawl plug so as to get in effective hold of at least 40 mm. Suitable teak wood plugs shall be provided to conceal the screw heads. The door frame shall rest on concrete sub- base in ground floor or structural floor slab in case of upper floors, the extra length of sides of frames thus embedded below finished floors shall not be measured for payment. All parts of wood work resting on or set in masonry or concrete i.e side connected to masonry/concrete shall be well painted with two coats of bituminous paint or solignum (termite protection) as directed by the Engineer-in-charge, prior to installations . All nails, screws, hold fasts, plates, plugs, pins required for wood work joinery and fixing work, shall be provided by the contractor, at his own cost. All materials shall be approved by Engineer-in-charge before using in works. Painting of door frames shall be carried out as per specifications for painting for wood work.

All the embedded timber shall be given two coats of hot tar or solignum before erection. This is incidental to the item and shall not be measured for payment.

TEAK WOOD PANELLED SHUTTERS :

Teak wood door shutter shall generally conform to standard laid in I.S. for requirements of materials, construction workmanship and shall be of specified thickness and of 1st class C.P. teak wood of approved design with stiles, top, bottom and lock rail generally as per drawing. Wherever shown, each panel shall be in a single width piece, but when two or more pieces have to be used and are permitted, all of them shall be of equal width and shall be jointed with a tongue and groove joint with chamfered edges glued together and reinforced with metal dowels.

TEAK WOOD GLAZED SHUTTERS :

The specifications for teak wood panelled shutter shall generally apply to glazed shutters for frame, stiles etc.

The sash and beading required for glazing shall be of the best teak wood and shall be fixed as per the design shown in relevant drawing. Any mouldings, carvings shown shall be worked out from the teak wood member of bigger size.

GLAZING :

Glazing shall be generally with minimum 4 mm. thick plain sheet glass/bajra glass unless otherwise mentioned in the schedule of quantities. The detailed specifications for glazing given hereafter shall be followed generally.

FLUSH DOOR SHUTTERS :

Solid core flush door shutters shall be of 5 ply construction and approved make generally conforming to the I.S. specification 2202-1991 (specification for wooden flush door shutter- solid core type). The finished thickness of the shutter shall be as mentioned in the schedule of items.

FACE VENEERS :

Commercial face veneers used in flush door shutter shall conform to the requirements laid down in I.S. 303 -1989 specifications for ply wood for general purposes (revised) interior grade.

Decorative face veneers used in flush door shutters shall be of grade - I and shall conform to the requirements of decorative veneer specified for grade - I decorative ply wood in I.S. 1328 - 1982 specifications for veneered decorative ply wood interior grade. Thickness of veneers shall not exceed 1 mm.

ADHESIVES :

Phenol formaldehyde synthetic resin (liquid type adhesives) conforming to I.S. 848 specifications for synthetic resins shall be used for bonding.

LIPPING :

The lipping shall be of best quality hard wood variety unless otherwise mentioned. In case teak wood lipping is mentioned in the schedule of quantities, it shall conform the specification for best quality teak wood. The internal lipping alround the shutter sides shall be one piece of size not less than 25 mm. wide and depth equal to the thickness of core. In case of double leaf shutters, the meeting stiles shall have lipping of not less than 35 mm. deep. **Thickness of external lipping, wherever specified in the item, shall not be more than 10mm and not less than 6mm.**

WORKMANSHIP AND FINISH :

All the faces of the door shutter shall be at right angles. The shutter shall be free from twist and warp in its plane. Both faces of the door shutters shall be sanded to a smooth even texture. The workmanship and finish of the face panels shall be in conformity with those specified in I.S. 303 specification for plywood for general purpose (revised) for commercial type and I.S. 1659 specification for block boards.

TESTS :

Tests shall be conducted as per mandatory test requirement, by the Department at contractors cost and acceptance criteria shall be as per I.S. 2202. The flush door shutters manufactured shall be inspected for its quality and workmanship and tested at the factory before dispatching. All facilities shall be extended for such inspection and testing. The sampling and testing shall be as per the IS requirements and all costs towards test including sample for various tests shall be borne by the contractor.

TOLERANCE :

Tolerance on nominal width and height shall be (+/-) 3 mm. Tolerance on nominal thickness shall be (+/-) 1.5mm. The thickness of the individual shutter shall be uniform throughout.

MISCELLANEOUS :

Wherever mentioned in the Schedule of quantities, vision panels, venetians, plastic laminates, push plates etc. shall be provided in the flush doors.

The vision panels shall be of size mentioned in the drawing and shall be provided with teak wood lipping alround the glass. The glass shall be minimum 4 mm. thick or as specified of best quality (Saint Gobain /Asahi India Glass/ Gujarat Guardian - Modiguard or equivalent approved), free from defects.

Teak wood venetians or louvers shall generally conform to relevant specifications of timber. Necessary grooves and rebate in frames shall be provided as per drawing.

Formica or approved equivalent plastic laminate of required design, required shade and colour shall be provided and fixed on flush door to the required size on any side of the shutter as shown in drawing. It shall be fixed with appropriate water based adhesive for plastic laminate & wood joinery . Fixing shall be done in such a way that there shall not be any air gap, warpage or undulations on the surface. Finished surface of formica shall be cleaned with wax polish.

The shutters shall be painted on commercial facing side with two coats of synthetic/flat oil paint of approved shade and make over an approved coat of primer. The decorative veneer side of the shutter shall be wax or french polished with two or more coats so as to render a satisfactory surface.

The flush doors shall be single leaf or double leaf type as mentioned in the schedule of quantities. In case of double leaf shutters, the meeting of the stiles shall be rebated 20 mm. and shall be either splayed or square type and the T.W. lipping around the meeting shall not be less than 35 mm. deep. The meeting stiles shall be in single piece.

Sufficient care shall be taken to prevent any damage and loss of shape during handling, transporting, stacking, fixing etc. The door shutters shall be handled with utmost care to prevent any surface damage, warping etc.

MODE OF MEASUREMENT :

The work covered under the respective items in schedule and the above specifications shall be measured as follows :

The cubic contents for wood work shall be measured for the finished size, limiting to those shown in the drawings or ordered by the Engineer-in-charge. The cross sectional dimensions shall be measured equivalent to nearest enclosing rectangle (least rectangle/square) for wrought and planed sizes. The cubical content shall be worked out correct upto three places of decimals of a cubic metre. The frames embedded below finished floor shall not be measured.

The square meter areas for shutters shall be measured for the exposed surfaces of shutter between frames from inside or outside whichever is more. The linear dimensions shall be measured upto two places of decimals of a metre. The area for payment shall be worked out correct upto two places of decimals of a square metre. The rate for shutters shall include:

i. Cost of supply assembly and erecting in position.

ii. Cost of polishing, painting, supplying wood preservative, screws, nails, hold fasts etc.

iii. Cost of labour for making adjustments in frames, if required, shutters and also for fixing required fittings and fixtures.

iv. In case of flush doors, the rate for individual item mentioned in the schedule of quantities shall include cost of shutters, labour for provision of glass for vision panel, plastic laminate sheet push plate, teak wood louvers etc., transporting charges and labour for fixing of fixtures and fastenings except fixing of door closers and painting and polishing as specified.

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23 10. FACTORY MADE PARTICLES BOARD PANELLED DOOR SHUTTERS/BLOCK BOARD SHUTTERS / MOULDED SKIN PANEL SHUTTER

GENERAL : Factory made particle board paneled door shutters shall be made of kiln seasoned and chemically treated timber as specified generally with stiles and top rails of 100 mm. in width, bottom rail and lock rails of 150/1 75 mm. width and panels made of 12 mm. thick both side commercial veneered teak wood particle board or as specified in schedule of quantities, bonded with phenol formaldehyde synthetic resin adhesive and generally conforming to I.S. 3091.

Factory made shutters, as specified shall be obtained from factories to be approved by the Engineer-in-Charge and shall conform to I.S. 2202 (Part-I)) & PART II. The contractor shall inform well in advance to the Engineer-in-Charge the name and address of the factory where from the contractor intends to get the shutters manufactured. The contractor will place order for manufacture of shutters only after written approval of the Engineer-in-Charge in this regard is given. The contractor is bound to abide by the decision of the Engineer-in-Charge and recommend the name of another factory from the approved list, in case the factory already proposed by the contractor is not found competent to manufacture quality shutters.

The contractor will also arrange stage-wise inspection of the shutters at factory of the Engineer-in-Charge or his authorized representative. Contractor will have no claim if the shutters brought at site are rejected by Engineer-in-Charge in part or in

full lot due to bad workmanship/quality. Such shutters will not be measured and paid and the contractor shall remove the same from the site of the work within seven days after the written instructions in this regard are issued by Engineer-in-Charge or his authorized representative.

Flush doors can be easily installed with minimum efforts made out of high quality wood with excellent tooling and finishing properties, the doors are made with chemically treated seasoned hardwood battens and frames.

The cross bands veneers are uniformly dried to the requisite moisture content, bonded with special quality Phenol formaldehyde synthetic resin as per the guidelines of IS:2202. Flush Doors are treated for total termite and borer protection.

- Manufactured with selected and high quality hard wood timber.
- Timbers used to manufacture Doors to be treated with anti-termite borer chemical before sawing.
- Frames and battens to be seasoned in advance seasoning chamber for equalize the moisture content.
- All the frames and battens to be cut through ripsaw machine and planer for equal size and thickness.
- The width of battens and frames should be wider as per the specification of BIS.
- Extra lock rail is provided for the convenience of handle and lock fittings.
- Special care is to be taken during the assembly of battens to avoid any gap inside the door.
- High solid content water proof PF Resin to be used for high strength.
- Doors are conditioned before cutting to avoid the warping and twisting.
- Doors are finished with highly precised wide belt sander.
- All doors are strictly tested as per the BIS guidelines.
- Door thicknesses of 30/ 32/ 35 mm.

Skin door by laminating two pieces of molded door skins over it. Honeycombs as well as solid timber strips infill are used to fill up the hollow core between the door skins for strength and stability; door skins are to be made of high quality HDF.

Resin coated finish doors for wet areas.

MOULDEN SKIN PANEL DOOR SHUTTERS
Skins used on the door as face panel are very high density wood fiber skins, source skins are 100% environment friendly & are manufactured by using 100% wood fiber & E1 glue ; seasoned & dried hardwood internal framing (Rail & stile) is used with choice of internal core construction (solid or Best quality Alternative Green Tubular Core). These doors are thermosetting resin bonded, hydraulic hot pressed. Door shutter in 2/3 /4 /6 number of Panels.

Hard wood Door frame shall be Kiln Dried, Seasoned, Chemically Treated & Finger Jointed (FT) - For better stability & strength

TIMBER :

The timber to be used in door shutters shall generally conform to relevant I.S. specifications for materials, moisture content, seasoning, preservation and workmanship.

All timber shall be from the heart of a sound tree of mature growth, entirely free from sapwood. It shall be uniform in texture, straight in fiber and shall be well and properly seasoned. It shall be free from large, loose, dead or cluster knots, soft or spongy spots, hollow pockets, pith or centre heart, waves, injurious open shakes, borer holes, rot, decay date, discoloration and all other defects or any other damages of harmful nature which will affect the strength, durability, appearance of its usefulness for the purpose for which it is required.

PARTICLE BOARD PANELS :

It shall be of well-seasoned teak timber particles of uniform thickness, bonded with liquid phenol formaldehyde synthetic resin adhesive of the hot press type. The particle board shall be either flat plate on press or extrusion type as approved by the Department conforming to the latest I.S. specifications. Panels shall be embedded into frames to a minimum of 12 mm. with 1.5 mm. air gaps.

SEASONING AND TREATMENT :

All timber to be used for sills and rails shall be kiln seasoned to the required standards as per I.S. 1141 -1 973.

ADHESIVE :

The adhesive for bonding of stiles, rails etc. shall be of highly water resistant type synthetic resins (liquid type) adhesive conforming to relevant specifications for synthetic resins.

WORKMANSHIP AND FINISH :

The workmanship shall be done by experienced first class skilled Carpenters. All members shall be in continues length. All the faces of the door shutter shall be secured and in true planes. All wrought timber is to be sawn, planed, drilled or otherwise moulded work to the correct size and shapes indicated in drawing or as specified. All joinery work shall fit truly and without wedging or filling. All the faces of the shutters shall be sanded to smooth even texture. The finished sizes and sections shall be as per drawing or as specified. The shutters shall be got approved from the Engineer-in-Charge at factory site before carting the same to the site of work. The shutters damaged during the cartage and if any sub-standard materials or bad workmanship is detected, the contractor, shall forthwith remove them and replace the same at his own cost, all as directed by the Engineer-in-charge.

PRIMER COAT :

All factory made panel door shutters with seasoned teak wood/hard wood frame shall be painted with approved Primer coat as per I.S. specifications 1003 (Part-I).

TESTS :

Tests shall be conducted as per mandatory test requirement by the Department at the contractors cost. All shutters shall have manufacturer's trade marks.

TOLERANCES :

Tolerances on nominal width and height shall be (+/-) 3 mm. Tolerance on nominal thickness shall be (+/-) 1 .5 mm. The thickness of the shutter frame shall be uniform through out with a variation not exceeding 1 mm., when measured at two points.

SAMPLES :

Sample of door shutter shall be got approved before manufacturing on large scale.

FIXING:

The shutter shall be fixed to teak wood or rolled M.S./EZ door frame (teak wood/rolled steel in door frames paid under relevant items) with necessary fittings as per drawing (cost of fittings and fixtures paid under relevant items). The shutter shall be painted as specified. The shutters of specified thickness and of required sizes as fixed in position as shown in drawing/schedule of quantities shall be measured for payment. The length and width of

the shutter fixed in position shall be measured correct upto three places of decimal of a metre and the areas so worked out shall be corrected upto two places of decimal of a square metre. The area of the shutter shall be measured for the exposed surfaces of shutter between frames from inside or outside whichever is more.

RATE TO INCLUDE :

The rate quoted by the contractor shall be :

i) or supplying and fixing in position of finished shutters with necessary fittings and fixtures as per drawings (excluding cost of fittings and fixtures which shall be paid under relevant items).

ii) painting/polishing as specified and as directed by the Engineer-in-charge.

*** * * ***

11. FITTINGS AND FIXTURES:

SCOPE OF WORK :

The work covered under these specifications consist of supplying different types of fittings and fixtures required for doors, windows, ventilators etc. The supply shall be in accordance with the specification, drawings / approved samples. Samples of various fittings and fixtures proposed to be incorporated in the work shall be submitted by the contractor for approval of the Engineer-in-charge before order for bulk supply is placed.

GENERAL :

All fittings and fixtures shall conform to relevant IS code and made of brass, nodized aluminium, iron oxidised (M.S.) or as specified. These shall be well made reasonably smooth and free from sharp edges, corners, flaws and other defects. Screw holes shall be counter sunk to suit the heads of the specified screws. All hinges pins shall be of steel for brass hinges and aluminium alloy NR-6 or steel pins for aluminium hinges with nylon washers or as specified. All riveted heads pertaining to hinge pins shall be well formed. Screws supplied for fittings shall be of the same

metal and finish as the fittings. However brass cadmium plated/chromium plated screws shall be supplied with aluminium fittings. Samples of each fixture/ fitting shall be furnished by the contractor for approval of the Engineer-in-Charge. Order for procurement of fittings and fixtures in bulk shall be placed only after approval by the Engineer-in-Charge.

The fittings and fixtures to be incorporated in the work shall be strictly according to the approved sample. Fittings shall be fixed in proper position as shown in the drawing and as directed by the Engineer-in-Charge. These shall be truly vertical or horizontal as the case may be. Screws shall be driven home with a screwdriver and not hammered in. Recess shall be cut to the exact size and depth for the counter sinking of hinges. The fittings and fixtures shall be fixed in a workman like manner and any damages done either to fittings and fixtures or to the shutter frames etc. should be rectified by the contractor at his own cost.

Fittings shall be of Mild steel, Stainless steel, aluminium, brass or as specified. The fittings shall be well made, smooth, and free from sharp edges and corners, flaws and other defects.

Mild steel fittings shall be bright satin finish black stone anodized or copper oxidized (black finish), nickel chromium plated or as specified.

Brass fittings shall be finished bright satin finish or nickel chromium plated or copper oxidized or as specified.

Aluminium fittings shall be anodized to natural matt finish or dyed anodic coating less than grade AC 10 of IS: 1868

Stainless steel fittings shall be non-magnetic, rust & moisture proof, strong & sturdy. Pin of hinges shall also be of stainless steel.

BUTT HINGES: Brass and aluminium hinges shall be manufactured from the extruded sections and shall be free from cracks and other defects. M.S. butt hinges shall be cranked and manufactured from M.S. sheets. All butt hinges shall conform to latest I.S. specifications butt hinges shall generally conform to relevant I.S viz IS 1341 (M.S.) IS : 205 (Cast brass & aluminium, IS : 362 (Parliament hinges); IS : 453 spring hinges, IS : 3818 (Piano hinges) etc. The size of butt hinges shall be taken as the length of the hinge. Width of the hinge shall be measured from the centre line of hinge pin to end of flange.

PARLIAMENTARY HINGES: These shall be manufactured from extruded section for brass and aluminium and from M.S. sheets for iron oxidized and shall be free from cracks and other defects. The size of the parliamentary hinges shall be taken as the width between open flanges, while the depth shall be as specified.

PIANO HINGES :

These shall be generally conformed to I.S. 3818 and shall be made of either brass oxidized, aluminium anodized, iron oxidized (M.S.) or as specified. Piano hinges shall be fixed in the entire length of the cupboard shutters in a single piece. No joints shall be allowed.

TOWER BOLTS : These shall generally conform to IS 204 (Part II & I). They shall be well made and shall be free from defects.

The tower bolts shall be of the following types :

i. MS semi barrel tower bolt with ms sheet pressed barrel and G.I. bolt or with ms barrel and ms Sheet bolt.

ii. Oxidized brass barrel tower bolt with brass sheet barrel and rolled or drawn brass bolt.

iii. Anodised aluminium tower bolt with barrel and bolt of extruded sections of aluminium alloy.

In case of M.S. tower bolt plates and straps after assembly shall be firmly anodized or spot welded properly.

The knobs of brass tower bolts shall be cast and the bolt fixed into the knob firmly as per I.S. specifications. The tower bolt shall be finished to correct shape and pattern so as to have a smooth action. Wherever specified, aluminium barrel tower bolts shall be manufactured from extruded sections of barrel & bolts.

Knobs shall be properly screwed to the bolt and riveted at the back. The size of the tower bolt shall be taken as the length of barrel without top socket.

Door Latch :

This shall be of MS, cast brass or as specified shall have smooth sliding action. MS Latch shall be copper oxidized (black finish) or as specified. Brass Latch shall be finished bright, CP or oxidized or as specified

ALDROPS :

These shall be oxidized brass or anodized aluminium, iron oxidized or as specified and shall be capable of smooth sliding action and shall be as per relevant I.S. Brass sliding door bolt (aldrop) shall be made from rolled brass generally confirming to IS : 2681. M.S. sliding door bolt shall generally conform to I.S.281. The hasp shall be of cast brass and screwed to the bolt in a workman like manner. Alternatively the hasp and the bolt may be in one piece. Bolts shall be finished to shape and threaded with worth standard and provided with round brass washers and nuts of square or hexagonal shape. All components shall be smooth and polished. The leading dimensions of aldrop shall be as the length of the bolt and specified diameter.

12. DOOR HANDLES- BOW/PLATE HANDLES :

These should generally conform to IS : 208. Unless otherwise specified door handles shall be of 100 mm size & windows handles of 75 mm size. These shall be of cast brass of specified size, shape and pattern as approved by the Engineer-in-charge. All edges and corners shall be finished smooth and correct to shape and dimensions. Brass handles shall be finished bright, chromium plated or oxidized as specified. Anodized aluminium or iron oxidized (m.s.) handles shall be of specified size, shape and pattern. The size of the handle is taken as the inside grip of the handle. In case of iron oxidized handles, the same shall be manufactured from m.s. sheet pressed into oval section as per I.S.

13. MORTISE LOCK & LATCH :

This should generally conform to I.S. 2209. Handles shall conform to IS 4992.

Mortise lock with latches and a pair of level handles shall be 6 levers, with zinc alloy pressure die cast/brass or as specified body of approved quality, and shall be right or left handed as specified. The pair of handles shall be either brass chromium plated or anodized aluminium of approved shape and pattern or as specified. It shall be of the best Indian make of approved quality. The size of the lock shall be determined by its length. The lock for single leaf door shall have plain face and that for double leaf door a rebated face. Level handles with springs shall be mounted on plates and shall be of approved quality, anodized aluminium or as specified.

14. HYDRAULIC DOOR CLOSER :

This shall be generally conform to IS : 3564. Hydraulic door closer shall be of approved quality and make. The operation of the Hydraulic door closer shall be very smooth.

This should be of H.D.-66 for external/main doors and elegant - 63 for all internal doors. The overall height should not be more than 170 mm. for H.D.-66 and 160 mm. for elegant - 63, base shall be 110 x 60 mm. for H.D.-66 and 100 x 55 mm. for elegant - 63 weighing not less than 4.5 kg. for H.D.-66 and 4 Kg. for elegant - 63. Speed of the Hydraulic door closer shall be adjustable and latch closing also shall be adjustable type. Suspension and lubrication of door closer shall be in perfect line and level.

The contractor shall provide for all the incidentals required for fixing these fixtures and fittings such as cadmium plated screws etc. Fittings and fixtures shall be fixed securely in a workman like manner all as directed by the Engineer-in-charge. Any of the fixtures damaged during the fixing shall be removed and new one fixed in their place and the surface of joinery made good where affected, at his own expense. Mortise plates shall be used over holes where the bolts enter in the wood work. Metal sockets shall be provided to all bolts where the shoot enter brick, stone, concrete etc. The incidental Fixtures like mortise plates, metal sockets, screws etc. shall not be paid for separately.

15. MORTICE NIGHT LATCH : This is a mortice lock having a single spring bolt withdrawn from the outside by using the key and from inside by turning the knob and with an arrangement whereby the lock can be prevented from being opened by its key from outside while the night latch is used from inside the room.

This should generally conform to IS: 3847. It shall be cast or sheet brass, cast or sheet aluminium alloy or mild steel as specified and of approved make. These shall be bright finished or copper oxidized (black) finish as specified. Normal size of the latch shall be denoted by the length of the face over the body in millimetres.

16. FLOOR DOOR STOPPER: The floor door stopper shall conform to IS: 1823. This shall be made of cast brass of overall size as specified and shall have rubber cushion. The shape and pattern of stopper shall be approved by the Engineer-in-Charge. It shall be of brass finished bright, chromium plated or oxidized or as specified. The size of door stopper shall be determined by the length of its plate. The body of the door stopper shall be cast in one piece. All parts of the door stopper shall be of good workmanship and finish and free from surface and casting defects. Aluminium stopper shall have anodic coating of not less than grade AC-10 of IS 1868.

MODE OF MEASUREMENT AND RATE : Unless otherwise specified, all fittings including all necessary accessories shall be measured in numbers and the rate shall include the cost of all materials including taxes, octroi, excise duty, if any, loading, unloading, transporting, cost of screws, bolts and other accessories and fixing the same complete.

* * * *

17. GLASS AND GLAZING :

SCOPE OF WORK :

The work covered by this specification include furnishing and fixing the glass panes to teak wood or steel doors and windows, strictly in accordance with these specifications and drawings.

MATERIALS :

i) **Glass :** The glass shall be special selected / selected ordinary quantity glass of M/s. Saint gobain/ASAHI. or of equivalent manufacture, as specified. Toughened float glass of approved manufacturer shall be used wherever specified. The glass shall be free from bubbles, flaws specks, waves, air holes, distortion, scratches, cracks or other defects. The glasses in bulk quantities shall be brought to site in Makers original packings and Makers guarantee shall be produced if called for by the Engineer-in-charge. The glass shall be of required thickness as mentioned in the items of schedule of quantities and/or drawing or as directed by the Engineer-in-charge. The contractor shall submit the sample of the glass which he proposes to use on the work and only such approved quality of glass shall be used in the works. The glass brought to site shall be protected against damages. Wherever frosted (obscure) glass is mentioned in the item of schedule of quantities and / or shown in drawings, the glass shall be of sand blown pattern (Sand blasted)and shall also be got approved from the Engineer-in-charge.

ii) **Beading :** The beading shall be of teak wood of superior quality timber in case of teak wood doors and windows and/or required sizes mentioned in the items of schedule of quantities and/or shown in drawing. In case of steel / Aluminium doors and windows, the beading shall be anodized aluminium beading of channel section as per sizes mentioned in the item and / or shown in the drawing. The junction of the beadings shall be mitre jointed.

iii) **Dimensions, Thickness and weight of the glass:** Unless otherwise specified, these shall be as per table given below. All panes shall have properly squared corner and straight edges

Normal	**Range of**	**Weight in kg /**
3.0 mm	2.8 to 3.2 mm	07.5
4.0 mm	3.8 to 4.2 mm	10.0
4.8 mm	4.6 to 5.1 mm	11.9
5.5 mm	5.2 to 5.8 mm	13.5
6.3 mm	6.0 to 6.6	15.5

WORKMANSHIP :

The glass shall be cut to the required sizes of panels where it is to be fitted, and it shall be so cut that it fits properly in the frames without rattling. Pre-measurement of each panel prior to the cutting of glass is essential.

