

“Proposed renovation of TV & Dance room, Hostel 3 for Indian Institute of Technology Bombay within IITB campus Powai. Mumbai –400 076”

NIT NO: IITB/DEAN IPS/DC/HOSTEL 3/10/2025 DATED: 08-07-2025

TENDER BID DOCUMENTS

FOR

CIVIL & CARPENTRY WORKS

TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS

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 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 & propitious 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. 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 & 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 Dean (I.P.S.), 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 specification shall take precedence.

II – LIST OF INDIAN STANDARDS::

Following are the various pertinent Indian Standards, relevant to buildings work : (N.A)

(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 constn. materials and components at site.
2. EARTH WORK (N.A)	
1200 Pt. I-1992	Method of measurement of Earth work.
4081-1986	Safety code for Blasting and related drilling operations.
6313 (Part 2) 2001	Anti Termite Measures in Buildings Part – 2 Pre-constructional chemical treatment .
3. MORTAR	
196-1966	Atmospheric conditions for testing (Reaffirmed - 1990)
269-1989	33 Grade Ordinary, rapid hardening and low heat Portland cement
383-1970	Coarse and fine aggregates from natural sources for concrete.
455-1989	Portland blast furnace slag cement
650-1991	Standard sand for testing of cement
712-1984	Building Limes
1489-1991	Portland pozzolana cement Fly ash based
1514-1990	Methods of sampling & Test for Quick Lime & Hydrated Lime. (Reaffirmed - 1996)
1542-1992	Sand for Plastering.
1727-1967	Methods of tests for pozzolanic materials
2250-1981	Code of practice for preparation and use of masonry mortar. (Reaffirm- 1990)
2386-1963	Methods of Test for Aggregates for Concrete
2386 Pt.I-1 963	Particle size and shape
2386 Pt. II-1963	Estimation of deleterious materials and organic impurities
2386 Pt.III-1 963	Specific gravity, density, voids, absorption and bulking
2686-1977	Cinder as fine aggregate for use of Lime Concrete. (Reaffirmed – 1992)
3025-1964	Methods of sampling & test (Physical & Chemical) water used in industry. (Reaffirmed-2003)
3068-1986	Broken brick (burnt clay) coarse aggregate for use in lime concrete (II-R.)
3182-1986	Broken brick (Burnt clay) fine aggregate for use in lime mortar
3812-1981	Fly Ash using as pozzolana and admixtures (Reaffirmed - 1999)
4031-1996	Methods of physical tests for hydraulic cement (Reaffirmed – 1996)
4032-1985.	Method of chemical analysis of hydraulic cement (Reaffirmed - 1990)
4098-1983	Lime pozzolana mixture (Reaffirmed - 1989)
6932 (Pt.I to X)	Methods of Test for Building Lime
6932 (Pt.I)-1973	Determination of insoluble residue, loss of ignition, silicon-dioxide, ferric & Alum. Oxide,
6932 (Pt.II)-1973	Determination of carbon dioxide content
6932 (Pt.III)-1 973	Determination of residue on slaking of quick lime.
6932 (Pt.IV)-1973	Determination of fineness of hydrated lime
6932 (Pt.V)-1973	Determination of unhydrated oxide