The beading shall then be fixed to glass panes and screwed at close intervals not more than 10 cm. from each corner and the intermediate not more than 20 cm. apart. When the glass panes are fixed with aluminium beading having mitred joints, epoxy resin or silicon sealant shall be applied covering the area in contact between the glass panes and sash bars and also between glass panes and the beading. In case of louvers, all the exposed edges of the glass shall be ground properly.

All glass panes shall be fixed within the aluminium framing by use of CP brass or SS screws and the joints sealed with epoxy resin or silicon sealant to make the unit completely waterproof. Glazing or caulking compound around the perimeter of glass shall not be permitted. Fixed glass panes shall be supported by setting blocks. There shall be no whistling or rattling.

GENERAL :

After the inspection is over and permitted by the Engineer-in-charge, glass panes shall be cleaned off any labels, paints smears and spots and shall be washed from both the sides and all glazing left clear, perfect and free from rattling. The contractor shall provide all the scaffolding, tools and plants for fixing the glass panes at his own cost. In case of steel windows, any hardware if fixed in position, shall be removed temporarily before fixing the glass panes and which shall be re-fixed back in position, all at the contractors cost.

MODE OF MEASUREMENT :

The rate for teak wood door/window shutters and/or steel door/window shall normally cover the cost of glass and glazing also, unless otherwise mentioned. In case the glazing is carried out as a separate item, the measurement shall be taken out to cut size of teak wood/steel door/window frames forming the sides of glass panes and area calculated to two places of decimal of a square meter.

The rate shall include the cost of supplying and fixing the glass panes, all materials, labour, transport, scaffolding etc.

Glazing with patch fitting :

SS 316 brush finished patch fittings of approved make
6 + 6 mm thick sandwiched PVB glued, laminated glass or toughened glass as per design and details.
Glass partition shall be complete with all stainless steel cappings and clamping or fixing devices, resilient pads and separators, as well as closures, gaskets and sealants as required for a complete installation in strict accordance with the manufacturers' specifications.
All exposed metal fittings shall be manufactured from type 316 stainless steel, finish to match approved samples.
All openings/ doors shall be provided with operating hardware, floor spring, patch fittings, locks and as per details and requirements.

Mode of measurement :

The rate for teak wood door / window shutters and / or steel door / patch fittings shall normally cover the cost of glass and glazing also, unless otherwise mentioned and area calculated to two places of decimal of a square meter.

The rate shall include the cost of supplying and fixing the glass panes, all materials, labour, transport, scaffolding , hardware etc.

Guarantee:
All materials and workmanship in above work shall be guaranteed for a period of one year (unless otherwise specified) from the date of handing over. Unqualified performance guarantee for smooth operation of the windows, doors, wall spans and precautionary measures against leakages etc. shall be furnished by the contractor on stamped paper. If so specified, in schedule of quantities. Any defect found during the guarantee period shall be replaced / made good to the original conditions / positions entirely at the cost of the contractor.

* * *

18. ALUMINIUM WINDOWS, VENTILATORS, COMPOSITE UNIT ETC. :

SCOPE OF WORK :

The scope of work in the tender item includes fabrication, supply and installation of white anodized matt finished aluminium windows, ventilators, composite units, glazing etc. strictly in accordance with these specifications and relevant detailed approved shop drawings.

GENERAL :

The material, fabrication and hardware shall conform to IS 1948 & 1949. The contractor shall submit six copies of shop drawings covering all types/details of work as generally shown in Architectural drawing and envisaged under these specifications before manufacture. The drawing shall show all dimensions, details of construction, installation, fixtures and relation to adjoining and related works. No fabrication work shall be under- taken prior to the approval of the shop drgs. from the Engineer-in-Charge. The tenderer shall intimate at the time of tendering, the types of sections he proposes to use on the works.

MATERIALS :

The aluminium alloy used in the manufacture for extruded window section shall correspond to I.S. 733 (or any further revision thereof). Extruded sections shall conform to I.S. designation HE9-WP and Hollow sections shall conform to I.S. Designation HV9-WP. The frame work, stiles, mullions, beadings, transoms, hinges, pegstays, handles etc. shall be of aluminium anodized sections as shown in the detailed drawings. All sections and hardware shall have minimum anodic film thickness of 0.015 mm. All sections shall be of JINDAL/HINDALCO or other equivalent make as per drg. The contractor can also propose nearest alternative sections they manufacture/posses without changing the elevations and functional requirements. Department reserves the right to accept the alternative sections or otherwise. The sections shall be structurally suitable to withstand all the load, the members have to sustain. Countersunk screws, nuts, bolts, washers, rivets and

other miscellaneous fastening devices shall be of approved cadmium plated or stainless steel as specified in the approved drawings.

FABRICATION :

The frames shall be manufactured square and flat. The corners of the frames shall be fabricated to true right angles. All the fixed, sliding, openable frames shall be constructed from sections which have been cut to length, mitred and mechanically jointed or welded at the corners. Where hollow sections are used with welded joints, argon arc welding or flash butt welding shall be employed (Gas welding or brazing not to be done). Sub-dividing bars of units shall be tennoned and rivetted into the frames. In case welded joints are used, all welding shall be on unexposed sides in order to prevent pitting, discolouration and other surface imperfections after finishing. The dimensions shown in the drawing are overall heights and widths to the outside of frames of aluminium windows. The side hung shutters shall have projected friction type hinges of aluminium alloy. Concealed projected hinges having structural stability and of good quality will also be considered only after the inspection of the sample submitted by the tenderer. The necessary pegstays, handles, window fasteners etc. shall be of aluminium. The handle shall be mounted on a handle plate rivetted to the opening frame. The pegstays shall be 300 mm. long or as required complete with peg and locking bracket and shall have holes for keeping the shutter open in three different positions. No field fabrication of frames is permitted. The complete fabricated assembly shall be anodized in approved satin finish with minimum film thickness of 0.0 15 mm. for the entire surface. A thick layer of clear transparent lacquer based on methacrylate or cellulose butyrate shall be applied on the finished sections of the aluminium windows etc. by the supplier to protect the surfaces from wet cement, lime, dirt, dust etc. during the installation. This lacquer coating shall be removed after installation is complete, if approved by the Engineer-in-Charge and all sections of the windows shall be protected by P.V.C. film covering.

HARDWARE :

All cut outs, recesses, mortising or milling and operations required for fixing the hardware shall be accurately made, reinforced with packing plate as required to ensure adequate strength of the connection. All the hardware, accessories shall be of best approved type and of anodized finish same as for the frame and other sections. All hardware shall be free from defects which may affect the appearance and serviceability. All hardware shall be fixed after obtaining the prior approval of the Engineer-in-Charge. Approved samples of hardware shall be kept in the custody of Engineer-in-Charge.

FIXING :

The window frames shall be accurately fixed in the brick masonry or R.C.C. work. The fixing of the frame shall be done with cadmium plated brass counter sunk screws driven on the teak wood rough grounds if required or fixed to the wall with holdfasts. All aluminium windows shall be fixed in position as per I.S. 1081 (or any revision thereof): Code of practice for fixing and glazing of aluminium windows. All joints between metal and masonry/rough ground wooden frame shall be fully caulked with mastic / Non shrink cementitious filler / Acrylic Latex caulk / One pack elastomeric siliconised acrylic sealant /One-part, low modulus neutral cure silicone sealant /Polyurethane foam Sika boom of Sika make or approved equivalent /Low

modulus Acetoxy silicone sealant / polysulphide compound (only at location specified in the drawing/ as required by E.I.C.) in order to ensure water tightness/insulation joints as directed by the Engineer-in-Charge. Joints shall be neatly painted with matching cement and excess materials shall be removed. Hardware shall be fixed in workman like manner all as directed by the Engineer-in-Charge.

SAMPLES :

The samples of different windows shall be submitted to the Engineer-in-charge, for approval.

GLAZING :

The glazing shall be of Indian make plain sheet/frosted figured glass of special selected quality and size as mentioned in item description and drawings and shall be of M/S. Saint gobain/ASAHI. or other approved equivalent. The specifications specified here-in-before shall hold good as far as applicable.

MODE OF MEASUREMENT :

Similar to as described under chapter "Aluminium Windows, Ventilators, Composite Unit Etc."

GUARANTEE :

All materials and workmanship in above work shall be guaranteed for a period of one year (unless otherwise specified) from the date of handing over the work. Unqualified performance guarantee for smooth operation of the windows, doors, wall spans and precautionary measures against leakages etc. shall be furnished by the contractor on stamped paper, if so specified in schedule of quantities. Any defect found during the guarantee period shall be replaced/made good to the original conditions/positions entirely at the cost of the contractor.

TESTING :

All windows shall be tested for water tightness. Any leakage found during testing shall be rectified by the contractor without any extra charge.

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19. CEMENT PLASTERING FOR WALLS & CEILINGS AND SAND FACE / ROUGH CAST PLASTERS :

SCOPE OF WORK :

The work covered under these specifications consists of supplying all materials and rendering all types of plaster/pointing finishes strictly in accordance with these specifications, applicable drawings etc. For all finishing works mentioned above, only blended cement shall be a used.

GENERAL :

Blended cement, sand and water required for the work shall conform to specifications laid down herein before under chapter 4 i.e. Plain and reinforced

cement concrete, except that sand for finishing coat shall be fine sand conforming to I.S. 1542. The plastering works shall generally conform to I.S. 1661 (Code of practice for cement and cement plaster finish on walls and ceilings). All general precautions as specified in I.S. 1661 (Pt. III) clause-8, shall be taken and preparation of the back ground shall be done as laid down in I.S. 1661 clause 12 and I.S. 2402 shall be generally followed for rough cast and sand faced plaster work. Scaffolding required for facility of working shall be provided by the contractor at his own cost. This may be double or single according to the requirement and shall be approved by the Engineer-in-Charge. Stage scaffolding shall be erected when ceiling plastering is done. The contractor shall be responsible for accidents, if any, take place. The contractor shall co-operate with the other agencies also. Whenever electrical contractor/agency has to fix up switch boxes in walls, necessary Thiyyas, Tapanish or Dhadas shall be arranged to be given in advance of actual plastering process at these locations so that the boxes are fixed properly in line with finished plaster surface. All finishing in and around these boxes as also around the conduit boxes in ceiling shall be done by plastering contractor without any extra cost to the Department. The decision of the Engineer-in-Charge in this regard shall be final and binding on the contractor. NO DRY CEMENT TO BE USED WHILE PLASTERING IT SHOULD BE IN MIXED STAGE. **Portland Pozzolana cement (Fly Ash) shall be used for Plastering**.

PREPARATION OF SURFACE :

The surface to be plastered shall first be thoroughly cleaned of all muck and cleaned down. All joints shall be raked out in case of brick work / stone masonry and closely hacked in case of concrete, **under the relevant masonry / concrete items. The plastering to be done on concrete surface shall be only be done on rough hacked (tacha) finished surface.** The surface to be plastered shall be well wetted for a minimum period of 6 hours before commencing the work. The mortar for all plaster work shall be blended cement mortar of mix as specified in the schedule of quantities.

After erection of scaffolding and before commencement of plastering work, top most junctions/joints/sides with beam/column shall be thoroughly packed with blended cement mortar to prevent cracks.

Before commencement of plastering operation, the contractor shall ensure that all the service pipes(concealed lines with plumbing/ electrical) electrical conduits, boxes, switch boxes etc. have been installed in position by other agencies and the plastering surface is duly approved by the Engineer-in-Charge. In order to enable other service contractors to fix the electrical conduits, conduit boxes, EDBs, pipes, outlets etc. in proper level and line with reference to the finished surface of the plaster, Thiyyas and Tapanis i.e. finished plaster patches shall be given by the main civil contractor on walls, ceiling at regular intervals well in advance of his plaster work at no extra cost to the Department. The entire work of preparation of surface before plastering shall thus be co-ordinated by the main civil contractor with all other agencies working at site.

Just before actual plastering work is taken up in hand, all the ceilings and walls etc. shall be marked with Tapanis or Thiyyas indicating the thickness of plaster required and which shall be in true line, level and plumb. The contractor shall get these marks approved by the Engineer-in-Charge before starting the plastering work. The

contractor shall also be responsible to render the final surface true to line, level and plumb etc.

All building operations like construction of walls, concreting etc. shall have been completed before plastering is taken up. The plastering operation should be taken up only after the service pipes etc. that are to be embedded in the wall or ceiling are completed and suitably protected against erosion by other agencies and okayed by the Engineer-in-charge. Damage if caused to any of the existing fittings, fixtures, including doors and windows etc. during the plastering operation shall be made good by the contractor at his own cost.

If the surface which is to be plastered either internally or externally is out of plumb and not in line and level and if the plastering to be done is more than specified thickness to bring the plastered surface to perfect line and levels, in such specific cases, chicken wire mesh is to be provided by the contractor at his own cost and the plaster should be done to required line and level with no extra cost whatsoever.

The finished plastered surface shall be free from cracks, fissures, crevices, hair cracks, blisterings, local swellings and flakings. The finished surface shall be true to line, level, plumb & plain and durable. The adhesion of the mortar with the background surface is of prime importance as this affects durability of plaster. Preparation of surface which has to take plastering is of great importance. Before starting the plastering work the surface should be got approved by the Engineer-in-charge.

In order to avoid the formation of deep and side cracks and for dispersion of cracks at the junctions between concrete surfaces and brick masonry work as also between junction of windows/door frames and brick masonry works, cautionary measures such as fastening and lapping of chicken mesh/ fibre Glass mesh over the junction areas should be carried out over which the plastering work has to be taken up as required by the Engineer-in-charge.

The minute gap between window/door frames with cills and jambs should be filled up/caulked by silicone sealants /Acrylic Latex caulk by caulking guns or by approved methods as instructed/approved by Engineer-in-Charge.

GROOVES :

The grooves shall be of required dimensions. The same shall be made to turn wherever necessary. The finish, inside, shall be of the same finish as that of the plaster. The lines of the grooves shall be well defined and rounded. The grooves are to be provided in plastering in internal and external surfaces. The groove shall be in straight line.

MIX PROPORTIONS :

The mortar for plastering shall be of proportion as specified in the item schedule. The mixes specified in the schedule are volumetric.

MIXING :

Cement and fine aggregates shall be mixed dry in the required proportions to obtain a uniform colour. Water shall then be added to get the required consistency for the plaster.

Mixing shall be done mechanically. However, manual mixing will be allowed only in exceptional circumstances at the discretion of the Engineer-in-Charge. Manual mixing, where adopted, shall be carried out on a clean water tight Galvanised steel side closed tray . After water is added during mixing, the mix shall be held back and forth for 10 to 15 minutes.

In machine mixing, the mixer shall run atleast five minutes after placing all the ingredients in the drum. Only so much quantity of mortar which can be used within half an hour after the addition of water shall be prepared at a time. Any mortar for plaster which is set or partially set shall be rejected & shall be removed forthwith from the site. The mix should not be laid on Ground; even if mixing is done in machine it should be collected in tray (laid below the mixer) after mixing & then transported by Ghamellas/construction trolleys or other means as per standard construction Practice.

20. 6 / 12 / 15 MM. PLASTER :

The plaster shall be laid with somewhat more than 12 mm. thickness and pressed and levelled with wooden ruler to a finished thickness of 12 mm. Straight edges shall be freely used to ensure a perfectly even surface. All exposed angles and junctions of walls, doors, windows, beams, slabs etc. shall be carefully finished so as to furnish a neat and even surface.

Note: For 6mm plaster, approved bonding agent shall be used as per manufacturer's specifications, wherever specified in the Schedule of Items.

21. 20 MM PLASTER :

The proportions of sand and cement shall be as specified and shall cover all irregularities, undulations, depressions due to chasing etc. in the surface to be plastered. The mortar shall be applied slightly more than 20 mm. thick and pressed and levelled with wooden ruler or straight edge to finished thickness of 20 mm. Straight edges shall be freely used to ensure a perfectly even surface. The finished surface shall be true and even and present uniform texture throughout and all joining marks shall be eliminated. All corners, edges and angles shall be made perfectly to line, plane and plumb. All exposed angles and junctions of walls, doors, windows, beams, slabs etc. shall be carefully finished so as to furnish a neat and even surface.

Plastering items amongst all other things as described in various items also include:

i) Preparation of surfaces to receive the plaster, providing cement plaster of the specified average thickness and proportions with specified number of coats.

ii) All labour, materials, scaffolding, use of tools and equipment to complete the plastering work as per specifications.

iii) Curing for 10 days.

iv) Cleaning the surface of doors, windows, floors or any other surfaces where plastering might have splashed.

v) Finishing the portion of plaster left above the terrazo, plain cement tiles, Ceramic/vitrified /stone or any type of skirting work to be finished rounded or as

directed by the Engineer-in-Charge, in a separate operation after laying of floor tiles skirting.

22. PLASTER OF PARIS (POP – $CaSO_4$, 1 / 2H_2O) FINISH :

Wherever specified, the wall / ceiling surfaces shall be finished smooth with approved quality Plaster of Paris (POP). POP shall be mixed in water for dehydration at site. Sufficient quantity, which can be used within half an hour only, shall be prepared at a time.

POP shall be applied immediately after the under coat of cement plaster has set. An entire unobstructed area shall be finished in one operation. POP shall be applied on top of finished coat of plaster which should be levelled without any scratch/key marks to the prepared and partially set. It shall be ensured that the surface to be covered is free of loose particles, dust, dirt, grease, oil and paint.It shall be applied with steel trowel to a thickness slightly exceeding 2 mm and rubbed down to 2 mm. It shall be polished to perfectly silk smooth and even finish working from top to bottom. All corners shall be truly brought to desired lines and levels in the base plaster along and the thickness of POP shall not exceed 2 mm, at these locations.

If blow holes / cracks are observed in POP plaster at any time during the contract period and during the defects liability period, the contractor will have to rectify the same including redoing painting to match with the adjacent surface etc., all at his own cost to the entire satisfaction of the Engineer-in-charge.

23. SAND FACED CEMENT PLASTER:

GENERAL : Materials and preparation of surfaces and scaffolding etc. for sand faced plaster wherever applicable shall conform to specification laid down here-in-before under section cement plastering and the following specifications are also to be complied with:

PREPARATION OF SURFACE : The surface to be plastered shall first be thoroughly cleaned down. All joints shall be raked out in case of brick work / stone masonry and closely hacked and wire brushed in case of concrete, **under the relevant masonry / concrete items.** The surface to be plastered shall be well wetted for a minimum period of 6 hours before commencing the work. The mortar for all plaster work shall be cement sand mortar of mix as specified in the schedule of quantities.

Double scaffoldings required for facility of construction shall be provided by the contractor at his own expenses wherever directed by the Engineer-in-Charge. Scaffolding shall be erected with pipes or ballies or bamboos of adequate strength so as to be safe for all the dead, live and impact loads likely to sustain by it during construction operations. The contractor shall take all measures to ensure the safety of the work and workmen. Any instruction of the Engineer-in-Charge in this respect shall also be complied with. The contractor shall be entirely responsible for any damage to Government property or injury to persons, resulting from faulty scaffolding, defective ladders and materials or otherwise arising out of his default in this respect. Proper scaffolding shall be provided to allow easy approach for workmen and supervisory staff to every part of the work. Ballies, bamboos etc. for scaffolding shall not be tied to the windows, doors, mulliions, ventilators etc. Any damage done to the windows, doors etc. shall be made good by the contractor to the

original conditions at his own cost. For better safety, steel pipe scaffolding is preferred.

WORKMANSHIP: The surface to be plastered shall first be dubbed out with cement mortar to cover all irregularities and faces upto proudest part. The dubbing coat which shall be of proportion as specified in schedule and a 12 mm. thick (1/2") layer shall then be applied/scored and keys shall be formed on the surface by thoroughly combing it with heavy horizontal lines about 12 mm. (1/2") apart and about 3 mm. (1/8") deep when mortar has just set.

The cement mortar for sand faced plaster shall have washed and approved sand with slightly larger proportions of coarse materials, but not exceeding 3 mm. The proportion of cement to sand shall be as specified in the schedule. The water is gradually added to make the mixture homogenous. The thickness of finishing coat excluding key shall be 8mm. (about 5/16"). After application the surface should be finished with a wooden float lined with cork closely pricked on with a wet sponge tapped gently to bring sand particles into prominence.

The chajjas and any other horizontal portions shall be cleaned and set mortar that might have been fallen at the time of plastering at higher elevation, before plastering work is taken up. Junction of wall and chajja shall be rounded off simultaneously as directed by the Engineer-in-Charge.

* * *

25. WALL CARE PUTTY

SCOPE OF WORK:

Wall care putty consists of white cement, high quality polymers and specialty chemicals and mineral fillers and is formulated to make it suitable to apply even on damp surfaces. Being cement based putty, it has better compatibility with the base plaster and forms a durable base for paints. It can be applied on both, Interior and exterior plastered surfaces. It is a water resistant base coating to the plastered surfaces to provide fine leveling and a protective base for the surfaces to be painted.

GENERAL:

Wall care putty shall have superior water resisting properties to prevent paint from flaking even if the walls are damp. It should fill-up fine pores in walls and ceilings to get the smooth and dry surface for painting. Wall care putty shall have better properties in terms of water-resistance, adhesive strength and durability as compared to the ordinary putties. The putty shall provide a breathable surface and allow any trapped moisture to move out keeping the wall dry and clean.

MATERIAL:

Wall care Putty shall be in dry free flowing powder form. Required quantity of Wall care putty shall be procured from the reputed manufacturers like M/s. Birla White Wall Care Putty / M/s. Walplast Products Pvt. Ltd. or equivalent approved manufacturers, or from their authorized dealers. The putty shall conform to the International standards (viz. HDB-Singapore Standards with Water-resistant properties).

The putty shall be procured in the form of FINE or COARSE (MATT) finish as specified in the description of the item.

PREPARATION OF SURFACE:

- Surface should be clean of loose particles, dirt, grease and traces of foreign material. Sand papering or chipping shall be done if so required.
- Loose plastered areas/defective materials shall be removed & surface re-plastered and cracks filled-up properly.
- Uneven ceiling/wall surfaces shall be made even by re-plastering.
- Surface should be pre-wetted prior to application. This helps in providing a strong bond with substrate.

MIXING:

- 12 to 16 litres of clean water shall be required for a bag of 40 kg of wall care putty. Required quantity of putty (which is required to be used at a time) shall be added to the water in right proportion. (Considering pot life of the mix as 60 minutes).
- Mix shall be stirred continuously by using an electric mixer or by hand to obtain a homogeneous lump-free paste.
- The paste shall be allowed to stand for about 10 minutes for the additives to dissolve.
- The paste shall be re-mixed again for about 2 minutes.
- This mix should be used within 60 minutes.

APPLICATION:

- The plastered surface shall be dampened with clean water and excess water shall be allowed to be drained-off.
- Using a steel trowel/blade, the above mix shall be applied to a thickness of about 1 – 2 mm. Then the surface shall be levelled and smoothened. This first coat shall be cured lightly after it dries-up.
- Then second coat shall be applied after first coat is fully dried and set. Second coat shall be cured lightly for two days.
- Over plastered / Coarse putty substrate, fine wall care putty of about 1 to 1.5 mm thickness shall be applied, to smoothen the surface with a steel trowel. Finished surface of wall care putty shall not require any dressing by Emery Paper but if at all it is done, the paper should not be less than 500 numbers.
- The thickness of each coat should not exceed 1.5mm and total wall putty thickness should not exceed 3mm.
- If specified in the description of item, coarse wall care putty of about 6 to 10

mm thickness shall be applied to remove the undulations and level the surface. More number of coats of coarse putty shall be applied to cover up undulations, only after approval of the Engineer-in-Charge.

- Coverage of wall care putty depends upon surface quality. However, approximate coverage for fine wall care putty shall be 20-22 Sqft/kg and for coarse wall care putty, it shall be 9-10 Sqft/kg.

- Application of primer before painting is not necessary over the surfaces finished with wall care putty.