I. S. CODE NO.	S U B J E C T
6932 (Pt.VI)-1973	Determination of volume yield of quick lime
6932 (Pt.VII)-1 973	Determination of compressive and transverse strength.
6932(Pt.VIII)-1 973	Determination of workability
6932 (Pt.IX)-1973	Determination of soundness
6932 (Pt.X)-1973	Determination of popping and pitting of hydrated Lime.
4. CONCRETE WORK	
383-1970	Coarse and fine aggregate from natural sources for concrete (Reaffirm - 1990)
456-2000	Code of practice for plain and reinforced concrete
516-1959	Method of test for strength of concrete (Reaffirmed in 2004)
1199-1959	Method of sampling and analysis of concrete
1200 (Pt.II)-1987	Methods of measurements of cement concrete work. (Reaffirm - 1992)
1322-1993	Bitumen felts for water proofing and damp proofing. (Reaffirm - 1998)
1661-1 987(Pt.I II)	Code of practice for application of cement lime plaster finishes.(Reaffirm- 1999)
2386-1977(Pt.1 to 8)	Methods of test for aggregate for concrete
2386 (Pt.I)-1 963	Test for particle size and shape
2386 (Pt.II)-1963	Test for estimation of deleterious materials and organic impurities
2386 (Pt.III)-1 963	Test for specific gravity, density, voids, absorption and bulking
2386 (Pt.IV)-1963	Mechanical properties
2645-1975	Specification for integral water proofing compounds
2686-1977	Specification for cinder aggregate for use in lime concrete. (Reaffirm - 1992)
3812-1981	Fly Ash using as pozzolana and admixtures for concrete. (Reaffirmed - 1999)
7861-1975 (Pt.I)	Hot weather concreting. .(Reaffirmed -1990)
7861-1981 (Pt.II)	Cold weather concreting. .(Reaffirmed -1992)
9103-1999	Admixture for concrete.
5. R.C.C. WORK	
432-1982	Mild steel & medium tensile steel bars and hard drawn steel wire for concrete
432 (Pt.I)-1982	Mild steel and medium tensile steel bars
456-2000	Code of practice for plain and reinforced concrete
457-1957	COP for general const. of plain & reinforced concrete for dams & other massive structure.
516-1959	Methods of test for strength of concrete
1161-1963	Specifications for steel tubes for structural purposes
1199-1959	Methods of sampling and analysis of concrete. (Reaffirmed - 1999)
1200 (Pt.II) -1974	Method of measurement of cement concrete work
1200(Pt.V) -1982	Method of measurement of form work. (Reaffirmed - 1989)
1343-1980	Code of practice for pre-stressed concrete.
1566-1982	Hard drawn steel wire fabric for concrete reinforcements (II Rev.) (Reff.1998)
1780-1961	Specifications for cold twisted steel bars for concrete reinforcement *
1785-1983	Specifications for plain hard drawn steel wire for pre-stressed concrete
1786-1985	H.Y.S.D./ Cold twisted steel bars for concrete reinforcement Reaffirmed - 1990)
I. S. CODE NO.	S U B J E C T
2090-1983	Specifications for high tensile steel bars used in prestressed concrete.

2204-1962	Code of practice for construction of reinforced concrete shell roof. (Reaffirmed - 1990)
2210-1988	Criteria for the design of shell structure and folded plates (Reaffirmed - 1998)
2502-1963	COP for bending and fixing of bars for concrete reinforcement. (Reaffirmed - 1999)
2750-1964	Specifications for steel scaffoldings
2751-1979	COP for welding of mild steel bars used for reinforced concrete construction.
2911-1984	Code of practice for design & Constn. of pile foundations
2911(Pt.I)-	Design & construction of Pile Foundations - Bored precast concrete piles.
2911 (Pt.III)-1 980	Under reamed pile foundations
2911 (Pt.IV)-1985	Load test on Piles
3201-1988	Criteria for design and construction of precast concrete trusses. (Reaffirmed - 1995)
3370.(Part I to IV)-	Code of practice for concrete structures for storage of liquids. (Reaffirmed - 1999)
3385-1965	Code of practice for measurement of Civil Engineering works - Pile Foundation)
3414-1968	Code of practice for design and installation of joints in buildings. (Reaffirmed - 1990)
3558-1983(Reaf-91)	Code of practice for use of immersion vibrators for consolidating concrete
3696 (Pt.I & II)	I-1987: Safety code of scaffolds; II-1991: Safety code of ladders
3935-1966	Code of practice for composite construction. (Reaffirmed - 1998)
4014-1967 (Pt. & II)	COP for steel tubular scaffolding (I: Definition/Material; II: Safety Resolutions) (Raffir 1999)
4926-2003	Code of practice for Ready Mix Concrete
4990-1993	Specifications for plywood for concrete shuttering work. (Reaffirmed - 1998)
10262-1982	Code of practice for design mix. (Reaffirmed - 1999)
6. EQUIPMENTS (N.A)	
460-1985 (Pt-I,II& III)	Specification for test sieves. (Reaffirmed - 1998)
1791-1985	Specification for batch type concrete mixer. (Reaffirmed - 1990)
2430-1986	Methods for sampling of Aggregates for concrete.
2505-1992	General requirement for concrete vibrators, immersion type
2506-1985	General requirements for screed board concrete vibrators
2514-1963	Specification for concrete vibrating tables. (Reaffirmed - 1991)
3366-1965	Specification for pan vibrators. (Reaffirmed - 1991)
4656-1968	Specification for form vibrators for concrete. (Reaffirmed-1991)
2722-1964(Reaf-95)	Specification for portable swing weighbatchers for concrete (single and double bucket type).
2750-1964	Specification for steel scaffolding. (Reaffirmed - 1991)
7. BRICK WORK:	
1077-1992	Common burnt clay building bricks
1200 (Pt.III)-19920	Method of measurements of brick work. (Reaffirmed - 1992)
2116-1980	Sand for masonry mortars. (Reaffirmed - 1998)
2212-1991	Code of practice for brick work
2250-1981	Code of practice for preparation & use of masonry mortar. (Reaffirmed - 1990)
3102-1971	Classification of burnt clay solid bricks
3495 (Pt.ItoIV)-1992	Method for test for burnt clay building brick
5454-1978	Method for sampling of clay building bricks. (Reaffirmed - 1995)