SPECIFICATIONS

Specification of Wall care putty – For smooth Finish			
SL. NO.	**PROPERTY**	**AS PER HDB (HOUSING DEVELOPMENT BOARD), SINGAPORE**	**TEST METHOD**
	Dry Adhesion	>=0.8 N/sqmm	EN 1015-12
	Wet Adhesion	>=0.3 N/sqmm	Chinese Std.
1	Tensile Adhesion Strength (N/sqmm) @ 28 Days	>0.8 N/sqmm	EN-1348
2	Compressive Strength (N/sqmm) @ 28 Days	7-12 N/sqmm	EN 1015-11
3	Setting Time (Minutes) - Initial & Final	<360 <500	EN 196
4	Water Absorption Coefficient - Kg/M². H1/2	<=0.13 for W2 / <=0.26 for W1	EN 1015-18
5	Water Capillary Absorption (ML) @ 24 Hrs.		Karsten Tube
6	Water Retentivity %	>=95%	EN 1015-8
	PH	Alkaline	

NOTE:

Putty being white cement based, it is alkaline, and hence direct eye and skin contact should be avoided. In case of eye contact, flush the same with clean water for 15 minutes and seek medical help.

* * *

26. PAINTING:

SCOPE OF WORK:

The work covered under these specifications consist of furnishing the various types of paints and also the workmanship for these items, in strict compliance with these specifications, which are given in detail here-in-after with the item of schedule of quantities.

MATERIALS :

Paints, oils, varnishes etc. of approved brand and manufacture shall be used. Ready mixed paints as received from the manufacturer without any admixture shall be used.

If for any reason, thinning is necessary in case of ready mixed paint, the brand of thinner recommended by the manufacturer or as instructed by the Engineer-in-Charge shall be used. Approved paints, oils or varnishes shall be brought to the site of work by the contractor in their original containers in sealed condition. The materials shall be brought in at a time in adequate quantities to suffice for the whole work or atleast a fortnights work. The materials shall be kept in the joint custody of the contractor and the Engineer-in-charge. The empties shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from the Engineer in-Charge.

The contractor shall associate the chemist of paint manufacturers before commencement of work, during and after the completion of work who shall certify the suitability of the surface to receive painting and the paint before use etc.

COMMENCING WORK :

Scaffolding: Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No ballies, bamboos or planks shall rest on or touch the surface which is being painted.

Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage or scratches to walls.

For painting of the ceiling, proper stage scaffolding shall be erected.

Painting shall not be started until and unless the Engineer-in-Charge has inspected the items of work to be painted, satisfied himself about their proper quality and given his approval to commence the painting work.

Painting, except the priming coat, shall generally be taken in hand after all other builders work, practically finished.

The rooms should be thoroughly swept out and the entire building cleaned up at least one day in advance of the paint work being started.

PREPARATION OF SURFACE :

The surface shall be thoroughly cleaned. All dirt, rust, scales, smoke and grease shall be thoroughly removed before painting is started. Minor patches if any in plastered/form finished surfaces shall be repaired and finished in line and level in C.M. 1:1 and cracks & crevices shall be filled with approved filler, by the contractor at no extra cost to the Department. The prepared surface shall have received the approval of the Engineer-in-Charge after inspection, before painting is commenced.

APPLICATION :

Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its containers. When applying also, the paint shall be continuously stirred in the smaller containers so that consistency is kept uniform.

The external surfaces of the buildings under reference including the R.C.C. Jalli, fins and the panels above and below the window etc. shall be finished in different colours of approved shade. The contractor will make suitable samples at site for Departments approval before taking up the work in hand and they will be allowed to proceed with the work only after getting Departments approval for the same.

The painting shall be laid on evenly and smoothly by means of crossing and laying off, the later in the direction of the grain in case of wood. The crossing & laying off consists of covering the area with paint, brushing the surface hard for the first time and then brushing alternately in opposite directions two or three time and then finally brushing lightly in direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying will constitute one coat.

Where so stipulated, the painting shall be done with spraying. Spray machine used may be (a) a high pressure (small air aperture) type or (b) a low pressure (large air gap) type, depending on the nature and location of work to be carried out. Skilled and experienced workmen shall be employed for this class of work. Paints used shall be brought to the requisite consistency by adding a suitable thinner. Spraying should be done only when dry condition prevails.

Each coat shall be allowed to dry out thoroughly and rubbed smooth before the next coat is applied. This should be facilitated by thorough ventilation.

Each coat except the last coat, shall be lightly rubbed down with sand paper or fine pumice stone and cleaned of dust before the next coat is laid.

No left over paint shall be put back into the stock tins. When not in use, containers shall be kept properly closed.

The final painted surface shall present a uniform appearance and no streaks, blisters, hair marks from the brush or clogging of paint puddles in the corners of panels, angles of mouldings etc. shall be left on the work.

In case of cement based paints/primers, the absorbent surfaces shall be evenly damped so as to give even suction. In any weather, freshly painted surfaces shall be kept damp for at least two days.

In painting doors and windows, the putty around the glass panes must also be painted, but care must be taken to see that no paint stains etc. are left on the glass. Tops of shutters and surfaces in similar hidden locations shall not be left out while painting. Perspect covers of electrical switch boxes have to be painted from inside by removing them. Care shall be taken while removing them in position after painting with respective approved paints. In painting steel work, special care shall be taken while painting over bolts, nuts, rivets, overlaps etc.

The additional specifications for primer and other coats of paints shall be as in accordance to the detailed specifications under the respective headings.

Any damage caused during painting work to the existing works/surfaces shall be made good by the contractor at his own cost.

BRUSHES AND CONTAINERS :

After work, the brushes shall be completely cleaned off paint and linseed oil by rinsing with turpentine. A brush in which paint has dried up is ruined and shall on no account be used for painting work. The containers, when not in use, shall be closed, kept air tight and shall be kept at a place free from dust. When the paint has been used, the containers shall be washed with turpentine and wiped dry with soft clean cloth, so that they are clean & can be used again.

MEASUREMENT :

a) Painting, unless otherwise stated shall be measured by area in square metre. Length and breadth shall be measured correct upto two places of decimal of a metre.

b) No deduction shall be made for opening not exceeding 0.05 sqm. and no addition shall be made for painting to the beading, moulding edges, jambs, soffits, sils, architraves etc. of such openings.

c) In measuring painting, varnishing, oiling etc. of joinery and steel work etc., the co-efficients as in the following table shall be used to obtain the areas payable. The co-efficients shall be applied to the areas measured flat and not girthed in all cases.

d) In case of painting of door shutter with push plates in plastic laminate, deduction will be made for area of such laminations.

Explanatory notes on the table of Co-efficients.

1. Where doors, window etc. are of composite types other than those included in para 47.7 (c), the different portions shall be measured separately with their appropriate co-efficients, the centre line of the common rail being taken as the dividing line between the two portions.

2. Measurements for doors, windows etc. shall be taken flat (and not girthed) over all including chowkhats or frames, where provided. Where chowkhats or frames are not provided, the shutter measurements shall be taken.

3. Collapsible gates shall be measured for width from outside to outside of gate in its expanded position and for height from bottom to top of channel verticals. No separate measurements shall be taken for the top and bottom guide, rails, rollers, fittings etc.

4. Rolling shutters of interlocked laths shall be measured for the actual shutter width and the height from bottom of opening to the centre of the shaft. No separate measurements shall be taken for painting guides and other exposed features within or outside the shutter area. The painting of top cover or hood shall however be measured separately.

5. Co-efficients for sliding doors shall be the same as for normal types of doors as mentioned in the table. Measurements shall be taken outside of shutters, and no separate measurements shall be taken for painting guides, rollers, fittings etc.

6. Measurement of painting of doors, windows, collapsible gates, rolling shutters etc. as above shall be deemed to include painting all iron fittings in the same

or different shade for which no extra will be paid.

7. The measurements as above shall be deemed to include also the painting of edges, blocks, cleats etc. for which no extra will be paid.

8. The co-efficients for doors and windows shall apply irrespective of the size of frames and shutter members.

9. When the two faces of a door, window etc. are to be treated with different specified finishes, measurable under separate items, the edges of frames and shutters shall be treated with the one or the other type of finish as ordered by the Engineer-in-Charge, and measurement of this will be deemed to be included in the measurement of the face treated with that finish.

10. In the case where shutters are fixed on both faces of the frames, the measurements for the door frame and shutter on one face shall be taken in the manner already described, while the additional shutter on the other face will be measured for the shutter area only excluding the frame.

11. Where shutters are provided with clearance at top or/and bottom, such openings shall be deducted from the over all measurements and relevant co-efficients shall be applied to obtain the area payable.

12. In case of trellis (or jaffri) work, the measurements shall include the painting of the frame member for which no separate measurements shall be taken. Trellis door or window shutters shall also be measured under terllis work.

13. Wherever air conditioning grill, lighting, fixtures etc. in false ceiling are painted along with, measurements shall be taken over all without deductions for opening in grills and no extra shall be paid for the grills. If grills, fixtures etc. are not painted, area of fixtures or grills as measured flat (not girthed) shall be deducted when it exceeds 0.05 sqm. individuals. Where walls and ceilings are painted in separate colours, the junctions of two paints shall be brought down on the walls in a straight line by about 6mm to 12mm. if so desired, if the junctions of walls and ceilings are not even. Nothing extra shall be paid to the contractor on this account. Beading wherever provided shall not be measured separately but shall be deemed to be included in the area of false ceiling etc. measured flat (not girthed).

14. For painting open palisade fencing and gates etc., the height shall be measured from the bottom of the lowest rail, if the palisades do not go below it, (or from the lower end of the palisades, if they project below the lowest rail), upto the top of rails or palisades whichever are higher, but not up to the top of standards when the latter are higher than the top rails or palisades.

15. In the case of asbestos cement corrugated or semi-corrugated sheeting and iron corrugated sheeting in roofs, side cladding etc., the work shall be measured flat (not girthed) as fixed.

16. For trusses, compound girders, stanchions, lattice girder and similar work, actual areas will be measured in sqm. and no extra shall be paid for painting on bolt heads, nuts, washers etc. even when they are picked out in a different tint to the adjacent work.

17. Painting of rain water, soil, waste, vent and water pipes etc. shall be measured in running metres of the particular diameter of the pipe concerned. Painting of specials such as bends, heads, branches, junctions, shoes etc. shall be included in the length and no separate measurements shall be taken for these or for painting brackets, clamps etc.

18. Measurements of wall surfaces and wood and other works not referred to already shall be recorded as per actual and opening exceeding 0.05 sqm. shall be deducted to get the net payable area. Length and breadth shall be measured correct upto two places of decimal of a metre and area so worked out shall be correct upto two places of decimal of a square metre.

19. In case the items of work requiring painting are inclusive of cost of painting, the painting carried out shall not be measured separately.

PRECAUTIONS :

All furniture, lightings, fixtures, sanitary fittings, glazing, floors etc. shall be protected by covering and stains, smears, splashings, if any shall be removed and any damage done shall be made good by the contractor at his cost.

RATES:

Rates shall include cost of all labour and materials involved on all the operations described above and in the particular specifications given under the several items.

27. PAINTING PRIMING COAT ON WOOD, IRON OR PLASTERED SURFACES :

Primer

1. The primer for wood work, iron work or plastered surface shall be as specified in the description of the item.

2. **Primer for Wood work / Iron & Steel / Plastered / Aluminium surfaces shall be as specified below:**

SN	SURFACES	PRIMER TO BE USED
a	Wood work (hard & soft wood):	Pink conforming to
b	Resinous wood and ply wood:	Aluminium primer
c	Iron & Steel, Aluminium and galvanised Steel	Zinc chromate primer conforming to
d	Plastered surfaces, cement brick work, Asbestos	Cement Primer

3. The primer shall be ready mixed primer of approved brand and manufacture.

Preparation of surface :

a) **Wood work :** The wood work to be painted shall be dry and free from moisture.

The surface shall be thoroughly cleaned. All unevenness shall be rubbed down smooth with sand paper and shall be well dusted. Knots, if any, shall be covered with preparation of red lead made by grinding red lead in water and mixing with strong glue sized and used hot. Appropriate filler material with

same shade as paint shall be used where so desired by the Engineer-in-charge.

The surface treated for knotting shall be dry before painting is applied. After the priming coat is applied, the holes and indentation on the surface shall be stopped with glaziers putty or wood putty (for specifications for glaziers putty and wood putty- refer as mentioned here-in-before). Stopping shall not be done before the priming coat is applied as the wood will absorb the oil in the stopping and the latter is therefore liable to crack.

b) **Iron and Steel Work :** All rust and scales shall be removed by scrapping or by brushing with steel wire brushes. Hard skin of oxide formed on the surface of wrought iron during rolling which becomes loose by rusting, shall be removed.

All dust and dirt shall be thoroughly wiped away from the surface.

If the surface is wet, it shall be dried before priming coat is undertaken.

c) **Plastered Surface :** The surface shall ordinarily not be painted until it has dried completely. Trial patches of primer shall be laid at intervals and where drying is satisfactory, painting shall be taken in hand. Before primer is applied, holes and undulations, shall be filled up with plaster of paris and rubbed smooth.

Application : The primer shall be applied with brushes, worked well into the surface and spread even and smooth. The painting shall be done by crossing and laying off as described here-in-before.

Other Details : The specifications for Painting (General) shall hold good so far as it is applicable.

28. PAINTING WITH SUPERIOR QUALITY & FLAT OIL READY MIXED PAINTS ON NEW SURFACE :

Paint : Ready mixed paints shall be of approved brand and manufacture and of the required shades. They shall conform in all respects to the relevant I.S. specifications.

Preparation of Surface:

(a) **Wood work :** The surface shall be cleaned and all unevenness removed as in para 47.10.2 (a). Knots if visible, shall be covered with a preparation of red lead. Holes and indentations on the surface shall be filled in with glaziers putty or wood putty and rubbed smooth before painting is done. The surface should be thoroughly dry before painting.

(b) **Iron and steel work :** The primer coat shall have dried up completely before painting is started. Rust and scaling shall be carefully removed by scraping or by brushing with steel wire brushes. All dust and dirt shall be carefully and thoroughly wiped away.

(c) **Plastered surfaces :** The priming coat shall have dried up completely before painting is started. All dust or dirt that has settled on the priming coat shall be thoroughly wiped before painting is started.

Application : The specifications mentioned here-in-before shall hold good as far as applicable.

The number of coats to be applied will be as stipulated in the item. The painted surface shall present a uniform appearance1 and glossy/semiglossy finish, free from streaks, blisters etc.

Other details : The specifications for Painting (General) specified here-in-before shall hold good in so far as they are applicable.

29. PAINTING WITH SYNTHETIC ENAMEL/SEMI GLOSSY PAINT ON NEW WORK :

1. **Paint :** Synthetic enamel/semi glossy paint of approved brand and manufacture and required shade shall be used for the top coat and an under coat of shade to match the top coat as recommended by the manufacturer shall be used. The paint shall be conforming to IS : 1932.

2. **Preparation of Surface :** This shall be as per painting with superior quality ready mixed paint as mentioned here- in- before.

3. **Application :** The number of coats including the under coat shall be as stipulated in the item.

   3.1. Under Coat : One coat of the specified paint of shade suited to the shade of the top coat shall be applied and allowed to dry over night. It shall be rubbed next day with the finest grade of wet abrasive paper to ensure a smooth and even surface free from brush marks and all loose particles shall be dusted off. All the cracks, crevices, roughness etc. will be filled with approved putty as per manufacturers recommendations.

   3.2. Top Coat : Finishing coats of specified paint of the desired colour & shade shall be applied after the under coat is thoroughly dried. Additional finishing coats shall be applied if found necessary to ensure a proper and uniform semi glossy surface.

4. **Other Details :** The specifications for "Painting (General)" mentioned here-in-before shall hold good as far as they are applicable.

30. PAINTING WITH ACRYLIC EMULSION/PLASTIC EMULSION PAINT.

1. This shall be polyvinyl based Acrylic/plastic emulsion paint of approved manufacture of the required shade, conforming to I.S.5411.

2. Primer: The primer to be used for the painting with acrylic emulsion on cement concrete surfaces, plastered surfaces, A.C. sheets, timber and metal surfaces, if necessary, shall be of approved base and as per recommendations of the manufacturers.

3. Putty : Plaster filler to be used for filling up (putting) uneven surfaces, small cracks and holes etc. shall be of approved compound and as per recommendations of the manufacturers. No oil based putty shall be used. The putty should be made from a mixture of whiting and plastic emulsion paint or as per manufacturers recommendations.

4. Finishing coats : All the finishing coats shall be of matt finish or any other finish as required by the Engineerin-charge. The number of finishing coats shall be as specified in the item.

MODE OF MEASUREMENT :

All the measurements for payment shall be taken on net surface area actually painted, unless otherwise specified. Deduction will be made from the areas for fixtures, grills, ventilation, outlets, electrical boxes and such obstructions not painted, if they are individually more than 0.05 sqm.

JOB REQUIREMENTS :

i) Acrylic emulsion paint is required to be provided on plastered and concrete surfaces in portions of the building. The Department shall reserve the option to delete or increase quantities in full or part from the scope of contract during progress of work.

ii) All wood surfaces are to be painted with semi glossy synthetic enamel paint with an approved primer.

iii) All shades and colours of paints shall be subjected to review and prior approval of Engineer-in-Charge shall be taken before the application.

31. WHITE WASHING WITH LIME

Preparation of Surface : Before new work is white washed, the surface shall be thoroughly brushed free from mortar droppings and foreign-matter.

In the case of old work, all loose pieces and scales shall be scrapped off and holes in plaster as well as patches of less than 0.05 sqm.area each shall be filled up with mortar of the same mix. Where so specifically ordered by the Engineer-in-charge, the entire surface of old white wash shall be thoroughly removed by scrapping and this shall be paid for separately.

Preparation of lime wash: The wash shall be prepared from fresh stone white lime "Katani" or equivalent. The lime shall be thoroughly slaked on the spot, mixed and stirred with sufficient water to make a thin cream. This shall be allowed to stand for a period of 24 hours and then shall be screened through a clean coarse cloth. 40 gm. of gum dissolved in hot water, shall be added to each 10 cubic decimetre of the cream. The approximate quantity of water to be added in making the cream will be 5 litres of water to one kg. of lime.

Indigo (Neel) up to 3 gm. per kg. of lime dissolved in water, shall then be added and wash stirred well. Water shall then be added at the rate of about 5 ltrs. Per kg. Of lime to produce a milky solution.

The lime shall be tested in a chemical laboratory and test certificate submitted, to conform the quality of lime with regard to its physical and chemical properties. The cost of testing lime shall be borne by the contractor.

White Washing: The white wash shall be applied with brushes or by spray in the specified number of coats. The operation for each coat in the case of brush application shall consist of a stroke of the brush given from the top downwards,

another from the bottom upwards over the first stroke, and similarly one stroke horizontally from the right and another from the left before it dries.

Each coat shall be allowed to dry before the next one is applied. Further each coat shall be inspected and approved by the Engineer-in-charge before the subsequent coat is applied. No portion of the surface shall be left out initially to be patched up later on.

For new work, three or more coats shall be applied till the surface present a smooth and uniform finish through which the plaster does not show. The finished dry surface shall not show any sign of cracking and peeling nor shall it come off readily on the hand when rubbed.

For old work, after the surface has been prepared as described here-in-before, a coat of white wash shall be applied over the patches and repairs. Then a single coat or two or more coats of white wash as stipulated in the description of the item shall be applied over the entire surface. The white washed surface should present a uniform finish through which the plaster patched do not appear. The washing on ceiling should be done prior to that on walls.

Protective Measures : Doors, windows, floors, articles of furniture etc. and such other parts of the building not to be white washed shall be protected from being splashed upon. Splashings and droppings, if any, shall be removed by the contractor at his own cost and the surfaces cleaned. Damages if any to painted surfaces, furnitures or fittings and fixtures etc. shall be recoverable from the contractor.

Measurements: All measurements for payment shall be taken on net surface areas actually white washed, unless otherwise specified. Deductions will be made from the areas for fixtures, grills, ventilation, outlets, electrical boxes and such obstruction not painted if they are individually more than 0.05 sqm. Length and breadth shall be taken correct upto two places of decimal of a metre and areas so worked out shall be correct upto two places of decimals of a square metre.

Corrugated surfaces shall be measured flat as fixed and the area so measured shall be increased by the following percentages to allow for the girthed area.

Corrugated asbestos cement sheets	20 %
Semi-corrugated asbestos cement sheets:	10 %

The number of coats of each treatment shall be stated. The item shall include removing nails, making good holes, cracks, patches etc. not exceeding 0.05 sqm. each with materials similar in composition to the surface to be prepared.

Rate : The rate shall include the cost of all materials and labour involved in all the operations described above.

32. COLOUR WASHING:

In the case of colour washing, mineral colours, not affected by lime, shall be added to white wash with proper glue. No colour wash shall be done until a sample of the colour wash to the required tint or shade has been got approved from the Engineer-in-Charge. The colour shall be of even tint or shade over the whole surface. If it is patchy or otherwise badly applied, it shall be redone by the contractor, at no extra cost to the Department.

For new work, the priming coat shall be of white wash lime or with whiting as specified in the description of the item. Two or three coats, shall then be applied as specified on the entire surface till it represents a smooth and uniform finish. Each coat after applying shall be got approved from the Engineer-in-Charge.

The finished dry surface shall not be powdery and shall not readily come off on the hand when rubbed.

Other specifications as detailed for Whitewashing with lime shall be applicable. Indigo (Neel) shall however, not be added.

33. WATER PROOFING CEMENT BASED PAINT :

a) **Material:** Cement based paint (IS:5410) of approved manufacture, quality, shade and colour only shall be used.

b) **Preparation of surfaces :** The surface shall be thoroughly cleaned off all mortar dropping, dirt, dust, algae, grease and other foreign matter by brushing and washing the surfaces. The surface shall be thoroughly wetted with clean water before the water proof cement paint is applied. The prepared surface shall be got approved before painting is commenced.

The water proof cement paint shall be mixed in such quantities as can be used up with in an hour of its mixing as otherwise the mixture will set and thicken, affecting flow and finish.

Water proof cement paint shall be mixed with water in two stages. The first stage shall comprise of 2 parts of water proof cement paint and one part of water stirred thoroughly and allowed to stand for 5 minutes. Care shall be taken to add the water proof cement paint gradually to the water and not vice versa. The second stage shall comprise of adding further one part of water to the mix and stirring thoroughly to obtain liquid of workable and uniform consistency. In all cases the manufacturers instruction shall be followed meticulously.

c) **Application:** The solution shall be applied on the clean and wetted surface with brushes or spraying machine. The solution shall be kept well stirred during the period of application. To avoid direct heat of the sun during painting, the cement based paint shall be applied on the surface which is on the shady side. Cement based paint shall not be applied on the surfaces already treated with white wash, colour wash, dry or oil bound distemper, varnishes, paints etc. It shall not be applied on gypsum, wood and metal surfaces.

d) **Other details :** The specifications for Painting (General) mentioned here-in-before shall hold good as far as they are applicable.

e) **Mode of measurement for dry distemper, oil bound distemper and water proof cement paint :** All measurement for payment shall be taken on net surface area actually painted unless otherwise specified and no co-efficient shall be applied for working out areas. Deductions will be made from areas for opening/obstructions not painted, if they are individually more than 0.05 sqm. Length and breadth shall be taken correct upto two places of decimal of a meter and areas shall be worked out correct upto two places of decimal of a square meter.

Corrugated surfaces shall be measured flat as fixed and the area so measured shall be increased by the following percentage to allow the girthed area: a) Corrugated asbestos cement sheets - 20%; b) Semi corrugated asbestos cement sheets - 10%.

The number of coats of each treatment shall be stated in the schedule of quantities. The whole surface shall be applied with approved putty/filler to get uniform and smooth surface at no extra cost to the Department.

Rates : The rate shall include cost of all materials and labour involved in all the operation described above.

34. BEES WAXING OR POLISHING WITH READY MADE WAX POLISH:(NEW WORK) :

Materials : The polishing shall be done with bees waxing prepared locally or with ready made wax polish of approved brand and manufacture, as stipulated in the description of item.

a) Where bees waxing is to be prepared locally, the following specifications for the same shall apply:

Pure bees wax free from paraffin or stearing adulterants shall be used. Its specific gravity shall be 0.965 to 0.969 and melting point shall be 63o C. The polish shall be prepared from a mixture of bees wax, linseed oil, turpentine and varnish in the ratio of 2: 1 .5: 1: 0.5 by weight.

The bees wax and boiled linseed oil shall be heated over a slow fire. When the wax is completely dissolved, the mixture shall be cooled till it is just warm and turpentine and varnish added to it in the required proportions and the entire mixture shall be well stirred.

Preparation of surface : Preparation of surface will be as mentioned here-in-under para 47.20.2 with the exception that knotting, holes and cracks shall be stopped with a mixture of fine saw dust formed of the wood being treated, beaten up with sufficient bees wax to enhance cohesion.

Application : The polish shall be applied evenly with a clean soft pad of cotton cloth in such a way that the surface is completely and fully covered. The surface is then rubbed continuously for half an hour.

When the surface is quite dry, a second coat shall be applied in the same manner and rubbed continuously for one hour or until the surface is dry.

The final coat shall then be applied and rubbed for two hours (more if necessary) until the surface has assumed a uniform gloss and is dry showing no sign of stickiness.

The final polish depends largely on the amount of rubbing which should be continuous and with uniform pressure, with frequent changes in the direction.

Other details : The specifications for painting (General) as mentioned here-in-before shall hold good as for as they are applicable.

35. FRENCH SPIRIT POLISHING: (ON NEW WORK WITH A COAT OF WOOD FILLER) :

Polish : Pure shellac varying from pale orange to lemon yellow colour, free from resin or dirt shall be dissolved in methylated spirit at the rate of 140 gm. of shellac to 1 litre of spirit. Suitable pigment shall be added to get the required shade.

Preparation of surface : The surface shall be cleaned. All unevenness shall be rubbed down smooth with sand paper and well dusted off. Knots if visible shall be covered with a preparation of red lead and glue size laid on while hot. Holes and indentations on the surface shall be stopped with glaziers putty. The surface shall then be given a coat of wood filler made by mixing whiting (ground chalk) in methylated spirit at the rate of 1 .5 kg. of whiting per litre of spirit. The surface shall again be rubbed down perfectly smooth with glass paper and wiped clean.

Application : The number of coats of polish to be applied shall be as described in the item.

A pad of woolen cloth covered by fine cloth shall be used to apply the polish. The pad shall be moistened with the polish and rubbed hard on the wood, in a series of overlapping circles applying the mixture sparingly but uniformly over the entire area to give an even level surface. A trace of linseed oil on the face of the pad facilitates this operation. The surface shall be allowed to dry and the remaining coats applied in the same way. To finish off, the pad shall be covered with a fresh piece of clean fine cotton cloth, slightly damped with methylated spirit and rubbed lightly and quickly with circular motions. The finished surface shall have a uniform texture and high gloss.

Measurement, Rate and other Details : These shall be as for Painting (General) mentioned here-inbefore as far as they are applicable.

* * *

38. WATER PROOFING :

GENERAL : The guarantee for waterproofing treatment in prescribed proforma must be given by the specialised agency which shall be countersigned by the contractor in token of his over all responsibility. The guarantee for waterproofing treatment in the prescribed proforma shall also cover Horizontal expansion joint and Vertical expansion joint. Waterproofing system shall be as per approved manufacturers specification.

On cleaned surface detect pores/gaps if any & Fill all gaps /pores and inject cement slurry mixed with Sunplex of Sunanda make (Shrinkage Compensating, Expanding

Grout Admixture with Plasticizer) or MC-Special DM of MC Bauchemie make. Then Apply acrylic based Polymer Modified Cementations Flexible Composite /Crystalline coating system over concrete slab.

39. WATER PROOFING PLASTER IN TOILET AREA :

The following specification shall be followed unless otherwise stated in schedule of quantities. This shall be 15 mm. thick plaster including an under coat not exceeding 8 mm. thick. Approved water proofing compound like CICO No. 1, Sunanda or other approved equivalent shall be added @ 3% by weight of cement in cement mortar or as per manufacturers specifications in both the coats. The workmanship and material shall be same as described in plaster work in general. All exposed surfaces shall be finished smooth with a coat of neat cement as directed, except areas where tiling work is to be done, where the plaster shall be left rough / float finish..

40. CEMENT BASED WATER PROOFING OF TOILET AREAS :

General : The water proofing treatment for the Bath and W.C. shall be essentially of cement based water proofing treatment with admixture of proprietary water proofing compound similar to M/s. CICOP/Sunanda or any other equivalent approved cement based water proofing treatment. The waterproofing treatment shall consist of providing cement slurry mixed with proprietary water proofing compound after preparation of surfaces, providing water proofing cement plaster, finishing smooth/rough as required to the required line, level, curing, finishing, guarantee for the water tightness of the water proofing treatment etc.

Preparation of Surface : The surface to receive water proofing treatment shall be thoroughly cleaned of scales, laitance, set mortar etc. for receiving water proofing treatment, and necessary preparation of the surface for providing water proofing treatment shall be done by the contractor. If any honey combs are observed in beams and slabs of Bath and W.C., the same shall be grouted with cement slurry mixed with water proofing compound and the cracks and crevices, filled with injection method.

Sequence of Treatment : All cutting and chasing in the floor and walls for plumbing work shall be done by the plumbing agency. Water proofing agency shall then provide CICO/Sunanda/MC Bauchemie or equivalent approved cement based water proofing treatment consisting of cement plaster treatment mixed with the water proofing compound according to the recommended specifications of the waterproofing agency. The thickness of water proof plaster shall be about 35 mm. on floor area of the depression and about 25 mm. thick on the vertical surface of walls/concrete surface in case of sunken slabs, upto the finished floor level. The thickness shall be about 18 mm. for the remaining wall height upto 600 mm. from finished floor level.

The plumbing agency shall then lay and fix the pipes, W.C. pans, traps etc. without disturbing the water proofing treatment. However, the joints of water supply and waste connections including holes drilled for clamps shall be treated by water proofing agency.

Waterproofing agency shall then fill-in the depression in the floor with their 'Sunanda/ MC Bauchemie/ CICO or equivalent approved waterproof brick bat coba

with the admixture of waterproofing compound according to waterproofing agency's specification and process, which should be furnished in writing to the Engineer-in-Charge for effective supervision of completeness of the process while executing the works.

Finishing : The surface of the exposed plaster shall be finished smooth with neat cement. The plaster surface where tiling is to be provided as well as brick bat coba filling where flooring to be provided, shall be finished to proper line, level, plane and plumb to receive the floor/dado finish. Curing of the waterproofing treatment shall be carried out for 14 days.

Testing and Guarantee : The contractor shall test the surface where waterproofing treatment is provided for the bone dry condition by filling with water inside the depressed plastered portion. No wet patches or leaks shall appear on he surrounding plastered walls or at the under side of the slabs. The testing shall be carried out to the entire satisfaction of the Engineer-in-Charge. The contractor shall furnish guarantee in the Proforma for the waterproofing treatment for maintaining the under side of the waterproofed surface in bone dry condition for a period specified in relevant tender clause. During this period, contractor shall attend to all leakages, defects etc. if noticed, free of cost, starting his work of checking up and rectification with in a weeks time from the date of receipt of information about such leakages etc. by him.

MODE OF MEASUREMENT :

i. Waterproof plaster shall be computed by taking the length and breadth of the area actually plastered correct upto two decimal places of a metre. No deduction shall be made for W.C. pans, pipes etc. in the measurement.

ii. The filling with waterproof brick bat coba shall be computed by noting the levels and dimensions of the filled up depression before and after the filling, upto two decimal places of a metre and also no deductions shall be made for W.C. pans, pipes etc.

* * *

41. DISMANTLING AND DEMOLITION :

SCOPE OF WORK :

The work envisaged under this sub-head is for dismantling and demolition of brick masonry in cement/lime mortar, reinforced cement concrete works, removing wooden chowkhats of doors, wooden or steel windows.

GENERAL :

The term Dismantling implies carefully taking up or down and removing without damage. This shall consist of dismantling one or more parts of the building as specified or shown on the drawings.

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

PRECAUTIONS :

Necessary propping, shoring and/or underpinning shall be provided for the safety of the adjoining work or property, which is to be left intact, before dismantling and demolishing 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 required, temporary enclosures or partitions shall also be provided.

Necessary precautions shall be taken to keep the dust- nuisance down as and when necessary.

Dismantling shall be commenced in a systematic manner. All materials which are likely to be damaged by dropping from a height or demolishing roofs, masonry etc., shall be carefully dismantled first. The dismantled articles shall be passed by hand where necessary and lowered to the ground and not thrown. The materials then be properly stacked as directed by the Engineer-in-charge.

All materials obtained from dismantling or demolition shall be the property of the Government unless otherwise specified and shall be kept in safe custody until handed over to the Engineer-in-charge.

Any serviceable material, obtained during dismantling or demolition shall be separated out and stacked properly as indicated by the Engineer-in-charge within a lead of 150 m. or as specified in the item. All under serviceable materials, rubbish etc. shall be disposed off as directed by the Engineer-in-charge.

TREATMENT :

All the dismantled area shall be rendered clean off all debris, dust etc. The sides of jambs, sills, soffits etc. of the openings if any, after taking out doors and window chowkhats, unless and otherwise to be treated, shall be plastered in C.M. 1:3 with neeru finish to render true sides, corners, edges etc.

MODE OF MEASUREMENT :

Brick Masonry & R.C.C. Works : The measurement of brick masonry with or without plaster/painting shall be taken correct to a centimeter and volume calculated in cubic metres upto two places of decimal.

Doors and Windows : Dismantling of doors and windows (wooden or steel) shall be enumerated. Removal of chowkhats (frame works) shall include (unless otherwise separately mentioned for removing shutters only), the removal of shutters along with architraves, beadings, fittings and fastenings along with frames.

Roof Terracing : Dismantling of roof waterproofing treatment shall be measured in square metre area. .Length and breadth shall be measured correct to a centimeter between parapets. No separate measurement shall be taken for gola and khurrah etc.

RATES :

The rate shall include cost of all such operations mentioned above including necessary labour, materials, transport, scaffolding, stacking the serviceable materials, disposing the unserviceable materials within the lead specified, all as directed by the Engineer-in-charge.

Providing and fixing in position UV resistant X-structure/multiwall/multicell Polycarbonate sheet (Lexan Thermoclear of GE Plastics or equivalent 1200 mm width and max length upto 12.0 m,including UV resistant coating on both sides, providing specially designed serrated polycarbonate clamping section at all longitudinal joints (parallel to span) on supporting member, fixing to box purlins/runner using specially designed stainless steel clamps and fasteners SS304 grade,(or) specially designed anodised aluminium clamping section with EPDM/Neo prene gaskets to be located on supporting member, the fasteners to be fixed on pre drilled or self drilled hole, all fixing to be completely water tight. etc. complete as per manufacturer specifications.

* * * *

LIST OF MATERIALS OF APPROVED BRAND AND/OR MANUFACTURER

Sr.no	Description	Approved make
1	Cement 53 Grade / 43 Grade only for Concrete works	Gujarat Ambuja, A.C.C., Ultra-tech, Birla
	Cement Portland Pozzolana (Fly ash based) for Plastering,masonry etc.	Gujarat Ambuja, A.C.C., Ultra-tech, Birla
2	White Cement	Birla / J.K. or equivalent
3	Mild & TOR Steel	Sail, Tisco, Rashtriya Ispat Nigam, Jindal or equivalent
4	Structural steel	SAIL/TATA/RINL/IISCO/JINDAL
5	AAC blocks	Ultratech/ Ascolite/ Siporex/Godrej & Boycee
6	Pest control	PCI/Godrej/Pecopp
7	White cement based putty	M/s Birla white, Plasto shine wall putty, M/s Walplast products pvt. Ltd.
8	Lustre oil paint	Nerolac / Akzo Nobel/ Asian Paint.
9	Emulsion paint	Nerolac/ Akzo Nobel / Asian Paints make.
10	Epoxy paint	Akzo Nobel /Berger/ Asian Paint
11	Vitrified tiles Matt or polished	KAJARIA/Somany/Johnson/RAK
12	Granite	As approved by Architect
13	Kotah Stone	As approved by Architect
14	Agglomerate Composite Marble	NITCO/Kalinga stone/CMC
15	Italian Marble	As approved by Architect
16	Timber	C.P seasoned teakwood of approved quality for lipping, beading, framing etc.

17	Laminated sheet	Greenlam /Merino / Euro
18	Plywood	Anchor / Green ply /Century
19	Veneer	Anchor / Green ply / Century / Euro / Timex (IS 710 : 200)
20	Melamine polish	Asian paint / MRF/ NEROLAC
21	Duco paint	MRF / Akzo Nobel / ASIAN
22	Adhesive	Fevicol
23	Self watering box	Greena/Gaia Pottery
24	Frosted film	3M
25	Hardware fittings	
i)	Hinges Butt	
	Stainless Steel (14g) powder coated hinges with screw Nettle fold screws/palladium size 5" x 11/4'' or as specified	Hettich / Palladium/Haffle/Kich / Dorma
ii)	Mortise lock - Brass or Stainless steel mortise lock of 6 lever 75mm width, all locks to be provided in one cabin shall be of common key and 5 such common keys shall be provided to the client.	Haffele / Dorma/ Hettich / Kich
iii)	Tower bolts - Stainless steel and brass	Haffle/Dorma / Hetich / Kich
iv)	Door closers	Haffle/Dorma / Hettich / Kich
v)	Floor spring	Haffle/Dorma / Hettich / Kich
vi)	Panic handle	DORMA/Haffle
vii)	Patch fittings	Dorma/kich/Haffle/Hettich
viii)	Door handle	Kich/Neki/Haffle/Hettich/Ozone
26	Flush doors	Century/Anchor or equivalent
27	Aluminium windows	Jindal, Hindalco,

28	Stainless Steel	Jindal/SAIL
29	Polycarbonate sheets	GE, Lexan, Danpalon, polygal
30	Gypsum	Saint Gobain Gyproc India/ USG Boral India
31	Water proofing chemicals	CICO/Sunanda/Sika/MC Bauchemie
32	Polymer modified mortar/Microconcrete	Sunanda/ROFF/Basf
33	Rust Preventive	Krishna Conchem/ Sunanda/ BASF
34	Bonding coat	Krishna Conchem/ Sunanda specialty coating/Fosroc
35	Glass	Saint Gobain/ Asahi India Glass Ltd / Gujarat Guardian - Modiguard
36	Galvalume roof	PHENIX Infra/ Kingspan/ LLOYD Insulations (I) Ltd
	Furniture Items	
37	TWO SEATER SOFAS-	Godrej or equivalent.
38	LOCKER WARDROBES	Godrej or equivalent.
39	OFFICE TABLE:	Godrej or equivalent.
40	OFFICE CHAIR	Godrej or equivalent.
41	DINING CHAIRS	Godrej or equivalent.
42	DINING TABLES	Godrej or equivalent.
43	CENTER TABLE	Godrej or equivalent.
44	CPU Trolley	Godrej or equivalent.
45	KBPT- Key Board Pullout Tray	Godrej or equivalent.

II PLUMBING WORKS

GENERAL TECHNICAL SPECIFICATION FOR PLUMBING WORK

1.0 GENERAL:

1.1 The work shall be carried out in the accordance with the drawings and design as would be issued to the Contractor by the Design Consultant duly signed and stamped by him. The Contractor shall not take cognizance of any drawings, designs, specifications etc. **not** bearing Design Consultant signature and stamp. Similarly the Contractor shall not take cognizance of instructions given by any other Authority except the instructions given by the Client's Representative in writing.

1.2 The work shall be executed and measured as per metric dimensions given in the Bill of Quantities, drawings etc.

1.3 The Contractor shall acquaint himself fully with the partial provisions for supports that may or may not be available in the structure and if are available then utilize them to the extent possible. In any case the Contractor shall provide all the supports regardless of provisions that they have been already made. Nothing extra shall be payable for situations where insert plates (for supports) are not available or are not useful.

1.4 Shop coats of paint that may be damaged during shipment or erection shall be cleaned off with mineral spirits, wire brushed and spot primed over the affected areas, then coated with paint to match the finish over the adjoining shop painted surface.

1.5 The Contractor shall protect / handle the material carefully and if any damage occurs while handling by the Contractor then the sole responsibility shall be of the Contractor. Such damages shall be rectified/recovered by the Contractor at no extra cost whatsoever.

1.6 The Contractor shall, within twenty one (21) days of receipt of the Notice of Award for the Project, where applicable, complete the submission of shop drawings to the Client's Representative for approval by the Design Consultants in order to conform to the contract schedule.

1.7 MEASUREMENTS:

All measurements shall be taken in accordance with relevant IS codes, unless otherwise specified.

2.0 APPLICABLE CODES AND STANDARDS:

All equipment, supply, erection, testing and commissioning shall comply with the requirements of Indian Standards and code of practice given below as amended up to the date of submission of Tender. All equipment and material being supplied shall meet the requirements of BIS and other relevant standard and codes.

Plumbing Works:

Vitreous Chinaware	-	IS: 2556 - 1974 (Part - I)

	-	IS: 2556 - 1981 (Part - II)
	-	IS: 2556 - 2556 (Part - III)
Ball Valve	-	IS: 1703 - 1977
Cistern Brackets	-	IS: 775 - 1970
Toilet Seat Cover	-	IS: 2548 - 1983
Vitreous China Cistern	-	IS: 2326 - 1987
Sand Cast Iron Pipes and Fittings	-	IS: 1729 - 1979
Spun Cast Iron Pipes and Fittings	-	IS: 3989 - 1984
GI Pipes	-	IS: 1239 - 1979
Galvanizing for GI Pipes	-	IS: 4736 - 1986
Pipe Threads	-	IS: 554 - 1985
Milleable Iron Fittings	-	IS: 1879 - 1987
Cast Iron Sluice Valves	-	IS: 780 - 1984
Full Way Valves	-	IS: 778 - 1984
Brass Ferrule	-	IS: 2692 - 1978
Stone Ware Gully Trap	-	IS: 651 - 1980
RCC Pipes	-	IS: 458 - 1971
Cast Iron Class LA Pipes	-	IS: 1536 - 1989
Cast (Spun) Iron Fittings	-	IS: 1538 - 1976
Pig Lead	-	IS: 782 - 1966
Induction Motors	-	IS: 4691
Code for Measurements	-	IS: 1200
UPVC Pipes and Fittings	-	IS: 4984
Specification for Caulking Lead	-	IS: 782
Code of Practice for laying of concrete	-	IS: 783

3.0 QUALITY ASSURANCE AND QUALITY CONTROL:

3.1 The work shall conform to high standard of design and workmanship, shall be structurally sound and aesthetically pleasing. Quality standards prescribed shall form the backbone for the quality assurance and quality control system.

3.2 At the site, the Contractor shall arrange the materials and their stacking/ storage in appropriate manner to ensure the quality. Contractor shall provide equipment and manpower to test continuously the quality of material, assemblies etc. as directed by the Client's Representative. The test shall be conducted continuously and the result of tests maintained. In addition the Contractor shall keep appropriate tools and equipment for checking alignments, levels, slopes and evenness of surface.

3.3 The Client's Representative shall be free to carry out such tests as may be decided by him at this sole direction, from time to time, in addition to those specified in this Document. The Contractor shall provide the samples and

labour for collecting the samples. Nothing extra shall be payable to the Contractor for samples or for the collection of the samples.

3.4 The test shall be conducted at Standard Laboratory selected by Client's Representative. Contractor shall keep the necessary testing equipment such as hydraulic testing machine, smoke testing machine, gauges and other necessary equipment required.

3.5 The Client's Representative shall transport the samples to the laboratory.

3.6 Testing charges shall be borne by the Client's Representative.

3.7 Testing may be witnessed by the Contractor or his Authorized Representative. Whether witnessed by the Contractor or not, the test results shall be binding on the Contractor.

4.0 SANITARY FIXTURES & C.P. FITTINGS:

4.1 SCOPE

4.1.1 Work under this section shall consist of transportation, furnishing, installation, testing and commissioning and all labour as necessary as required to completely install all sanitary fixtures, brass and chromium plated fittings and accessories as required by the drawings and specified hereinafter or given in the Bill of Quantities.

4.2 GENERAL REQUIREMENTS

4.2.1 All fixtures and fittings shall be fixed with all such accessories as are required to complete the item in working condition whether specifically mentioned or not in the Bill of Quantities, specifications, drawings or not.

4.2.2 All fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per architectural design requirements. Wherever necessary the fittings shall be centered to dimensions and pattern desired.

4.2.3 Fixing screws shall be half round head chromium plated brass with C.P. washers wherever required as per directions of Client's Representative.

4.2.4 All fittings and fixtures shall be fixed in a neat workmanlike manner true to levels and heights shows on the drawings & in accordance with the manufacturer's recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, wall or ceiling surfaces shall be made good at Contractors cost.

4.2.5 All fixtures of the similar materials shall be by the same manufacturers.

4.2.6 All fitting shall be of the chromium plated materials.

4.2.7 Without restricting to the generally of the foregoing the sanitary fixtures shall include all sanitary fixtures, C.P. fittings and accessories etc. necessary and required for the building.

4.7.8 Whether specifically mentioned or not all fixtures and appliances shall be provided with approved fixing devices, nuts, bolts, screws, and hangers as required. These supports shall have the necessary adjustment to allow for irregularities in the building area construction.

4.7.9 For the installation of the CP fittings, Teflon tape shall be used.

4.3 EUROPEAN W.C.

4.3.1 European W.C. of glazed vitreous china shall be wash down, single or double symphonic type, floor or wall mounted set, flushed by means of flush valve as specified in Bill of Quantities. Flush pipe / bend shall be connected to the W.C. by means of suitable rubber adopter. Wall hung W.C. shall be supported by C.I. floor mounted chair.

4.3.2 Each W.C. seat cover shall be so fixed that it remains absolutely stationary in vertical position without falling down on the W.C. Seat cover shall be of white solid plastic, elongated open front with heavy duty hinges. Exposed fixture trims shall be Chrome plated, and trims of similar function shall be by the same manufacturer.

4.3.3 Flush valves shall be of the best approved quality procurable with C.P. control valve and C.P. flush pipe.

4.3.4 The flush pipe/bend shall be connected to the WC by means of a suitable rubber adopter.

4.3.5 Alternatively if flushing cistern to be used shall conform to the requirements of IS: 774-1971. High level cisterns shall be of cast iron unless otherwise specified. Low level cistern shall be of the same material as the water closet or as instructed by the Owner/Architect/ Consultant. The cisterns shall be mosquito proof & shall fulfill the requirements of the local Authority.

4.3.6 The levels of the WC should be checked by placing sprit level on the W.C. W.C. should be tested on completion of fixing by putting small paper balls and flushing out. If all the paper balls are not flushed out. The fixing will have to be rectified / re-aligned.

4.4 KITCHEN / PANTRY SINKS

4.4.1 Sinks shall be of stainless steel material as specified in the Bill of Quantities/Drawings.

4.4.2 Each sink shall be provided with R. S. brackets and clips and securely fixed. Counter top sinks shall be fixed with suitable angle iron clips or brackets as recommended by the manufacturer. Each sink shall be provided with 40 mm dia Chromium Plated waste with chain and plug or P.V.C. waste with Escutcheon plates. Fixing shall be done as directed by Client's Representative.

4.4.3 Supply fittings for sinks shall be mixing fittings or C.P. taps, angle cocks etc. all as specified in the Bill of Quantities/Drawings.

4.5 WASH BASINS

4.5.1 Wash basin shall be of white vitreous china of best quality manufactured by an approved firm and sizes as specified in the Bill of Quantities.

4.5.2 Wash basin shall be of under counter drop in type shall be supported on a pair of rolled steel brackets of approved design and shall be mounted on a countertop. So that rim and basin bowl is exposed from top.

4.5.3 Wash basin shall be provided with single lever mixer with chain and rubber plug, chromium plated brass bottle trap of approved quality, design and make where hot water required. Single tap where hot water is not required.

4.5.4 Wash basin shall be fixed at proper location and height and truly horizontal as shown on drawing or as directed by Client's Representative.

4.6 HOSE BIBB'S

4.6.1 Hose Bib of Chromium Plate tap is draw off tap with horizontal inlet and free outlet knurling on outer face to fix the hose pipe. Hose bib shall be of specified size and shall be of screw down type and shall conform to IS: 781-1984. The closing device shall work by means of a disc carrying a renewable non-metallic washer which shuts against the water pressure on a seating at right angle to the axis of the threaded spindle which operate it. The handle shall be either crutch or butterfly type securely

4.7 URINALS

Half stall wall hung urinals of glazed vitreous china shall be provided with 15mm dia, C.P. brass spreader, 32mm dia C.P. domical waste and C.P. cast brass bottle trap with pipe and wall flange and shall fixed to wall by one C.I. bracket and two C.I. clips as recommended by manufacturers complete as directed by the Client's Representative.

Urinals shall be flushed by means of "NO-TOUCH" infrared operated flush valves.

Waste pipes for urinals shall be any one of the given material as directed by the Client's Representative:

a) G.I. Pipes
b) Rigid PVC/High density polyethylene.

Waste pipes may be exposed on wall or concealed in chase as directed by the Client's Representative.

4.8 BATH TUB

Bath tub & panel shall be white enameled cast iron or pressed steel as specified in the Bill of Quantities of guaranteed quality and specifications.

Each bath tub shall be provided with 40mm dia CP brass waste with 32mm C.P. brass overflow, 40mm dia cast brass overflow-cum-waste trap with pop-up waste assembly.

Bath tub shall be provided with four Nos. C.P. brass concealed stop cocks, bath spout and overhead shower or as specified in the Bill of Quantities.

Bath tubs shall be fixed true to level firmly fixed to another or supports provided by the manufacturer. Edges touching the wall shall be slightly recessed in the wall finishing so as ensuring water tightness. The fixing shall be perfectly done so that the wall behind does not tend to get damp or patchy.

Contractor shall during the entire period of installation and afterwards protect the bathtub by providing suitable cover or any other protection so as to absolutely prevent any damage to the bathtub until handing over.

4.9 MEASUREMENTS

4.9.1 Rate for providing and fixing of sanitary fixtures, accessories, urinal partitions shall include all items and operations stated in the respective specifications and Bill of Quantities, and nothing extra is payable.

4.9.2 Rates for all items under specifications para above shall be inclusive of cutting holes and chases and making good the same, C.P. screws, nuts, bolts and any fixing arrangement required.

5.0 WATER SUPPLY:

5.1 SCOPE

5.1.1 Work under this section consists of furnishing all labour, materials equipment and appliances necessary and required to completely install the water supply system as required by the drawings, specified hereinafter and given in the bill of quantities.

5.1.2 Without restricting to the generality of the foregoing, the water supply system shall include the following:-

i. Pipe protection & painting.

ii. Connections to all plumbing fixtures, tanks, pump etc.

iii. Providing hot water pipe lines and supply point with isolation valves, wherever required.

iv. Control valves, masonry chambers and other appurtenances.

v. Connections to all plumbing fixtures, tanks and appliances.

vi. Excavation and refilling of pipe trenches, wherever necessary.

vii. Internal galvanized water supply piping inside the toilets shaft/plant room/terrace.

viii. Testing all line and fixtures as specified.

5.2 GENERAL REQUIREMENTS:

5.2.1 All materials shall be new of the best quality and shall be furnished, delivered, erected, connected and finished in every detail conforming to specifications and subject to the approval of Client's Representative.

5.2.2 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.

5.2.3 Short or long bends shall be used on all main pipe lines as far as possible. Use of elbows shall be restricted for short connections.

As far as possible all bends shall be formed by means of hydraulic pipe bending machine for pipes up to 65mm dia.

5.2.4 Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc. and shall be selected and arranged so as to fit properly into the allocated building space.

5.2.5 Pipes shall be securely fixed to walls by suitable clamps at intervals specified.

5.2.6 Valves and other appurtenances shall be located to provide easy accessibility for operation, maintenance and repairs.

5.2.7 Connection between dissimilar materials.

5.2.8 All G.I. pipes jointing shall be with white lead and spun yarn.

5.2.9 Drawings illustrating block out and penetration of pipes in the wall/floor/slab.

5.2.10 UNIONS:

Contractor shall provide adequate no. of unions on all pipes to enable dismantling later and for servicing. Union shall be provided near each gunmetal valve.

5.3 INTERNAL WORKS

5.3.1 MATERIALS:

5.3.1.1 G.I. PIPES

i. The pipes shall be galvanised mild steel threaded pipes conforming to the requirement of IS: 1239 Part-I for heavy grade upto 150mm dia and IS: 3589 for pipes above 150mm dia. They shall be of the dia (nominal bore) specified in the description of the item. Galvanising shall confirm to IS: 4736.

ii. The pipes shall be clearly finished, well galvanised in and out and free from cracks, surface flow, laminations and other defects. All screw threads shall be clean and well cut. The ends shall be cut cleanly and

square with axis of the tube.

iii. All screw tubes shall have pipe threads conforming to the requirements of IS: 544-1955 (or revised).

5.3.1.2 G.I. FITTINGS

i. All fittings shall be conforming to IS: 1239 Part II (or as revised). All fittings shall have manufacturer's trade mark stamped on it. Fittings in G.I. pipe lines shall include elbows, tees, bends, reducers, nipples, union, G.I. Clamps / Steel structural supports of approved design, nuts, bolts, washers, etc. All fittings shall be tested at manufacturer's works. Contractors may be required to produce certificate to this effect from the manufacturers.

ii. The fittings shall have screw threads at the ends conforming to the requirements of IS: 544-1955 (or revised). Female threads on fittings shall be parallel and male threads (except on running nipples and collars of unions) shall be tapered.

5.3.1.3 CUTTING AND JOINTING:

i) The pipes and fittings shall be inspected at site before use to ascertain that they conform the specification given in para no. 5.3.1.1 above. The defective pipes shall be rejected. Where the pipes have to be cut or re-threaded, the ends shall be carefully filled out so that no obstruction to bore is offered. The end of the pipes shall then be threaded conforming to the requirements of IS: 544-1955 with pipe dies and taps carefully is such a manner as will not result in slackness of joints when the two pieces are screwed together. The taps and dies shall be used only for straightening screw threads which have become bend or damaged and shall not be used for turning of the threads so as to make them slack, as the later procedure may not result in water tight joint.

ii) The screw threads of pipes and fittings shall be protected from damage until they are fitted.

iii) The pipes shall be cleaned and cleared of all foreign matter before being laid. In jointing the pipes, the inside of the socket and the screwed end of the pipes shall be oiled and rubbed over with white lead and a few turns of spun yarn wrapped round the screwed end of the pipe. The end shall then be screwed in the socket. Care should be taken that all pipes and fitting are properly jointed so as to make the joints completely water tight and pipes are kept at all times free dust and dirt during the fixing. Burr from the joint shall be removed after laying. The open ends of the pipes shall be temporarily plugged to prevent access of water, solid or any other foreign matter.

5.3.2 INSTALLATION OF G.I.:

Tender drawings indicate schematically the size and location of pipes. The Contractor on the award of the work, shall prepare detailed coordinated with other trades working drawings, showing the cross-section, longitudinal sections, details of fittings, locations of isolating and control valves,

drain valves and all pipe support, structural supports. He must keep in view the specific openings in buildings and other structures through which pipes are designed to pass.

i. Piping shall be properly supported on or suspended from connection clamps, hangers as specified and as required. Install pipes in a manner to avoid strain on equipments connections. The Contractor shall adequately design all the brackets, saddles, anchors, clamps and hangers, and be responsible for their structural sufficiency.

ii. Pipe supports shall be of steel, adjustable for height and primer coated with rust preventive paint and finish coated back. Where pipe and clamps are of dissimilar materials a dielectric fitting shall be provided in between. Spacing of pipe supports shall not exceed the following:

Pipe Size	**Spacing between Supports**
Upto 12 mm	1.5 meter
15 to 25 mm	2.0 meter
32 to 150 mm	2.0 meter
150 mm and over	2.5 meter

iii. Vertical risers shall be parallel to walls and column lines and shall be straight and plumb. Risers passing from floor to floor shall be supported at each floor by clamps or collars steel structural supports attached to pipe and with a 15 mm thick rubber pad or any resilient material. Where pipes pass through the terrace floor, suitable flashing shall be provided to prevent water leakage. Risers shall have a suitable clean out at the lowest point and air vent at the highest point.

iv. Pipe sleeves, 50 mm larger diameter than pipes, and 50mm above F.FL. Shall be provided wherever pipes pass through walls and slabs, and annular space filled with fire proof materials like putty, fire seal etc.

v. All pipe work shall be carried out in workmen like manner, causing minimum disturbance to the existing services, buildings, roads and structure. The entire piping work shall be organized in consultation also coordinated with other Contractors work so that particular area work shall be carried out in one stretch.

vi. Cut outs in the floor slab for installing the various pipes are indicated in the drawings. Contractor shall carefully examine the cut outs provided and clearly point out wherever the cut outs shown in the drawings, do not meet with the requirements.

vii. The Contractor shall make sure that the clamps, steel structural supports, brackets, clamp saddles and hangers provided for pipe supports are adequate. Piping layout shall take due care for expansion and contraction in pipes, and include expansion joints where required.

viii. All pipes shall be accurately cut to the required sizes in accordance with relevant BIS codes and burrs removed before laying. Open ends of the piping shall be closed as the pipe is installed to avoid entrance of

foreign matter. Where reducers are to be made in horizontal runs, eccentric reducers shall be used for the piping to drain freely. In other locations, concentric reducers may be used.

ix. All buried pipes shall be cleaned and coated with zinc chromate primer and bitumen paint, then wrapped with bitumen faced hesian.

x. In case the pipe is embedded in walls or floors, it should be painted with two coats of anti corrosive bitumastic paint of approved quality, covered with one layer of fiberglass tissue and finally painted with one coat of bitumen paint. The pipe should not come in contact with cement mortar or cement concrete as the pipe will be affected by cement. Under the floors, the pipes shall be laid in layer of filling under concrete floors.

xi. For pipes 15mm to 25mm dia, the holes in the walls and floors shall be made by drilling with chisel or jumper and not by dismantling the brick work or concrete. However, for bigger dimension pipes the holes shall be carefully made of the smallest size as directed by the Client's Representative. After fixing the pipes the holes shall be made good with cement mortar 1:3 (1 cement: 3 coarse sand) properly finished to match the adjacent surface.

xii. All pipes above ground shall be painted with one coat of red lead and two coats of synthetic enamel paint of approved shade and quality. Pipes shall be painted to standard colour code/or as specified by the Client's Representative.

xiii. Springing or forcing pipe into place will not be permitted. Protect piping at all times from dirt and moisture. During storage at construction site, keep end plugged to prevent dirt and moisture entering.

xiv. Carefully grade all pipes to eliminate traps and pockets. Where air pockets or water traps can not be avoided provide means of drainage with valved hose connection for water traps and valved automatic air vents for air pockets.

xv. Below grade piping shall be installed in such a manner that it does not appear directly on ground.

xvi. Any location where pipes/valves through or closed to basement walls shall be protected from direct contact of concrete block.

xvii. Pipes passing through building walls shall be protect by cast iron sleeves large enough to permit changes size eccentric fittings shall be used except where branch pipes connect into mains and in domestic system.

5.3.3 INSULATION:

- All the Hot Water supply & Hot Water return pipe shall be insulated in the manner specified hereinafter.

- Insulating material shall be rigid performed sections of mineral/rock

wool with a "K" value of not more than 0.036 W/MK at 100 Deg. C mean temperature and of density 140 Kg/Cu.m

- No insulation shall be applied until the pipe is satisfactorily pressure tested.

- Pipes shall be insulated with rigid performed pipe sections of the following thickness:

Pipe Diameter (mm)	**Thickness (Mineral Wool) mm**
80-150	50

- Pipe insulation shall be applied as follows:

- Pipe shall be thoroughly cleaned with wire brush and rendered free from all rust and grease and applied with two coats of anti-rust paint.

- Pipes in Shaft:

  i) Fix rigid performed sections of insulation with adhesive between all points (transverse and circumferential).

  ii) The insulation shall be tied with GI chicken wire mesh.

  iii) The insulation shall be provided with 24 gauge aluminium cladding screwed at the joints with cadmium coated self tapping screws. Joints shall be overlapped minimum 12mm wide.

- Pipes exposed to weather:

  i) Same as (b) (i) to (ii)

  ii) Provide polythene based hessian (500 gauges) overlapping 100mm on all joints (transverse and circumferential) and stitched at the joints.

  iii) The hessian shall be covered with 15mm x 20mm hexagonal chicken wire mesh.

  iv) Over the wire mesh the surface shall be covered with two layers of tarfelt grade-II and type-II with bitumen between layer overlapping 100mm on all joints (transverse & circumferential).

  v) Over the second layer of tarfelt final coat of hot bitumen not less than 6mm thick shall be applied.

  vi) Over the final layer of tarfelt and hot bitumen coat aluminium cladding shall be provided with 24 gauge aluminium shut screwed at the joints with cadmium coated self-tapings screws. Joints shall be overlapped minimum 25mm wide.

  d) Pipes Buried Underground:

  i) Rigid pipe sections of insulation shall be fixed tightly to the surface taking care to seal all joints with 50mm wide aluminium adhesive

tape (transverse and circumferential).

ii) The insulation shall be tied with aluminium band not less than 6mm width and 24 gauge 4 bands per meter or equivalent plastic band using G.I. sheet clamp crimped at the joints.

iii) Wrap the insulation with polythene sheet 400 gauges. Polythene sheet shall be tied with 6mm, 24 gauge, aluminium band 4 bands per meter or equivalent plastic tape using GI sheet clamp crimped at the joint.

iv) The polythene surface shall be covered with two layers of tarfelt grade – II, type – II with bitumen between layers overlapped 100mm on all joints (transverse and circumferential).

v) Over the second layer of tarfelt final coat of hot bitumen not less than 6mm thick shall be applied.

5.3.4 TESTING:

After laying and jointing, the pipes and fittings shall be inspected under working condition of pressure and flow. Any joint found leaking shall be redone and all leaking pipes removed and replaced without extra cost. Use of any compound or stop leak compound will not permit.

The pipes and fittings after they are laid shall be tested to hydraulic pressure of 1.5 times the working pressure or 7.5 Kg/Sq.cm whichever is more. The pipes shall be slowly and carefully charged with water allowing all air to escape and avoiding all shock or water hammer. The draw of taps and stop cocks shall then be closed and specified hydraulic pressure shall be applied gradually. Pressure gauge must be accurate and preferably should have been recalibrated before the test. The test pump having been stopped, the test pressure should be maintained without loss for at least two hours. The pipes and fittings shall be tested in sections as the work of laying proceeds, having the joints exposed for inspection during the testing.

5.3.5 PAINTING:

The pipes shall be finally provided with synthetic enamel paint of approved quality for exposed pipes after the Hydrostatic test pressure. The cost of such painting should be included to the Contractor's quote.

5.3.6 MEASUREMENTS:

The length above ground shall be measured in running meter correct to a cm for the finished work, which shall include G.I. pipe and G.I. fittings such as bends, tees, elbows, reducers, crosses, plugs, sockets, nipples and nuts, unions etc... Deductions for length of valves shall be made. Rate quoted shall be inclusive of all fittings, clamps, cutting holes chased and making good the same and all items mentioned in the specifications and Bill of Quantities.

5.4 EXTERNAL WORKS:

5.4.1 MATERIALS:

5.4.1.1 G.I. PIPES

i. The pipes shall be galvanised mild steel threaded pipes conforming to the requirement of IS: 1239 Part-I for heavy grade upto 150mm dia and IS: 3589 for pipes above 150mm dia. They shall be of the dia (nominal bore) specified in the description of the item. Galvanising shall confirm to IS: 4736.

ii. The pipes shall be clearly finished, well galvanised in and out and free from cracks, surface flow, laminations and other defects. All screw threads shall be clean and well cut. The ends shall be cut cleanly and square with axis of the tube.

iii. All screw tubes shall have pipe threads conforming to the requirements of IS: 544-1955 (or revised).

5.4.1.2 G.I. FITTINGS

i. All fittings shall be conforming to IS: 1239 Part II (or as revised). All fittings shall have manufacturer's trade mark stamped on it. Fittings in G.I. pipe lines shall include elbows, tees, bends, reducers, nipples, union, G.I. Clamps / Steel structural supports of approved design, nuts, bolts, washers, etc. All fittings shall be tested at manufacturer's works. Contractors may be required to produce certificate to this effect from the manufacturers.

ii. The fittings shall have screw threads at the ends conforming to the requirements of IS: 544-1955 (or revised). Female threads on fittings shall be parallel and male threads (except on running nipples and collars of unions) shall be tapered.

iii. Contractor shall provide adequate number of unions on all pipes to enable dismantling later. Unions shall be provided near each gunmetal valve, stop cocks, or check valves and on straight runs as necessary at appropriate locations as required and/or directed by Client's Representative.

5.4.1.3 CUTTING AND JOINTING:

i) The pipes and fittings shall be inspected at site before use to ascertain that they conform the specification given in para no. 5.4.1.1 above. The defective pipes shall be rejected. Where the pipes have to be cut or re-threaded, the ends shall be carefully filled out so that no obstruction to bore is offered. The end of the pipes shall then be threaded conforming to the requirements of IS: 544-1955 with pipe dies and taps carefully is such a manner as will not result in slackness of joints when the two pieces are screwed together. The taps and dies shall be used only for straightening screw threads which have become bend or damaged and shall not be used for turning of the threads so as to make them slack, as the later procedure may not result in water tight joint.

ii) The screw threads of pipes and fittings shall be protected from damage until they are fitted.

iii) The pipes shall be cleaned and cleared of all foreign matter before being laid. In jointing the pipes, the inside of the socket and the screwed end of the pipes shall be oiled and rubbed over with white lead and a few turns of spun yarn wrapped round the screwed end of the pipe. The end shall then be screwed in the socket. Care should be taken that all pipes and fitting are properly jointed so as to make the joints completely water tight and pipes are kept at all times free dust and dirt during the fixing. Burr from the joint shall be removed after laying. The open ends of the pipes shall be temporarily plugged to prevent access of water, solid or any other foreign matter.

5.4.1.4 INSTALLATION:

i) Trenches :

The galvanised iron pipes and fittings shall be laid in trenches. The widths and depths of the trenches for different diameters of the pipes shall be as in Table below:-

Dia of pipe	**Width of trench**	**Depth of trench**
15 mm to 50 mm	30 cm	60 cm
65 mm to 150 mm	45 cm	75 cm

At joints the trench width shall be widened where necessary. All G.I. / C.I. pipes below ground in trenches minimum cover over pipes shall be 60cm. Covered shall be measured from top of pipe to the surface of ground. The bed of the trench if in soft or made up earth, shall be well watered and rammed before laying the pipes and depressions if any shall be properly filled with earth and consolidated in 20cm layers.

If the trench bottom is extremely hard and rocky or loose stony soil, the trench shall be excavated at least 150mm below the trench grade. Rocks, Stone or other hard substances from the bottom of the trench brought back the required grade by filling with selected fine earth or sand and compacted so as to provide smooth bedding for the pipe. When excavation required blasting operation, it shall be ensured that no pipes have be stacked in the vicinity and completed pipe in the vicinity has already been covered before starting of blasting operations; this is necessary to prevent damage to the exposed pipe in the vicinity by falling stone as result of blasting.

After the excavation of the trench is completed, hollows shall be cut at the required position to receive the socket of the pipes and these hollows shall be of sufficient depth to ensure that the barrel of the pipes shall rest throughout their entire length on the solid ground and that sufficient spaces lift for jointing the under side of the pipe joint. These socket holes shall be refilled with sand after jointing the pipe.

Roots of tree within distance of about 0.5 meter from the side of the pipe line shall be removed or killed.

The excavated materials shall be placed within 1 meter or half of the depth of the trench, whichever is greater, from the edge of the trench. The material excavated shall be separated and stacked so that in refilling they may be re-laid and completed the same order to satisfaction of the Client's Representative.

The filling shall be done in layers not exceeding 15mm in depth. Each layer shall be watered, rammed and consolidated. Ramming shall be done with iron rammers where possible and with blunt end of the crow brass where rammers cannot be used. Special care shall be taken to ensure that no damage is caused to the pipes, drains, masonry or concrete in the trenches.

Filling in trenches shall be commenced soon after the joints of pipes, cables; conduits etc. have been tested and approved by Client's Representative. The space around the pipes shall be cleared of all debris where the trenches are excavated in hard/soft soil. The filling shall be done with earth on the sides and tops of pipes in layers not exceeding 15mm in depth. Each layer shall be watered rammed and consolidated. The clods and lumps of earth exceeding 8cm in any direction shall be broken or removed before the excavated earth is used for filling. Generally no test is done to determine the instrument diversity of filled earth but on the discretion of Client's Representative the 95 proctor's compaction test may be done to ensure the in situ density after filling. Consolidation is removal of water from the pores and compaction is the explosion of air from the pores. In case of refilling consolidation places most important role as the watering of the each layer is being done properly. If required by the Client's Representative proctors needle may also be used for the proper checking of the refilling items of in situ density.

ii) Pipe Protection:

For underground G.I. pipes following treatment will be given:

Coat of hot bitumen R 85/25

a) Wrapping of fiberglass tissue.
b) Coat of hot bitumen R 85/25 over fiberglass tissue.

The pipes shall be laid on a layer of 7.5 cm sand and filled upto 15 cm above the pipes. The remaining portion of the trench shall then be filled with excavated earth. The surplus earth shall be disposed off as directed.

iii) Jointing :

The pipes shall be cleaned and cleared of all foreign matter before being laid. In jointing the pipes, the inside of the socket and the screwed end of the pipes shall be oiled and rubbed over with white lead and a few turns of spun yarn wrapped around the screwed end of the pipes. The end shall then be screwed in the socket, tee etc with the pipe wrench. Care shall be taken that all pipes and fittings are properly jointed so as to make the joints completely water tight and pipes are kept at all times free from dust and dirt during fixing. Burr from the joints shall be removed after screwing. After laying, the ends of the pipes shall be temporarily plugged to prevent access of water, soil or any other foreign matter.

iv) Thrust Blocks :

In case of bigger pipes (80 mm dia and above), thrust blocks of cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate of 20 mm nominal size) shall be constructed on all bends as directed by the Client's Representative.

5.4.1.5 TESTING:

i. All external water supply pipes shall be tested by hydrostatic pressure of 1.5 times the working pressure or 7.5 Kg/Sq.cm whichever is more.

ii. Pressure shall be maintained for a period of at least 180 minutes without any drop in the pressure after fixing at site.

iii. In addition to the sectional testing carried out during the construction. Contractor shall test the entire installation after connections to the hydropneumatic system or pumping system. He shall rectify all leakages, and shall replace all defective materials in the system. Any damage done due to careless will has to be replaced by the Contractor.

iv. The initial back fill shall be placed evenly in a layer of about 100mm thick. This shall be properly consolidated and this shall be continued till there is a cushion of at least 300mm of cover over the pipe.

v. The joint or coupling during the testing of mains shall be left exposed for inspection before cover-up, sufficient back fill shall be placed on the pipe to resist the movement due to pressure while testing. In this way if any error if workmanship will be found shall immediately corrected at a minimum cost.

5.4.1.6 MASONRY CHAMBER:

i) All masonry chambers for stop cocks, sluice valves and meter etc. shall be built as per supplied drawings.

ii) The excavation for chambers shall be done true to dimension and level indicated on plans or as directed by the Client's Representative.

iii) Concrete shall be having cement concrete 1:2:4 (1 cement: 2 fine sand: 4 graded stone aggregate 40mm nominal size).

iv) Brick shall be in 1st class bricks in cement mortar 1:5 (1 cement: 5 fine sand).

v) Plastering not less than 12mm/15mm thick shall be done in cement mortar 1:3 (1 cement: 3 coarse sand) finished with a floating coat of neat cement for inside plaster and same for outside but with Rough plaster.

5.4.1.7 MEASUREMENTS:

All G.I pipes below ground shall be measured per linear meters (to the nearest cm) and shall be inclusive of all fittings e.g. coupling, tees, bends,

elbows, unions, deduction for valves shall be made rate quoted shall be inclusive of all fittings, excavation, back filling and disposal of surplus earth, cutting holes and chase and making good all item mentioned in Bill of Quantities.

All C.I. class (LA) pipes below ground level shall be measured per linear meter (to the nearest cm) and shall be inclusive of all fittings e.g. tees, elbows, bends, deduction for valves shall be made. The portion of the pipe within the collar at the joints shall not be included in the length of the pipe work. Rate quoted shall be inclusive of all fittings, excavation, back filling of surplus earth including consolidation and compaction of earth.

5.5 VALVES:

5.5.1 BUTTERFLY VALVES:

All the isolation valve 50cm and above on the equipment and water lines, where specified or shown on drawings shall be wafer type butterfly valves. They shall be designed to fit without gaskets, the water tight seal being obtained by EPDM seat projection at the faces compressed between the flanges. The valves shall be supplied inclusive of M.S. pipe flanges and high tensile steel bolts of dimensions recommended by suppliers of valves. The valves shall comply with following specifications:

a)	Test Pressure	: Body 24 Bar, Seat 16 Bar
b)	Valve Component	: Material of Construction
i)	Body	: Cast Iron, Gr. FG 260, IS:210
ii)	Disc iron, Gr, FG 260	: Nylon or Epoxy powder coated high duty
iii)	Stem Part-II.	: Stainless Steel or carbon steel IS: 1570,
iv)	Seat	: EPDM
v)	Hand Lever	: Cast Iron (Mechanical Memory Stop)
vi)	Bearings	: PTFE or Nylon covered S.S. bush bearings at stem and pivot.
vii)	Primary Seal	: Reinforced PTEE slide bearings
viii)	Temperature	: 80 Degree C (max.)

5.5.2 INSTALLATION:

Valve shall be installed in a manner that allows future removal and service of the valve.

Packing and gasket shall not contain asbestos.

The valve shall be of the same size as the pipe to which they are installing.

Valve above 150mm diameter shall be self locking warm gear type water proof and protory lubricated.

Provide chain operators with chain cleats for all valves more than 2.4 meters above floor.

5.5.3 NON RETURN VALVES:

All non-return valves shall be provided as shown in the drawings conforming to relevant Indian Standards and in accordance with the following specifications.

Size	**Construction**
Ends	
Up to 50 mm. Screwed	Gun metal
65 mm and above flanged	Gun metal/cast iron

Non-return valves shall be of approved make. Flap type non-return valve shall be used and tested to 15 Kg. / Sq.cm. pressure.

5.5.4 BALL VALVES (FLOAT VALVE):

The ball valve shall be of high pressure class and shall be confirm to IS: 1703 of sizes as specified. The nominal size of a ball valve shall be that corresponding to the size of the pipe to which it is fixed. The ball shall be of brass or gun metal as specified and the float shall be of polythene sheet. The minimum gauge of copper sheet used for making the float shall be 0.45mm for float upto 115mm dia and 0.55mm for float exceeding 115mm dia and shall be special in shape. The valve shall be constructed to permit replacing without console of the valve body from the valve line and the system shall not blow out under pressure. The jointing of the float shall be made by efficiently burnished, lapped and soldered seam or by bracing. Plastic float may also be used if specified. The body of ball valve when assembled in working conditions with the float immersed to not more than half of its volume shall remain closed against a test pressure of 10.5 Kg/Sq.cm. All ball valves shall be capable of withstanding a pressure of 14 Kg/Sq.cm.

The ball valve shall generally conform to IS specifications No. 1703-1962.

5.5.5 BALL VALVES:

The ball valve shall be of Brass or Gunmetal as specified conforming to IS: 1703. The ball valve shall be as given below:

High Pressure:
Indicated by the abbreviation 'HP' for use on mains having pressure. These shall remain closed at a test pressure of 10.5 Kg/Sq.cm.

SL. NO.	NOMINAL SIZE OF BALL VALVE					
	15 mm	20m	25m	32m	40m	50m
1. Diameter of spherical float (mm)						
High Pressure	127	152	203	229	254	305
Low Pressure	114	127	178	203	203	254
Minimum weight of ball valve including back nut, body and piston (gms)	283	446	823	114	158	1852

The ball valves shall be of following nominal sizes 15mm, 20mm, 25mm, 32mm, 40mm and 50mm. The nominal size shall correspond with the nominal bore of the inlet shanks.

5.5.6 AIR VALVES:

Air valves shall be provided in all high points in the system to prevent air locks as shown on the drawings or directed by Client's Representatives.

5.5.7 TESTING:

All valves shall be tested while installed in pipe by hydrostatic pressure of 1.5 time of the working pressure 7.5 Kg/Sq.cm whichever is more.

5.5.8 MEASUREMENTS:

All valves as mentioned in Bill of Quantities shall be measured by numbers and shall include all items mentioned in the Bill of Quantities.

5.6 CHLORINATION OF DOMESTIC WATER LINES:

5.6.1 After the completion of all the hot and cold water service piping, disinfect all the fresh water supply work and water reservoirs using a chlorine solution.

5.6.2 CHLORINATED SYSTEMS SHALL INCLUDE:

i. Domestic fresh water tanks
ii. Fire water tanks
iii. All pipe work systems receiving suction from the above mentioned tanks apart from the fire systems.

5.6.3 Before handover of the system, submit to the consultant copies of the certification of performance and laboratory report (if required)

5.6.4 Under no circumstances the use of any portion of the fresh water system until it is properly disinfected, flushed and certified shall be permitted.

5.6.5 During the Chlorination work the Contractor shall take all necessary precautions to prevent site staff from drinking the system water. Such precautions shall include looking doors to 'wet' areas and providing warning signs in English and Hindi.

5.7 CPVC PIPES & FITTINGS:

i. The pipes and fittings chemically known as Chlorinated Poly Vinyl Chloride [CPVC] shall be produced in Copper Tube Size [CTS] from ½" to 2" with two different standard dimensional ratios – SDR 11 and 13.5. The fittings shall be produced as per SDR 11. All the CPVC pipes and fittings in SDR 11 and SDR 13.5 shall be made from the identical CPVC compound having the same physical properties. Pipes and fitting shall be produced as per SDR 11 & shall meet the requirement of ASTM D 2846 where as the pipes produced with SDR 13.5 shall meet the requirement derived from ASTM F 442, specific to CPVC in Iron Pipe Size[IPS] dimension, which also shall be applied to CPVC pipes in Copper Tube Size[CTS] dimension.

5.7.1. CUTTING AND JOINTING AND INSTALLATION OF CPVC PIPES & FITTINGS:

i. CUTTING:

In order to make a proper and neat joint, the pipe length shall be measured accurately and make a small mark. Ensure that the pipe and fittings are size compatible. It shall be easily cut with a wheel type plastic pipe cutter or hacksaw blade. Cutting tubing as squarely as possible shall provide optimal bonding area within a joint.

ii. DEBURRING / BEVELING:
Burrs and filings shall prevent proper contact between tube and fitting during assembly and should be removed from the outside and inside of the pipe. A pocket knife or file shall be used for this purpose. A slight bevel on the end of the tubing shall ease the entry of the tubing into the fitting socket.

iii. FITTING PREPARATION:
Using a clean, dry rag, wipe dirt and moisture from the fitting sockets and tubing end. The tubing should make contact with the socket wall 1/3 to 2/3 of the way into the fitting socket.

iv. SOLVENT CEMENTS APPLICATION:
Use only CPVC cement or an all – purpose cement conforming to ASTM - 493 or joint failure may result. When making a joint, apply a heavy, even coat of cement to the pipe end. Use the same applicator without additional cement to apply a thin coat inside the fitting socket. Too much cement can cause clogged water ways.

v. ASSEMBLY:
Immediately insert the tubing into the fitting socket, rotate the tube ¼ to ½ turn while inserting. This motion will ensure and even distribution of cement within the joint. Properly align the fittings. Hold the assembly for approximately 10 seconds, allowing the joint to set-up.

vi. SET AND CURE TIMES:
Solvent cement set and cure times are a function of pipe size, temperature and relative humidity. Curing time is shorter for drier

environments, smaller sizes and higher temperatures. It requires 10 to 20 minutes for perfect joint.

vi. CEMENTING:

- Verify the cement is the same as the pipes and fittings being used.
- Check the temperature where the cementing will take place.
  - Cement takes longer time to set up in cold weather. Be sure to allow extra time for curing. Do not try to speed up the cure by artificial means – this could cause porosity and blisters in the cement film.
  - Solvents evaporate faster in warm weather. Work quickly to avoid the cement setting up before the joint is assembled. Keep the cement as cool as possible. Try to stay out of direct sunlight.
- Keep the lid on cements, cleaner and primers when not in use. Evaporation of the solvent will affect the cement.
- Stir or shake cement before using.
- Use ¾" dauber on small diameter pipes, 1 ½" dauber up through 3" pipe, and a natural bristle brush, swab or roller ½ the pipe diameter on pipes 4" and up.
- Do not mix cleaner or primer with cement.
- Do not use thickened or lumpy cement. It should be like the consistency of syrup or honey.
- Do not handle joints immediately after assembly.
- Do not allow dauber to dry out.
- Maximum temperature allowable for CPVC pipe is 180° F.
- All colored cements, primers and cleaners will have a permanent stain. There is no known cleaning agent.
- Use according to the step outline in ASTM D – 2846, joining of pipe and fittings.

5.7.2 TESTING

After laying and jointing, the pipes and fittings shall be inspected under working condition of pressure and flow. Any joint found leaking shall be redone and all leaking pipes removed and replaced without extra cost. Use of any compound or stop leak compound will not permit.

The pipes and fittings after they are laid shall be tested to hydraulic pressure of 1.5 times the working pressure or 7.5 Kg/Sq.cm whichever is more. The pipes shall be slowly and carefully charged with water allowing

all air to escape and avoiding all shock or water hammer. The draw of taps and stop cocks shall then be closed and specified hydraulic pressure shall be applied gradually. Pressure gauge must be accurate and preferably should have been recalibrated before the test. The test pump having been stopped, the test pressure should be maintained without loss for at least two hours. The pipes and fittings shall be tested in sections as the work of laying proceeds, having the joints exposed for inspection during the testing.

5.7.3 MEASUREMENTS

The length above ground shall be measured in running meter correct to a cm for the finished work, which shall include G.I. pipe and G.I. fittings such as bends, tees, elbows, reducers, crosses, plugs, sockets, nipples and nuts, unions etc... Deductions for length of valves shall be made. Rate quoted shall be inclusive of all fittings, clamps, cutting holes chased and making good the same and all items mentioned in the specifications and Bill of Quantities.

5.8 COMPOSITE PIPES & FITTINGS :

(a) The pipe shall conform to IS 15450 2004 having welded aluminium tube reinforcement between inner & outer polyethylene layers being bonded to aluminium tube by a melt adhesive with welded aluminium tube. The pipe dimensional detail shall be :

Nominal pipe size	Equivalent NB size	Wall thickness in mm	
ID : OD	In inch.	Minimum	Maximum
12:16	½	1.75	2.00
16:20	¾	2.00	2.25
20:25	1	2.45	2.70
25:32	1x1/4	2.80	3.20
32:40	1x1/2	3.40	3.80

(b) The test pressure rating shall be as below :

Nominal pipe size	**Minimum Burst Pressure**
ID : OD	in kg per sq.cm
12:16	60
16:20	50
20:25	40
25:32	40
32:40	35

(c) The internal test pressure rating for fittings shall be as below :

Nominal pipe size	**Minimum Burst Pressure**
ID : OD	in kg per sq.cm
12:16	34.30
16:20	26.70
20:25	26.70
25:32	23.00
32:40	22.30

(d) The fittings shall withstand the following condition & the manufacturer

shall submit the test certificate for the following:

Test Temperature :	83 deg Celcius	
Test Pressure	:	3.5 kg per sq.cm.
Test duration	:	3000 hrs.

(e) Jointing:

Jointing shall be done by using proper fittings. Proper tools shall be used for the same

(f) Installation:

The pipe bending shall be done by using proper supports springs, either internal or external. The bending radius shall not be less than 5 times the OD of the pipe.

For concealed piping no supports shall be required but for exposed piping, the spacing of supports shall be as below:

The test pressure rating shall be as below:

Nominal pipe size	Support spacing for horizontal pipe lines	Support spacing for vertical pipe lines
ID : OD	in mtr.	In mtr.
12:16	0.80	1.00
16:20	0.80	1.00
20:25	1.00	1.00
25:32	1.20	1.20
32:40	1.20	1.20

5.8.1 INSULATION

5.8.1.1 All the Hot Water supply & Hot Water return pipe shall be insulated in the manner specified hereinafter.

5.8.1.2 Insulating material shall be rigid performed sections of mineral/rock wool with a "K" value of not more than 0.036 W/MK at 100 Deg. C mean temperature and of density 140 Kg/Cu.m

5.8.1.3 No insulation shall be applied until the pipe is satisfactorily pressure tested.

5.8.1.4 Pipes shall be insulated with rigid performed pipe sections of the following thickness:

Pipe Diameter (mm)	**Thickness (Mineral Wool) mm**
80-150	50

5.8.1.5 Pipe insulation shall be applied as follows OR AS SPECIFIED IN BOQ:

Pipe shall be thoroughly cleaned with wire brush and rendered free from all rust and grease and applied with two coats of anti-rust paint.

a) Pipes in Shaft:

i) Fix rigid performed sections of insulation with adhesive between all points (transverse and circumferential).

ii) The insulation shall be tied with GI chicken wire mesh.

iii) The insulation shall be provided with 24 gauge aluminium cladding screwed at the joints with cadmium coated self tapping screws. Joints shall be overlapped minimum 12mm wide.

b) Pipes exposed to weather:

i) Same as (a) (i) to (ii)

ii) Provide polythene based hessian (500 gauges) overlapping 100mm on all joints (transverse and circumferential) and stitched at the joints.

iii) The hessian shall be covered with 15mm x 20mm hexagonal chicken wire mesh.

iv) Over the wire mesh the surface shall be covered with two layers of tarfelt grade-II and type-II with bitumen between layer overlapping 100mm on all joints (transverse & circumferential).

v) Over the second layer of tarfelt final coat of hot bitumen not less than 6mm thick shall be applied.

vi) Over the final layer of tarfelt and hot bitumen coat aluminium cladding shall be provided with 24 gauge aluminium shut screwed at the joints with cadmium coated self-tapings screws. Joints shall be overlapped minimum 25mm wide.

c) Pipes Buried Underground:

i) Rigid pipe sections of insulation shall be fixed tightly to the surface taking care to seal all joints with 50mm wide aluminium adhesive tape (transverse and circumferential).

ii) The insulation shall be tied with aluminium band not less than 6mm width and 24 gauge 4 bands per meter or equivalent plastic band using G.I. sheet clamp crimped at the joints.

iii) Wrap the insulation with polythene sheet 400 gauges. Polythene sheet shall be tied with 6mm, 24 gauge, aluminium band 4 bands per meter or equivalent plastic tape using GI sheet clamp crimped at the joint.

iv) The polythene surface shall be covered with two layers of tarfelt grade – II, type – II with bitumen between layers overlapped 100mm on all joints (transverse and circumferential).

v) Over the second layer of tarfelt final coat of hot bitumen not less than 6mm thick shall be applied.

5.8.1.6 TESTING

After laying and jointing, the pipes and fittings shall be inspected under working condition of pressure and flow. Any joint found leaking shall be redone and all leaking pipes removed and replaced without extra cost. Use of any compound or stop leak compound will not permit.

The pipes and fittings after they are laid shall be tested to hydraulic pressure of 1.5 times the working pressure or 7.5 Kg/Sq.cm whichever is more. The pipes shall be slowly and carefully charged with water allowing all air to escape and avoiding all shock or water hammer. The draw of taps and stop cocks shall then be closed and specified hydraulic pressure shall be applied gradually. Pressure gauge must be accurate and preferably should have been recalibrated before the test. The test pump having been stopped, the test pressure should be maintained without loss for at least two hours. The pipes and fittings shall be tested in sections as the work of laying proceeds, having the joints exposed for inspection during the testing.

5.9. Copper Pipes & Fittings

The pipes shall be hard tempered copper pipes and tubes confirming to requirements of BS 2871 Table 'X' Part -1-1971 and the fittings shall confirm to BS 864 Part 2.
The fittings shall be as follows:

a. Internal Solder Ring (ISR) fitting: For pipes from 15 mm to 35 mm dia.
b. Endex Fittings: For pipes from 42 mm to 54 mm dia.
c. End brazes Fittings: For pipes from 67 mm dia and above.

Fabricated fittings in NO case shall be allowed. Fittings of all types such as Tees, Crosses, Elbows, Reducers, Unions, Off Sets etc. shall be used on the pipes. Suitable fittings of approved type and make shall be used for jointing copper pipes to GI pipes and for-jointing copper pipes to CP fittings etc. shall be used. Use of DZR fitting shall be made for all connections.

Laving: and .Jointing: Of Copper Pipes and Capillary Fittings

The copper" pipes and fittings shall run in wall chase or ceiling or as specified, The fixing shall be done by means of standard pattern holder bat clamps keeping the pipes about 1.5 mm clear of the wall where to be laid on surface. Where it is specified to conceal the pipes, chasing may be adopted. For pipes fixed in the shafts, ducts, etc. there should be sufficient space to work on the pipes with the usual tools. As far as possible, pipes inlays are buried for short distances provided adequate protection is given against damage and where so required special care to be taken at joints. Where directed by the Owner's Site Representative I Architect, pipe sleeves shall be fixed at a place the pipe is passing through a wall or floor for reception of the pipe and allow freedom for expansion and contraction and other movements. In case of pipe is embedded in walls or floors it shall be covered with a protective tape wrapped around the pipes and fittings.

Copper pipes shall be jointed with approved above mentioned fitting conforming to BS 864 Part 2. Care shall be taken to remove any burr from the end of the pipes after cutting. Only fittings of the size suitable to the

pipe shall be used. The ends of the tube shall be cut to the correct size using a tube cutter or a fine blade hacksaw. Care shall be taken to ensure that the ends of the tube are cut perpendicular to the axis of the tube and that the ends remain undamaged and free of burrs. Any burrs remaining shall be removed with a smooth file. Clean the outside surface of the tube that shall go into the fitting. Flux shall be applied on the pipe surface ensuring even and uniform application. Insert the tube into the fittings and push home until the stop is reached. Wipe off excess flux with a soft cloth. Now the assembled joint shall be heated with a blow torch or any similar appliance that emits a clean, blue, soot free flume. The heat shall be turned off once a complete ring of solder has appeared around the mouth of the fitting.

The joint shall be allowed to cool without disturbance.

All copper pipes to G.I. pipe and connection with the valves and faucets shall be with De-zincified Resistance fittings (DZR).

5.10. ASTM - PVC PIPES & FITTINGS

5.10.1 SCOPE:

This specification covers the requirements for manufacture, supplying, lowering, laying, jointing, testing and commissioning of ASTM solvent welded PVC pipe with fittings for the conveyance & distribution system for above ground as well as below ground installation with required civil work.

5.10.2 CODES & STANDARDS:

The manufacturing, testing, supplying, jointing and testing at work sites of PVC pipes shall comply with all currently applicable statutes, regulations, standards and codes. in particular, the following standards, unless otherwise specified herein, shall be referred.

5.10.3 MATERIALS

ASTM D 1785 Pipes, SCH	-	Specification for Poly Vinyl Chloride (PVC) Plastic 40 & SCH 80.
ASTM D 2466 40	-	Socket type Vinyl Chloride Plastic Pipe Fittings SCH
ASTM D 2467 80	-	Socket type Vinyl Chloride Plastic Pipe Fittings SCH
ASTM D 2564	-	Solvent Cement for Plastic Pipes & Fittings
ASTM D 2774	-	Underground installation of Thermo plastic Pipes

5.10.4 DESIGN

Design of uPVC pipes shall be according to ASTM D-1785 & fittings shall be made according to ASTM D-2467 (for Schedule 80). The pipe shall have socketed solvent welded fittings.

5.10.5 TRENCHING

5.10.6 The width of the trench at the crown of the pipe shall be not less than the outside diameter of pipe plus 300 mm to allow proper compaction of the side fills & at a 225 mm above the crown of the pipe. The trench width shall be as below :

NOMINAL PIPE SIZE (IN MM)	TRENCH WIDTH MIN. (IN MM)	TRENCH WIDTH MAX. (IN MM)
110	450	600
160	450	600
200	600	700
225	600	700
250	600	700
315	700	850
355	750	900
400	800	950
450	850	1000

5.10.7 The minimum trench depth shall be width plus outer diamter of pipe or 0.75 mtr. above crown of pipe whichever is more.

5.10.8 The trench shall be backfilled as soon as possible.

5.10.9 The excavated material shall be deposited at a sufficient distance away from the edge of the trench to avoid damage to the pipes through falling stones & debris.

5.10.10 Pipe shall be laid with a cover, measured from the top of the pipe to the surface of the ground of not less than1.2 mtr. under roads

5.10.11 The pipe bedding shall be with a granular material & backfilling shall be performed in layer of 6 inch with each layer & shall be sufficiently compacted to 85% to 95% compaction.

5.10.12A meachanical compaction shall be carried out for compacting sand & gravel backfill. Optionally manual compaction shall be carried out.

5.10.13A trench shall be compeltely filled & backfilling shall be palced & spread in uniform layers to prevent any unfilled spaces or voids. Large rocks, stones, etc. shall be removed. Heavy tampers or rolling equipment shall be used for final backfilling only.

5.11 PIPE HANDLING & STORAGE :

5.11.1 The pipe shall not be pushed or dragged from the truck bed. Pallets for pipe shall be removed with a fork lift. Loose pipe can be rolled down on timber.

5.11.2 The pipe shall be stored in open ground which shall be dry & free from sharp objects.

5.11.3 The pipe shall be protected from the sun & shall be in area with proper ventilation.

5.11.4 If the pipe shall be stored in racks or it shall be supported throughtout its length with the spacing not more than 3 feet.

5.12 LAYING & JOINTING :

5.12.1 Pipe shall be cut sqaure with the special tool.

5.12.2 The inside & outside edges shall be cleaned form any burrs with file or deburring tool.

5.12.3 The surface shall be cleaned with a clean dry cloth.

5.12.4 With light pressure, pipe should go one third to one half of the way into the fitting socket.

5.12.5 Pipes & fittings that are too tight shall not be used. Use an applicator having size equal to one half the pipe diameter.

5.12.6 For jointing, full even layer of cement shall be povided on external surface of the pipe & medium layer of cement shall be provided to the inside of a fitting

5.12.7 Pipe & fittings shall be assembled & pipe shall give a qaurter turn.

5.12.8 The piping (for sch. 40) shall be supported by the means of hangers having recommended spacing as below :

NOMINAL PIPE SIZE (MM)	**TEMPERATURE IN DEG. C**				
	15.5	26.6	37.7	48.8	60
15	4.5 MTR.	4.5 MTR.	4 MTR.	2.5 MTR.	2.5 MTR.
20	5 MTR.	4.5 MTR.	4 MTR.	2.5 MTR.	2.5 MTR.

25	5.5 MTR.	5 MTR.	4.5 MTR.	3 MTR.	2.5 MTR.
32	5.5 MTR.	5.5 MTR.	5 MTR.	3 MTR.	3 MTR.
40	6 MTR.	5.5 MTR.	5 MTR.	3.5 MTR.	3 MTR.
50	6 MTR.	5.5 MTR.	5 MTR.	3.5 MTR.	3 MTR.
63	6.5 MTR.	6 MTR.	5.5 MTR.	4 MTR.	3 MTR.
75	7 MTR.	7 MTR.	6 MTR.	4 MTR.	3.5 MTR.
100	7.5 MTR.	7 MTR.	6.5 MTR.	4.5 MTR.	4 MTR.
150	8.5 MTR.	8 MTR.	7.5 MTR.	5 MTR.	4.5 MTR.

5.12.9 The pipe joint setting & curing time shall be recommended as :

5.12.10SET TIME :

Temperature	Pipe size	Pipe Size	Pipe Size
Range	15 mm to 32 mm	40 mm to 75 mm	100 & 150 mm
15.5-37.7 deg C	15 minute	30 minute	60 minute
4.4-15.5 deg C	60 minute	120 minute	240 minute

5.12.11CURE TIME :

Temperature	Pipe size	Pipe Size	Pipe Size
Range	15 mm to 32 mm	40 mm to 75 mm	100 & 150 mm
15.5-37.7 deg C	6 hrs.	12 hrs.	24 hrs.
4.4-15.5 deg C	12 hrs.	24 hrs.	48 hrs.

5.12.12 To compensate the expansion & contraction, suitable means shall be provided by expansion loops with 90 deg elbows / bellows subject to the application for the above ground installation

5.12.13 For underground application, the compensation for expansion & contraction shall be done by anaking the pipe in trench.

5.13 TESTING :

5.13.1 The pipe shall be tested with water. Before testing, it shall be properly anchored.

5.13.2 Thrust blocks shall be provided at dead ends, at change in direction & at cahnge in size.

5.13.3 The piping shall be slowly filled with water with velocity not exceeding 1ft./sec.

5.13.4 Vents shall be provided at high points & air shall be release before testing.

5.13.5 All valves & vents shall kept open during testing to release the air.

5.13.6 The piping shall be tested for 125% of design working pressure for one hour maximum

5.13.7 During testing, if any joint is leaking, it shall be cut & replaced.

6.0 INTERNAL DRAINAGE (SOIL, WASTE, VENT AND RAIN WATER PIPES):

6.1 SCOPE:

6.1.1 Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install all soil, waste, vent and rainwater pipes as required by the drawings, specified hereinafter and given in the Bill of Quantities.

6.1.2 Without restricting to the generality of the foregoing, the soil, waste, vent and rainwater pipes system shall include the followings:-

i. Cast Iron / UPVC vertical and horizontal soil waste and vent pipes, rainwater pipes and fittings, joints clamps and connections to fixtures.

ii. Floor traps, floor drain clean out plugs, inlet fittings and rainwater roof drain, area/local drains, trench drain...

iii. Waste pipes connections from all fixtures e.g. wash basins, sinks,

kitchen equipment.

iv. Testing of all pipes.

v. Connection of main.

6.2 GENERAL REQUIREMENTS

6.2.1 All materials shall be new of the best quality conforming to specifications and subject to the approval of Client's Representative.

6.2.2 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.

6.2.3 Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

6.2.4 Pipes shall be securely fixed to walls by suitable clamps at intervals specified.

6.2.5 Access doors for fittings and cleanouts shall be so located that they are easily accessible for repair and maintenance.

6.2.6 All works shall be executed as directed by Client's Representative.

6.3 CAST IRON PIPES & FITTINGS

6.3.1 Soil, waste, vent and anti-siphonage pipes shall be cast iron pipes with socket and spigot. All pipes shall be straight and smooth and inside free from irregular bore, blow holes, cracks and other manufacturing defects. Pipes shall be centrifugally spun iron soil pipes conforming to sand cast I.S. 1729-1967.

6.3.2 STANDARD WEIGHT DIMENSIONS AND PIG LEAD REQUIRED FOR JOINTS SHALL BE AS FOLLOWS:-

For conforming to I.S. 1729-1967 (sand cast iron soil pipes and fittings)

Diameter	**Thickness**	**Overall Depth**	**Weight 6'length or 1.83 M**	**Internal diameter of socket**	**Depth of lead**
50	5		11.41	76	25
75	5		16.52	101	25
100	5		21.67	129	25
150	5		31.91	181	32

6.3.3 TOLERANCE

Acceptable tolerance for pipes to I.S. 1729 shall be as follows:-

a) Wall thickness -15%
b) Length ± 20 mm
c) Weight ± 10%

6.3.4 FITTINGS

Fittings shall conform to the corresponding Indian Standard as for pipes. Contractor shall use pipes and fittings of matching specification.
Access door shall be secured air and water tight with 3mm thick insertion rubber washer and white lead. The bolts shall be lubricated with grease or white lead for easy removal.

6.3.5 JOINTING:

All soil, waste and vent pipes including fixture connections between traps and soil pipes shall be jointed with refined pig lead conforming to IS: 27-1977 sufficient sken of jute rope shall be caulked to leave a minimum space for the pig lead as given in **6.3.2** to be poured in. After pouring the lead shall be caulked into the joint with caulking tool and hammer. All surplus lead shall be cut and joint left flush with the rim of the socket neatly.

6.3.6 Vent pipes penetration through roof shall be by means of sleeves. The sleeve will be kept 100mm higher the finish roof level and annular space filled with fire proof materials like putty, fire seal etc.

6.3.7 PIPE, HANGERS, SUPPORT, CLAMP, BRACKE ETC.:

All vertical pipes shall be fixed by M.S. Clamps truly vertical. Branch pipes shall be connected to the stack at the same angle as that of the fittings. No collars shall be used on vertical stacks. Each stack shall be terminated at top with a cowl (terminal guard).

Inclined pipes running along ceiling shall be fixed on M.S. adjustable hangers of special design shown on the drawings or as directed. Pipes shall be laid to uniform slope and the hangers adjusted to the proper levels so that the pipes fully rest on them.

M.S. clamps shall be of standard design and fabricated from M.S. flat 40mm x 3mm x 3mm thick. They shall be painted with two coats of black bitumen paint before fixing.

Structural clamps shall be fabricated from M.S. structural members e.g. rods, angles, channels, flats, as per detailed drawing or as directed. Contractor shall provide all nuts, bolts, welding and paint the clamps with one coat of red oxide. Wooden saddles shall be provided free of cost.

Slotted angle/channel supports on walls shall be provided wherever shown on drawings or as required. Angles/channels shall be fixed to brick walls and bolts embedded in cement concrete blocks and to RCC walls with suitable anchor fasteners. Holes required in RCC walls shall be neatly drilled by electric drills and no manual chiseling will be allowed. The spacing of supports horizontally shall not exceed 1.8 M.

Wherever M.S. clamps are required to be anchored directly to brick walls, concrete slabs, beams or columns, nothing extra shall be payable for clamping arrangement and for making good with cement concrete 1:2:4 (mix 1 cement :2 coarse sand :4 stone aggregate 20mm nominal size) as directed by the Client's Representative.

6.3.8 TESTING:

All pipe work shall be tested before connecting any appliances and then again after connection of appliances. Pipe shall be tested after installation by one of the test given below as directed by the Client's Representative.

Before use at site, all C.I. soil pipes shall be tested by filling up with water for at least 10 minutes at 3 meter head. After filling, pipes shall be struck with a hammer and inspected for blow holes and cracks. All defective pipes shall be rejected and removed from the site within 48 hours.

Water Test:

Pipes shall be tested after installation by filling up the stack with water. All openings and connections shall be suitable plugged. The total head in the stack shall however not 3 M exceed. The level of water in the stack shall not drop within 8 hours. If there is a drop in level of water the leak shall be detected and rectified and test shall be re-conducted until satisfactory result is achieved.

Smoke Test:

Contractor may test all soil and waste stacks by a smoke testing machine. Smoke shall be pumped into the stack after plugging all inlet and outlet connections.

The stack shall then be observed for leakages and all defective pipes and fittings removed or repaired as directed by the Client's Representative.

6.3.9 UPVC PIPES AND FITTINGS (RAIN WATER):

The pipes shall be round and shall be supplied in straight lengths with socketed ends. The internal and external surfaces of pipes shall be smooth, clean, and free from grooving and other defects. The ends shall be cleanly cut and square with the axis of the pipe. The pipes shall be designated by external diameter and shall conform to IS: 4985-1981.

OUTER DIA. (MM)	**PRESSURE (KG/CM^2)**	**INNER DIA. (MM)**	**WEIGHT/MT (KG.)**
110	4	104.5	1.315
125	4	118.7	1.712
140	4	133.0	2.131
160	4	152.0	2.783
180	4	175.9	3.560
200	2	190.1	4.526
225	4	213.8	5.480

Fittings:

Fittings shall be of the same make as that of pipes, injection moulded and shall conform to Indian Standard.

Laying and Jointing:

The pipes shall be laid and clamped to wooden plugs fixed above the surface of the wall. Alternatively plastic clamps of suitable designs shall be preferred. Provision shall be made for the effect of thermal movement by not gripping or disturbing the pipe at supports between the anchors for suspended pipes. The supports shall allow the repeated movements to take place without abrasion.

Jointing for UPVC pipes shall be made by means of solvent cement for horizontal lines and `O' rubber ring for vertical line. The type of joint shall be used as per site conditions/direction of the Client's Representative. Where UPVC pipes are to be used for rain water pipes, the pipe shall be finished with G.I. adopter for insertion in the R.C.C. slab for a water proof joint complete as directed by Client's Representative.

Supports:

UPVC pipes require supports at close intervals. Recommended support spacing for unplasticised PVC pipes is 1400 mm for pipes 50 mm dia and above. Pipes shall be aligned properly before fixing them on the wooden plugs with clamps. Even if the wooden plugs are fixed using a plumb line, pipe shall also be checked for its alignment before clamping, piping shall be properly supported on, or suspended from clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchors, clamps and hangers and be responsible for their structural sufficiency. Pipe supports shall be primer coated with rust preventive paint.

Repairs:

While temporary or emergency repairs may be made to the damaged pipes, permanent repairs should be made by replacement of the damaged section. If any split or chip out occurs in the wall of the pipe, a short piece of pipe of sufficient length to cover the damaged portion of the pipe is cut. The sleeve is cut longitudinally and heated sufficiently to soften it so that it may be slipped over the damaged hard pipe.

Testing:

All lengths of PVC rain water pipes shall be fully tested for water tightness by means of water test maintained for not less than 30 minutes. All pipes shall be subjected to a test pressure of at least 1.5 meter head of water head. The test pressure shall, however, not exceed 6 meter head at any point. The pipes shall be plugged preferably with standard design plugs with rubber plugs on both ends. The upper end shall, however, be connected to a pipe for filling with water and getting the required head.

6.3.10 WASTE PIPE FROM APPLIANCES:

i) Waste pipe from appliances e.g. wash basins, sinks, urinals, chrome plate where seen water coolers shall be of galvanised steel (heavy class) conforming to IS:1239-1979.

ii) All pipes shall be fixed in gradient towards the outfalls of drains. Pipes inside a toilet room shall be in chase unless otherwise shown on drawings. Where required pipes may be run at ceiling level in suitable gradient and supported on structural clamps. Spacing for clamps for such pipes shall be as follows:-

	Vertical	Horizontal
G.I. Pipes	300 cms	240 cms
P.V.C. Pipes	180 cms	120 cms

6.3.11 PAINTING

Soil, waste vent and rainwater pipes in exposed location, in shafts and pipe spaces shall be thoroughly cleaned to remove dirt, rust and other contamination, and painted with two or more coats of synthetic enamel paint to give an even shade.

Paint shall be of approved quality and shade, where directed pipes shall be painted in accordance with approved pipe colour code.

Waste pipes in chase shall be thoroughly cleaned to remove dirt, rust and other contamination, and painted with two coats of bitumen paint, covered with polythene tape and a final coat of bitumen paint. Exposed pipes shall be painted with two or more coats of synthetic enamel paint.

C.I. soil and waste pipes below ground and covered in cement concrete shall not be painted.

6.3.12 MEASUREMENTS:

C.I. / UPVC/ G.I. waste/soil, waste, vent and rain water pipes shall be measured over all along the center line correct to a centimeter including all fittings along its length. The rate for these pipes shall be inclusive of all fittings, holder bat clamps, lead caulked joint for C.I. and cement joints for UPVC and all other items described in the Bill or Quantities. The portion of the pipe within the collar for C.I./UPVC pipe at the joint shall not be included in the length of the pipe work.

6.4. SWR uPVC PIPES AND FITTINGS:

6.4.1 Soil, waste, vent SWR Ring Fit pipes with socket and spigot. All pipes shall be straight and smooth and inside free from irregular bore, blow holes, cracks and other manufacturing defects. These pipes conform to Indian Standard IS: 4985 – 2000 and are designed to withstand continuous internal hydraulic pressure of 4 Kgf/cm so as to ensure life-long trouble free working. The pipes are provided with an integral rubber ring type socket at one end while the other end is kept plain, smooth and free from burrs. Rubber ring type socket ends provide easy push – fit type jointing. Simultaneously, allowance for thermal expansion can also be provided during installation. Pipes shall be centrifugally spun iron soil pipes conforming to sand cast I.S. 1729-1967.

6.4.2 FITTINGS:

Fittings shall conform to the corresponding Indian Standard as for pipes. Contractor shall use pipes and fittings of matching specification.

Access door shall be secured air and water tight with 3mm thick insertion rubber washer and white lead. The bolts shall be lubricated with grease or white lead for easy removal.

6.4.3 JOINTING:

Rubber Seal Rings for Joints & Access Doors : Manufactured in accordance with IS : 5382 for 75 mm / 90 mm / 110 mm sizes. These are made out of natural rubber with a shore 'A' hardness pf 40 × 5. Provide superior resistance to biological attack. Special design of cross section ensures perfect sealing.

Lubricant: Available in 100 gms, 250 gms & 500 gms packing. Specially formulated for compatibility with rubber seal as well as PVC. Does not support the growth of bacteria or fungi.

6.4.4 PIPE, HANGERS, SUPPORT, CLAMP, BRACKE ETC.:

Supports:
UPVC pipes require supports at close intervals. Recommended support spacing for unplastisized PVC pipes is 1400 mm for pipes 50 mm dia and above. Pipes shall be aligned properly before fixing them on the wooden plugs with clamps. Even if the wooden plugs are fixed using a plumb line, pipe shall also be checked for its alignment before clamping, piping shall be properly supported on, or suspended from clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchors, clamps and hangers and be responsible for their structural sufficiency. Pipe supports shall be primer coated with rust preventive paint.

6.4.5 TESTING:

Before the system is put into use, it should be tested for leakages by air test, hydraulic test or smoke test.

6.5 TRAPS:

6.5.1 NAHANI TRAP OR FLOOR TRAPS:

Nahani traps or floor traps shall be cast iron/ PVC / , deep seal with an effective seal of 50 mm. The trap and waste pipes shall be set in cement concrete blocks firmly supported on the structural floor. The blocks shall be in 1:2:3 mix (1 cement: 2 coarse sand: 4 stone aggregate 20 mm nominal size) mixed with water proof compound and extended to 40 mm below finished floor level. Contractor shall provide all necessary shuttering and centering for the blocks. Size of the block shall be 30 x 30 cms of the required depth. The trap shall be installed at lowest point ensure no pending occurs at perimeters of the drain.

6.6 FLOOR TRAP INLET

Bath room traps and connections shall ensure free and silent flow of discharging water. Where specified, the Contractor shall provide a special type galvanised iron inlet fitting without or with one, two or three inlet sockets to receive the waste pipe. Joint between waste and fitting shall be connected to a C.I. 'P' or 'S' trap with at least 50mm seal (Hopper and traps shall be paid for separately). Floor trap inlet fittings and the trap shall be set in cement concrete blocks.

6.7 C.P./STAINLESS STEEL GRATINGS

Floor and Urinal traps shall be provided with 100-150mm square or round C.P./Stainless steel grating as approved by Client's Representative with rim, of approved design and shape. Minimum thickness shall be 4-5mm or as specified in the Bill of Quantities.

6.8 CLEANOUT PLUGS

Contractor shall provide cast brass cleanout plugs in all horizontal run more than 15 meter length required one cleanout plugs shall be threaded and provided with key holes for opening. Cleanout plugs shall be fixed to the pipe by a G.I. socket and lead caulked joint.

6.9 PIPE SLEEVES

Pipe sleeves 50mm larger diameter than pipes shall be provided wherever pipes pass through walls and slabs and annular space filled with fire proof materials like putty, fire seal etc. All pipes shall be accurately cut to the required sizes in accordance with relevant BIS codes and burs removed before laying. Open ends of the pipe shall be closed as the pipe is installed to avoid entrance of foreign matters. Vertical sleeve shall finish 50mm above finish floor level.

7.0 EXTERNAL DRAINAGE SYSTEM (SEWERAGE AND STORM WATER):

7.1 SCOPE:

i. Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install the drainage system as required by the drawings and specified hereinafter or given in the Bill of Quantities.

ii. Without restricting to the generality of the foregoing, the drainage system shall include:
Sewer lines including excavations, pipe lines, man holes, drop connections, underground storm water drains, including pipes, man holes, catch basins and open drains, thrust blocks.

7.2 GENERAL REQUIREMENTS:

All materials shall be new of the best quality conforming to specifications and subject to the approval of the Client's Representatives.

Drainage lines shall be laid to the required gradients and profiles.

All drainage work shall be done in accordance with the local municipal bye-laws.

Contractor shall obtain necessary approval and permission for the drainage system from the municipal or any other competent authority and also existing invert levels required to enter sanitary system.

Location of all manholes, catch basins, etc. shall be confirmed by the Client's Representatives before the actual execution of work at site.

All excavation, trenches etc shall be barricaded as per instruction of the Client's Representatives.

All works shall be executed as directed by the Client's Representatives.

7.3 TRENCHES FOR PIPE & DRAINS:

7.3.1 ALIGNMENT AND GRADE:

The drains are to be laid to alignment and gradients in continuous shown on the drawings but subject to such modifications, as shall be ordered by the Client's Representative from time to time to meet the requirements of the works. No deviations from the line, depths of cutting or gradients of sewers shown in the plans and sections shall be permitted except by the express direction in writing of the Client's Representative.

7.3.2 OPENING OUT TRENCHES:

In excavating the trenches at the road metaling, pavement kerbing etc. are to be placed on one side and preserved for rein statement when the trench or other excavation shall be filled-up.

Before any road metal is replaced, it shall be carefully shifted. The surface of all trenches and holes shall be restored and maintained to the satisfaction of the Client's Representative. The Contractor shall not cut or break down any live fence or trees in the line of the proposed works but shall tunnel under them unless the Client's Representative shall order to the contrary.

Trench to be excavated to alignment + depth required. Trench to be properly dressed and de-watered. Trench shall be kept free of water at all time. Discharge of water shall be into nearest drainage channel not on the road.

All under ground pipe to be laid open in trench. Pipes to be laid and maintained at required levels and grade during course of work. All joints to be aligned and complete.

Trench shall be of 450mm wide than pipe. Concrete anchors at change in direction for C.I. pipe shall be provided. Pipe shall be rest on cushion in the trench.

The Contractor shall scrub up and clear the surface over the trenches and other excavations of all stumps, roots and all other encumbrances affecting execution of the work and shall remove them from the site to the approval of the Client's Representative.

7.3.3 CONSTRUCTION ACROSS THE ROADS:

All the pipe line or drain crossing existing road, the road crossing shall be excavated at a time, the second half being commenced after the pipes have been laid in the first half and the trench refilled. Necessary safety measure for traffic as directed shall be adopted. All type of pipes, water mains, cables etc. met within the course of excavation shall be carefully protected and supported. Care shall be taken not to disturb the electrical and communication cable removal of which is necessary shall be arranged by the Client's Representative or the Contractor shall arrange to support and protect them during excavation.

7.3.4 EXCAVATION TO BE TAKEN TO PROPER DEPTH:

The trenches shall be excavated to such depth and width that the sewers pipe shall rest on cushion so that the inverts may be at the levels given on the section/plan. In bad ground the Client's Representative may order the Contractor to excavate to a greater depth than that shown on the drawings and to fill up the excavation to the level of the sewer with such materials as decided by Client's Representative in writing.

7.3.5 REFILLING:

The filling shall be done in layers not exceeding 15mm in depth. Each layer shall be watered, rammed and consolidated. Ramming shall be done with iron rammers where possible and with blunt end of the crow brass where rammers cannot be used. Special care shall be taken to ensure that no damage is caused to the pipes, drains, masonry or concrete in the trenches. Filling in trenches shall be commenced soon after the joints of pipes, cables; conduits etc. have been tested and approved by Client's Representative. The space around the pipes shall be cleared of all debris where the trenches are excavated in hard/soft soil. The filling shall be done with earth on the sides and tops of pipes in layers not exceeding 15mm in depth. Each layer shall be watered rammed and consolidated. The clods and lumps of earth exceeding 8cm in any direction shall be broken or removed before the excavated earth is used for filling. Generally no test is done to determine the instrument diversity of filled earth but on the discretion of Client's Representative the 95 proctor's compaction test may be done to ensure the in situ density after filling. Consolidation is removal of water from the pores and compaction is the explosion of air from the pores. In case of refilling consolidation places most important role as the watering of the each layer is being done properly. If required by the Client's Representative proctors needle may also be used for the proper checking of the refilling items of in situ density.

7.3.6 CONTRACTOR SHALL RESTORE SETTLEMENT AND DAMAGES:

The Contractor shall at his own cost make good promptly during the whole period the works are in hand, any settlements that may occur in the

surfaces or roads, beams, footpaths, gardens, open spaces etc. Whether public or private caused by his trenches or by his other excavations due to not using the method of compaction as given in clause 7.3.5 and he shall be liable for any accidents caused thereby.

He shall also at his own expense and charges, repair and make good any damage done to the building and other properties.

7.3.7 DISPOSAL OF SURPLUS SOIL:

The Contractor shall at his own cost and charge, dispose off from the site all surpluses excavated material not required to be used on the works.

i. The width of excavated trench shall be as per table given below:

Excavation upto Upto 150 mm	**Upto 100 mm**	
	Dia. Pipe	**Dia. pipe**
90 cms depth cms	33 cms	33
90 - 150 cms depth 60 cms	60 cms	
150 - 300 cms depth cms	75 cms	75
300 - 500 cms depth cms	90 cms	100

7.3.8 PROTECTION OF EXISTING SERVICES:

All pipes, water mains, cables etc encountered in the course of excavation shall be carefully protected and supported. In case of any damage caused the same shall be made good at no extra cost failing which necessary works will be carried out by the Clients Representative and contract charged to the Contractor.

7.4 RCC PIPES:

7.4.1 All underground storm water drainage pipes and sewer lines where specified (other than those specified cast iron) shall be centrifugally spun RCC pipes NP2 for general and NP3 where road crossing. Pipes shall be true and straight with uniform bore throughout. Cracked, wrapped pipes shall not be used on the work. All pipes shall be tested by the manufacturer and the Contractor shall produce, prior to use on site, a certificate to that effect from the manufacturer.

The pipes shall be with or without reinforcement as required and of the class as specified. These shall conform to IS: 458 - 1971. The reinforced cement concrete pipes shall be manufactured by centrifugal (or spun) process.

All pipes shall be true to shape, straight, perfectly sound and free from cracks and flaws. The external and internal surface of the pipes shall be smooth and hard. The pipes shall be free from defects resulting from

imperfect grading of the aggregate mixing or moulding. The pipes shall be R.C.C. light duty, NP2 and NP3 type.

7.4.2 LAYING:

R.C.C. spun pipes shall be laid on cements concrete bed or cradles as specified and shown on the detailed drawings. The cradles may be pre-cast and sufficiently cured to prevent cracks and breakage in handling. The invert of the cradles shall be left 12mm below the invert level of the pipe and properly placed on the soil to prevent any disturbance. The pipe shall then be placed on the bed concrete or cradles and set for the line and gradient by means of sight rails and boning rods, etc. Cradles or concrete bed may be omitted, if directed by the Client's Representatives.

7.4.3 JOINTING (RIGID SPIGOT AND SOCKET JOINT):

Hemp rope soaked in neat cement wash shall be passed round the joint and inserted in it by means of caulking tool. More skein of yarn shall be added and rammed home. Cement mortar with one part of cement and one part of sand and with minimum water content but on no account soft or sloppy, shall be carefully inserted, punched and caulked into the joint and more cement mortar added until the space of the joint has been filled completely with tightly caulked mortar. The joint shall then be finished off neatly outside the socket at an angle of 45 degree.

7.4.4 CURING:

The joint shall be cured for at least seven days.

7.4.5 CEMENT CONCRETE FOR PIPE SUPPORTS:

a) Unless otherwise directed by the Client's Representative cement concrete for bed, all round or in haunches shall be laid as follows:

	Upto 1.5m depth (5')	**Upto 3m depth (10')**	**Beyond 3m depth (10')**
Pipes in open ground (no sub soil water)	all round (1:5:10)	in haunches (1:3:6)	all round (1:5:10)
RCC/C.I. pipes in sub soil water	all round (1:3:6)	in haunches (1:3:6)	in haunches (1:3:6)
RCC/C.I. pipes (in all conditions)	all round (1:3:6)	in haunches (1:3:6)	in haunches (1:3:6)
RCC/C.I pipes under road or building	all round (1:3:6)	all round (1:3:6)	all round (1:3:6)

b) RCC pipes or CI pipes may be supported on brick masonry or pre-cast RCC or in situ cradles. Cradles shall be as shown on the drawings.

c) Pipes in loose soil or above ground shall be supported on brick or stone masonry pillars as shown on the drawings.

7.4.6 TESTING:

All lengths of the sewer and drain shall be fully tested for water tightness by means of water head maintained for not less than 30 minutes. Testing shall be carried out from manhole to manhole. All pipes shall be subjected to a test pressure of at least 1.5 meters head of water at the highest point of the section under test. The pipes shall be plugged preferably with standard drain plugs (with rubber rings) on both ends. The upper end shall, however, be connected to a pipe for filling with water and getting the required head.

Permissible drops in water head should not exceed .....

7.4.7 MEASUREMENT:

a) Excavation:
Measurement for excavation of pipes trenches shall be made per linear meter.

b) Trenches shall be measurement between outside walls of manholes at top and the depth shall be the average depth between the two ends to the nearest cm. The rate quoted shall be for a depth upto 1.5 meter or as given in the Bill of Quantities.

Payment for trenches more than 1.5 m in depth shall be made for extra depth as given in the Bill of Quantities and above the rate for depth upto 1.5 m.

c) RCC pipes shall be measured for the length of the pipe line per linear meter i.e.:

i. Length between manholes shall be recorded from inside of one manhole to inside of other manhole.

ii. Length between gully trap and manhole shall be recorded between socket of pipe near gully trap and inside of manhole.

7.5 STONEWARE PIPE

a) GENERAL REQUIREMENTS

7.5.1 All materials shall be new of the best quality conforming to specifications and subject to the approval of the Consultant/ Client/ Architect.

Drainage lines shall be laid to the required gradients and profiles.

7.5.2 All drainage work shall be done in accordance with the local Municipal by-laws.

7.5.3 Contractor shall obtain necessary approval and permission for the drainage system from the Municipal or any other competent authority.

7.5.4 Location of all manholes, catch basins etc. shall be got confirmed by the Consultant/ Client/ Architect before the actual execution of work at site.

7.5.5 All works shall be executed as directed by Consultant/ Client/ Architect.

a) ALIGNMENT AND GRADE

The sewer and storm water drainage pipes shall be laid to alignment and gradient shown on the drawings but subject to such modifications as shall be ordered by the Consultant/ Client/ Architect from time to time to meet the requirements of the works. No deviation from the lines, depth of cutting or gradients of sewers shown on the plans and sections shall be permitted except by the express direction in writing of the Consultant/ Client/ Architect.

b) EXCAVATION

The excavation for sewer works shall be open cutting unless the permission of the Consultant/ Client/ Architect for the ground to be tunneled is obtained in writing. Where sewers have to be constructed along narrow passages, the Consultant/ Client/ Architect may order the excavation to be made party in tunnel and in such cases the excavated soil shall be brought back later on for refilling the trenches or tunnel.

c) OBSTRUCTION OF ROADS

The contractor shall not occupy or obstruct by his operation more than one half of the width of any road or street and sufficient space shall be then left for public and private transit. He shall remove the materials excavated and bring them back again when the trench is required to be refilled. The contractor shall obtain the consent of the Architect in writing before closing any road to vehicular traffic and the foot walks must be clear at all times.

d) EXCAVATION TO BE TAKEN TO PROPER DEPTH

The trenches shall be excavated to such a depth that the sewer shall rest on concrete as described in the several clauses relating there to and so that the inverts may be at the levels given in the sections. In bad ground, the Consultant/ Client/ Architect may order the contractor to excavate to a greater depth than that shown on the drawings and to fill up excavation to the level of the sewers with the concrete, broken stone, gravel or other materials, the contractor, shall be paid extra at rates laid down for such works in the schedule. If the extra work was ordered by the Consultant/ Client/ Architect in writing, but if the contractor shall excavate the trench to a greater depth than is required without a specific order to that effect in writing of the Consultant/ Client/ Architect the extra depth shall have to be filled up with concrete at the contractor's own cost and charges to the requirements and satisfaction of the Consultant/ Client/ Architect.

e) REFILLING

After the sewer or other works has been laid and proved to be water tight, the trench or other excavation shall be refilled. Utmost care shall be taken in doing this, so that no damage shall be caused to the sewer and other permanent work. The filling in the haunches and upto 75 cms. Above the crown of the sewer shall consist of the finest selected materials

placed carefully in 15 cms. Layers and consolidated. After this has been laid, the trench and other excavation shall be refilled in 15 cms. Layers with materials taken from the excavation, each layer being watered to assist in the consolidation, unless the Architect shall otherwise direct.

f) CONTRACTOR TO RESTORE SETTLEMENT AND DAMAGES

The contractor shall as his own costs and charges, make good promptly during the whole period for the works in hand, any settlement that may occur in the surfaces of roads beams, footpaths, gardens, open spaces etc. whether public or private caused by his trenches or by his other excavations and he shall be liable for any accident caused thereby. He shall also, at his own expense and charges, repair and make good may damage done to building and other property. If in the opinion of the Consultant/ Client/ Architect he fails to make good such works with all practicable dispatch, the Consultant/ Client/ Architect shall be at the liberty to get the work done by other means and the expenses thereof shall be paid by the contractor or deducted from any money that may be or become due to him or recovered from him any other manner according to the law of land.

g) DISPOSAL OF SURPLUS SOIL

The contractor shall at his own costs and charges provide places for disposal of all surplus materials not required to be used on the works. As each trench is refilled the surplus soil shall be immediately removed, the surface properly restored and roadways and sides left clear.

h) TIMBERING OF SEWER AND TRENCHES

1. The contractor shall at all times support efficiently and effectively the sides of the sewer trenches and other excavations by suitable timbering, pilling and sheeting and they shall be closed, timbered in loose or sand strata and below the surface of the sub soil water level.

2. All timbering, sheeting and piling with their walling and supports shall be of adequate dimension and strength and fully braced and strutted so that no risk of collapse of subsidence of the walls of the trench shall take place.
3. The contractor shall be held responsible and will be accountable for the sufficiency of all timbering, sheeting and pilling used as also for all damage to persons and property resulting from improper quality, strength, maintaining or removing of the same.

i) SHORING OF BUILDINGS

The contractor shall shore up all buildings, walls and other structures, the stability of which is liable to be endangered by the work and shall be fully responsible for all damage to persons or property resulting from any accidents.

j) REMOVAL OF WATER FROM SEWER, TRENCH ETC.

1. The contractor shall at all times during the progress of the work keep the trenches and excavations free from water which shall be disposed of by him in a manner as will neither cause injury to the public health nor to the public or private properly nor the work completed or in progress nor to the surface of any roads or streets, nor cause any interference with the use of the same by the public.

2. If any excavation is carried out at any point or points to a greater width the specified cross section of the sewer with its envelop, the full width of the trench shall be filled with concrete by the contractor at his own expense and charges to the requirements of the Consultant/ Client/ Architect.

k) WIDTH OF TRENCH

The Consultant/ Client/ Architect shall have power by giving an order in writing to the contractor to increase the maximum width in respect of which payment will be allowed for excavation in trenches for various classed of sewer, manholes and other works in certain lengths to be specifically laid down by him where on account of bad ground or other unusual conditions, he considers that such increased widths are necessary in view of the site conditions.

Recommended width of trenches at the bottom of the trench are as follows:

100 mm dia pipe	55 cms
150 mm dia pipe	55 cms
225-250 mm dia pipe	60 cms
300 mm dia pipe	75 cms

Maximum width of the bed concrete shall be also as above. No additional payment is admissible for widths greater than specified.

m) SALT GLAZED STONEWARE PIPES:

Stone ware pipe shall be of first class quality salt glazed and free from rough texture inside and outside and straight. All pipes shall have the manufacturers names marked on it and shall comply to IS 651-1971.

n) LAYING AND JOINTING OF STONEWARE SALT GLAZED PIPES :

1. Pipes are liable to be damaged in transit and not with standing tests that may have been made before dispatching each pipe shall be examined carefully on arrival at site. Each pipe shall be rung with a wooden hammer or mallet and those that do not ring true and clear shall be rejected. Sound pipes shall be carefully stacked to prevent damage. All defective pipes should be segregated marked in a conspicuous manner and their use in the works prevented.

2. The pipes shall be laid with sockets leading uphill and should rest on solid and even foundations for the full length of the barrel. Socket holes shall be formed in the foundation sufficiently deep to allow the

pipe jointer room to work right round the pipe and as short as practicable to admit the socket and allow the joint to be made.

3. Where pipes are not bedded in concrete the trench bottom shall be left slightly high and carefully bottomed up as pipe laying proceeds so that the pipe barrels rest no firm ground. If excavation has been carried too low it shall be made up with cement concrete at the contractor's cost and charges.

4. If the bottom of the trench consists of rock or very hard ground that cannot be easily excavated to a smooth surface, the pipes shall be laid on cement concrete bed to ensure even bearing.

o) JOINTING OF PIPES

1. Tarred gasket shall first be wrapped round the spigot of each pipe and the spigot shall then be placed into the socket of the pipe previously laid, the pipe shall then adjusted and fixed in its correct positions and the gaskin caulked tightly home so as to fill not more than one quarter of the total length of the socket.

2. The remainder of the socket shall be filled with stiff mix of cement mortar (1 cement : 1 clear sharp washed sand). When the socket is filled, a filled should be formed round the joint with a trowel forming an angle of 45 Degrees with the barrel of the pipe. The mortar shall be mixed as needed
   For immediate use and no mortar shall be beaten up and used after it has begun to set.

3. After the joint has been made, any extraneous material shall be removed from inside of the joint with a suitable scraper or 'badgar'. The newly made joint shall be protected until set from the sun, drying winds, rains or dust. Sacking or other materials which can be kept damp shall be used. The joints shall be exposed and space left all round the pipes for inspection by the Consultant/ Client/ Architect. The inside of the sewer must be left absolutely clear in bore and free from cement mortar or other obstructions throughout its entire length, and shall efficiently drain and discharge.

p) TESTING

1. All lengths of the sewer and drain shall be fully tested for water tightness by means of water pressure maintained for not less than 30 minutes. Testing shall be carried out from manhole to manhole. All pipes shall be subjected to a test pressure of atleast 1.5 mtrs. head of water. The test pressure shall, however, not exceed 6 metres head at any point. The pipes shall be plugged preferably with standard design plugs with rubber plugs on both sides. The upper end shall, however, be connected to a pipe for filling with water and getting the required head poured at one time permit.

2. Sewer lines shall be tested for a straightness by :

(i) Inserting a smooth ball 12 mm less than the internal diameter of the pipe. In the absence of obstruction such as yarn or mortar projecting at the joints the ball should roll down the invert of the pipe and emerge at the lower end.

(ii) Means of a mirror at one end and a lamp at the other end. If the pipe line is straight the full circle of light will be seen otherwise obstructions or deviations will be apparent.

(iii) The contractor shall give a smoke test to the drain and sewer at his own expense and charges, if directed by the Consultant/ Client/ Architect.

(iv) A test register shall be maintained which shall be signed and dated by contractor. Architect and representative of consultants.

q) MASONRY WORK

Masonry work for manhole, chambers, septic tanks and such other works as required shall be constructed from local best quality bricks in cement mortar 1 : 5 mix (1 cement : 5 coarse sand) or as specified in the Bill of Quantities. All joints shall be properly raked to receive plaster.

r) CEMENT CONCRETE FOR PIPE SUPPORT

1. Wherever specified or shown on the drawings, all pipes shall be supported in bed all round or in haunches. The thickness and mix of concrete shall be as given in the Bill of Quantities. Widths of the bedding shall be as per Para 13.

2. Unless otherwise directed by the Consultant/ Client/ Architect, cement concrete of bed, all rounds or in haunches shall be laid as follows:

	Upto 1.5 m depth	Upto 3 m depth	Beyond 3 m depth
RCC, stoneware pipes in open ground (above sub soil water)	All round (1 : 5 : 10)	In haunches (1 : 5 : 10)	In haunches (1 : 5 : 10)
C.I.pipes in sub soil water	All round (1 : 3 : 6)	In haunches (1 : 3 : 6)	In haunches (1 : 3 : 6)
RCC or S.W. pipes in sub soil water	All round (1 : 3 : 6)	All round (1 : 3 : 6)	All round (1 : 3 : 6)
RCC or S.W. pipes under floors or building	All round (1 : 2 : 4)	All round (1 : 2 : 4)	All round 3. : 2 : 4)

3. RCC pipes or C.I. or stoneware pipes may be supported on brick masonry or precast RCC or in situ cradles. Cradles shall be as shown on the drawing.

4. Pipes in loose soil or above ground shall be supported on brick or stone masonry pillars as shown on the drawings.

5. Hand mixing on properly constructed platforms may be allowed for small quantities by the Consultant/ Client/ Architect. Rate for cement concrete shall be inclusive of all shuttering and centering at all depths and heights.

6. Concrete work shall be of such thickness and mix as given in the Bill of quantities.

7. All concrete work shall be cured for a period of at least 7 days. Such work shall be kept moist by means of gunny bags at all times. All pipes trenches and foundations shall be kept dry during curing period.

7.6 SEWER MANHOLES WITH FRAME AND COVER:

7.6.1 SCOPE

This specification covers the requirements for providing and constructing of Brick Masonry (for up to 3 mtr. depth) / RCC M 20 grade or 1:1x1/2 :3 mix (for more than 3 mtr. depth) manholes with steps, frame, cover and vent shafts.

7.6.2 STANDARDS

The following standards/codes, unless otherwise specified herein, shall be referred. In all cases, the latest revision of the standards /codes shall be referred to.

IS : 210	Specification for gray iron castings
IS : 269	Specification for ordinary and low heat Portland cement
IS : 383	Specification for coarse and fine aggregates from natural sources for concrete
IS : 432	Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement
IS : 516	Methods of tests for strength of concrete
IS : 651	Specification for salt-glazed stoneware pipes and fittings
IS : 1077	Specification for common burnt clay building bricks
IS : 1726	Specification for cast iron manhole covers and frames
IS : 1786	Specification for high strength deformed steel bars and wires for concrete reinforcement
IS : 2116	Specification for sand for masonry mortars
IS : 3495	Methods of tests of burnt clay building bricks
IS : 5455	Specification for cast iron steps for manholes

7.6.3 CODES OF PRACTICE

IS : 456	Code of practice for plain and reinforced concrete
IS : 2212	Code of practice for brickwork
IS : 2250	Code of practice for preparation and use of masonry mortars
IS : 4111	Code of practice for ancillary structures in sewerage system part 1manholes
IS : 4127	Code of practice for laying of glazed stoneware pipes

7.6.4 LOCATION

Manholes shall be constructed in accordance with the drawings at the locations indicated thereon.

7.6.5 CONSTRUCTION MANHOLES:

At every change of alignment, gradient or diameter of a drain, there shall be a manhole or inspection chamber. Bends and junctions in the drains shall be grouped together in manhole as far as possible. The maximum distance between manholes shall be according to NBC.

Manholes of different types and sizes as specified shall be constructed in the sewer line at such places and to such levels and dimensions as shown in the drawings or as directed by the Engineer-in- charge. The size specified shall indicate the inside dimensions between brick faces of the manholes.

Where the diameter of the drain is increased, the crown of the pipe shall be fixed at the same level and necessary slope given in the invert of the manhole chamber. In exceptional cases and where unavoidable, the crown of the branch sewer may be fixed at lower level but in such cases the peak flow level of the two sewers shall be kept the same.

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

No drain from house fittings, e.g. gully trap or soil pipe, etc. to manhole shall normally exceed a length of 6 m unless it is unavoidable.

Manholes 90 x 80 cm are generally constructed within compound for house drainage only and near the buildings for house drainage. Manholes 1.2 m x 90 cm are generally constructed for main drainage work for depths less than 1.5 m.

Manhole 1.4 m x 90 cm is of the arched type and is generally constructed for main drainage works where depth is 1.50 m or more. The width of manholes shall be increased more than 90 cm on bends or junctions or pipes with diameter greater than 450 mm and that the benching width on either side of the channel is minimum 20 cm.

Manholes 1.4 m internal diameter are generally constructed for main drainage works where depth is 2.45 m or more as an alternative to manholes of arch type. The diameter shall be increased suitably, for pipes with diameter greater than 450 mm in the same manner as in the case of rectangular manholes.

Before deciding size of manholes, it shall be as specified in BOQ or as per Local Municipal Bye Laws. When manholes are constructed on foot path, these shall be provided with cover of medium duty casting and when built within the width of the road under vehicular traffic, these shall be provided with cover of heavy duty casting.

7.6.6. EXCAVATION

The excavation for manhole shall be true to dimensions and levels shown on the plans or as directed by the Engineer-in-charge.

7.6.7 BED CONCRETE

The manhole shall be built on a bed of foundation PCC 1 : 2 : 4 unless required by local authorities. The thickness of the bed concrete shall be 15 cm for manholes up to 4.5 m depth and 30 cm for depths beyond 4.5 m unless otherwise specified or directed by the Engineer-in-charge. In bad ground, special foundations as suitable shall be provided.

7.6.8. BRICK MASONRY / CEMENT CONCRETE WORK

BRICK MASONRY

For depth up to 3 mtr, manhole shall be constructed with masonry wall, for more than 3 mtr. Depth, it shall be of M 20 grade as specified below:

The brick work shall be with class 75 bricks in cement mortar 1:4 (1 cement: 4 coarse sand).
The brick work shall be with class 75 bricks in cement mortar 1:4 (1 cement: 4 coarse sand). The external joints of the brick masonry shall be finished smooth, and the joints of the pipes with the masonry shall be made perfectly leak proof. For arched type and circular manholes, brick masonry in arches and arching over the pipes shall be in cement mortar 1 : 3 (1 cement: 3 fine sand). In the case of manholes of circular type the excess shaft shall be corbelled inwardly on three sides at the top to reduce its size to the cover frame to be fitted.

The walls shall be built of one brick thickness for depths up to 4.25 m. below a depth of 4.25 mtr in ordinary subsoil the wall thickness shall be increased to one and half brick and at 9.75 m below ground two brick thick walls

CEMENT CONCRETE WORK

The walls shall be built of M20 grade (1 cement : 1.5 coarse sand : 3 coarse aggregate having 20 mm nominal size) with 15 cm thickness for depth up to

4.5 m. Below a depth of 4.5 m in ordinary subsoil the wall thickness shall be increased to 30 cm

The thickness of the wall shall be take the total load coming over it including earth pressure & water pressure. The chamber shall be tested for water tightness.

The wall shall further be water proofed with addition of approved water proofing compound in a quantity as per manufacturer's specifications. In case Local Authorities/Bye Laws specify richer specifications, the same shall be adopted.

For earth work excavation, bed concrete work, R.C.C. work and refilling of earth, respective specifications shall be followed.

PLASTER AND POINTING

In case of brick walls, the walls of the manholes shall be plastered inside with 20 mm thick cement plaster 1:2 (1 cement: 2 coarse sand) finished smooth. The plaster shall further be water proofed with addition of approved water proofing compound in a quantity as per manufacturer's specifications. In case Local Authorities/Bye Laws specify richer specifications, the same shall be adopted.

For earth work excavation, bed concrete brick work, plaster and pointing, R.C.C. work and refilling of earth, respective specifications shall be followed.

7.6.9 BENCHING

The channels and benching shall e done in cement concrete 1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size) and rendered smooth with neat cement. The depth of channels and benching shall be as given in Table .

SIZE OF DRAIN	TOP OF CHANNEL AT THE CENTER ABOVE BED CONC.	DEPTH OF BENCHING AT SIDE WALLS ABOVE BED CONC.
10 cm	15 cm	20 cm
15 cm	20 cm	30 cm
20 cm	25 cm	35 cm
25 cm	30 cm	40 cm
30 cm	35 cm	45 cm

7.6.10 FOOT RESTS

All manholes deeper than 0.8 m shall be provided with foot rests.

7.6.10.1 Foot rest shall be CI type, each weighing 5.5 Kg, 1:2:4 coping.

7.6.10.2 Alternatively MS foot rest shall be provided. These shall be embedded 20 cm deep in 20 x 20 x 10 cm blocks of cement concrete 1:2:4 (1 cement : 4 coarse sand : 4 graded stone aggregate 20 mm nominal size). The concrete block with M.S. foot rest placed in its center shall be cast in situ along with the RCC wall & finished smooth.

SIZE OF DRAIN MM	TOP OF CHANNEL AT THE CENTER ABOVE BED CONCRETE CM	DEPTH OF BENCHING AT SIDE WALLS ABOVE BED CONCRETE CM
100	15	20
150	20	30
200	25	35
250	30	40
300	35	45
350	40	50
400	45	55
450	50	60

Foot rests which shall be of 20x20 Sq. M.S. bars.
Foot rests shall be fixed 40 cm apart vertically and staggered laterally and shall project 10 cm beyond the surface of the wall. The top foot rest shall be 45 cm below the manhole cover.

Foot rests shall be painted with coal tar, the portion embedded in the cement concrete block being painted with thick cement slurry before fixing.

7.6.11 MANHOLE COVERS AND FRAMES

The frame of manhole shall be firmly embedded to correct alignment and levels in R.C.C. slab or plain concrete as the case may be on the top of the masonry. After completion of the work, manhole covers shall be sealed by means of thick grease.

7.6.12 MEASUREMENTS

Manholes shall be enumerated under relevant items. The depth of the manhole shall be reckoned from the top level of RCC cover to the invert level of channel. The depth shall be measured correct to a cm. The extra depth shall be measured and paid as extra over the specified depth.

7.6.13 RATE

The rate shall include the cost of materials and labour involved in all the operations described above but exclude the cost of (i) excavation, (ii) refilling (iii) dewatering if required. These items shall be paid for separately under relevant items of work.

Payment for extra depths of manholes shall be made separately under relevant items of work.

7.7 DROP CONNECTION

In cases where branch pipe sewer enters the manhole of main pipe sewer at a higher level than the main sewer, a drop connection shall be provided. The work shall be carried out as per specifications and RCC pipes and special conforming to IS: 458 shall be of the same size as that of the branch pipe sewer.

For 150 and 250 mm main line, if the difference in level between the water line (peak flow level) and the invert level of the branch line is less than 60 cm, a drop connection may be provided within the manhole by giving suitable ramp. If the difference in level is more than 60 cm, the drop shall be provided externally.

The sewer main lines shall be designed with 0.8 full flow.

7.7.1 EXCAVATION

The excavation shall be done for the drop connection at the place where the branch line meets the manhole the excavation shall be carried up to the bed concrete of the manhole and to the full width of the branch line.

7.7.2 MEASUREMENTS

Drop connection shall be enumerated. The depths beyond 60 cm shall be measured in running metres correct to a cm under relevant items.

7.7.3 RATE

The rate shall include the cost of labour and materials involved in all the operations described above but excluding the cost of excavations and refilling.

7.7.4 TESTING

The interior of manholes shall be cleared of all debris after construction and before testing the same for water tightness by Contractor.

Water for testing of manholes along with pipeline shall be arranged by Contractor at his own cost.

7.7.5 R.C.C PRE CAST M.H.F.C.

Manufacture, supply delivery at site of work and fixing on top of manhole precast RCC Frame & cover suitable to drainage M.H. and including cost of reinforcement M.S. Angles or Flat, curing, mold work etc.

7.7.6 GENERAL SPECIFICATION

R.C.C Precast manhole frame & cover shall be manufacture as per standard type design. Frame shall confirm to IS: 12592 part – II – 1991. Cover shall confirm to IS : 12592 part – I – 1988.

7.7.7 MATERIAL

Sand, cement, water, aggregates and reinforcement steel shall confirm to relevant I.S. specifications. Thickness of frame shall be 10 cm. Necessary reinforcement, M.S. angle or flat shall be placed as per design during the concreting work fabrication of R.C.C. M.H.F.C shall be carried out by mechanically vibrating process.

7.7.8 INSPECTION :

Inspection of materials will be carried out at work site by the Engineer who shall carry out inspection as soon as material is brought on work site. Inspection will be carried out normally within one week time. The supplier has to take care of the following points.

The manufacturer has to go in for one line stenciling for identifying size and class for proper separation.

The unloaded material has to be stacked in manageable batches with adequate inspection space like spreading the pieces etc. to permit proper inspection.

7.7.9 TRANSIT RISK

The contractor shall bring goods at his own risk or it should be covered against the transit risk at its own cost.

7.7.10 TEST CERTIFICATE

The contractor shall always provide manufacturer's test certificate in accordance with every batch/lot of goods so manufactured and supplied.

The supplier shall also produce in addition to manufacturer's test certificate as mentioned in above, the inspection certificate issued by Engineer for the same purpose.

7.7.11 FIXING

Precast R.C.C. frame shall be fixed on the top of manhole and properly embedded in cement concrete 1:1.5:3 in required quantity in such a way that the top of the cover when placed in position shall remain at the finished road level.

7.7.12 MEASUREMENT

The measurement shall be made on number basis subsequent to fixing the frame on top of manhole and placing the cover in the frame.

7.7.13 MARKING

Each manhole frame and cover shall have cast on them the following information.

a) Manufacturer's name or trademark.
b) Grade denoted by abbreviation such as HD, MD or LD.
c) The word SWD or sewer to denote storm water drain or sewer respecting if desired.
d) An identification name as required by purchaser.

9.0 LIST OF APPROVED MAKES:

Sr. No.	Item	Approved Make
1	SWR PVC PIPE & FITTINGS 6 KG CM^2; FITTINGS : 6 KG CM^2 ECO. DRAIN PIPE & FITTINGS	FINOLEX / SUPREME/PRINCE SUPREME/ ASTRAL
2	GULLY TRAP	GIRCO / TIRUMALA / SONIA/ SUPREME/ ASTRAL
3	STONE WARE PIPES	GIRCO / TIRUMALA / SONIA
4	RCC HUME PIPES	INDIAN HUME PIPE / PRANALI
5	C.I. PIPE & FITTINGS	NICO OR EQ.
6	PPR PIPES & PPR FITTINGS	SUREME/PRINCE/
7	M.S/G.I. PIPES FOR WATER SUPPLY	TATA / JINDAL/ SWASTIK
8	ASTM/CPVC PIPE & FITTINGS FOR WATER SUPPLY	ASTRAL / SUPREME/ASHIRWAD /
9	COMPOSITE PLUMBING PIPE & COMPOSITE FITTINGS	KITEC OR EQ.
10	G.I. PIPES FITTINGS WATER SUPPLY	DRP-M / R-BRAND / ZOLOTO
11	GI TO GI JOINTS	CHAMPION / EQUIVALENT
12	SOLVENT CEMENT	SUPREME / KISSAN / FINOLEX
13	BALL VALVES	LEADER / ZOLOTO / AUDCO
14	WHEEL VALVES	LEADER / ZOLOTO/AUDCO