I. S. CODE NO.	SUBJECT
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8. STONE WORK:	(N.A)
1121 (Pt.I)-1974	Methods for determination of compressive, transverse & shear strengths of natural building stones
1122-1974	Methods for determination of specific gravity and porosity of natural building stones
1123-1975	Methods for identification examination of natural building stones
1124-1974	Methods of test for water absorption of natural building stones
1125-1974	Methods of test for weathering of natural building stones
1126-1974	Methods of test for durability of natural building stones
1129-1972	Dressing of natural building stones
1200 (Pt.IV)-1976	Method of measurement of stone masonry. (Reaffirmed - 1992)
1597-1992	Code of practice for construction of stone masonry
1597. (Pt.I)-1992	Code of practice for construction of Rubble stone masonry. (Reaffirmed -1996)
1597 (Pt.II)-1992	Code of practice for construction of ashlar masonry (Reaffirmed - 1996)
1805-1973	Glossary of Terms relating to stone Quarrying and dressing. Reaffirmed - 1993)
4101 (Pt.I)-1967	Stone facing. (Reaffirmed - 1990)
9. MARBLE WORK: (N.A)	
1122-1974	Methods for determination of specific gravity and porosity of natural building stones
1124-1974	Methods of test for water absorption of natural building stones
1130-1969	Marble (blocks, slabs and tiles)
10. 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
420-1953	Putty used on metal frame (withdrawn).
1734 - 1983	Methods of tests for plywood (IIR) (Ref 1993)
206-1992	Tee and strap hinges
207-1964	Gate and shutter hooks and eyes. (Reaffirmed - 1996)
208-1987	Door handles
281-1991	Mild steel sliding door bolts for use with padlocks
287-1973(Reaf-98)	Recommendation for maximum permissible moisture contents of timber used for Different
303-1989	Plywood for general purpose
362-1991	Parliament hinges
363-1993	Hasps and staples
364-1993	Fanlight catch
401-1982	Code of practice for preservation of timber
419 - 1967	Putty for use on window frame (I Rv.) (and out 3)
451-1999	Technical supply condition for wood screws
452-1973	Door springs, rat-tail type(II Rev.) (Reaffirmed 1990)
453-1993	Double acting spring hinges. (Reaffirmed – 1999)
723-1972	Steel counter sunk head wire nails. (Reaffirmed - 1996)
I. S. CODE NO.	SUBJECT
729.1979	Drawer locks, cup board locks, and box locks (III Rev.) (Reaffirmed 1992)

848-1974	Synthetic resin adhesive for plywood (phenolic and aminoplastic) (I RV) (
851-1978	Synthetic resin adhesive for construction work (Non-structural) in wood (I-Rev.) (amt
852-1994	Specifications for animal glue for general wood working purposes. (II Rev)
1003-1994	Timber panelled and glazed shutters
1003(Pt.I)-2003	Door shutters (III Rev.) (a 1)
1003 (Pt.II)-1994	Window and ventilator shutters (III Rev.)
1019-1974	Rim latches. (Reaffirmed - 1991)
1141-1993	Code of practice for seasoning of timber (II Rev.)
1200	Method of measurement of Building and Civil Engineering works
1200 (Pt.XIV)-1984	Glazing. (Reaffirmed - 1990)
1200 (Pt.XII)-1 973	Wood work and joinery. (Reaffirmed - 1992)
1322-1993	Bitumen felts for water proofing and damp proofing.
1328-1996	Veneered decorative plywood
1341-1992	Steel Butt hinges (VI Rev.)
1378-1987	Oxidized copper finishes. (Reaffirmed - 1998)
1568-1970	Wire cloth for general purposes. (Reaffirmed - 1998)
1629-1960	Rules for grading of out size of timber. Superseded in I.S. 1331
1658-1977	Fiber hard board. (Reaffirmed - 1990)
1659-2004	Block boards
1708-1986	Method of testing of clear speciman of timber (II Rev) (Q.1) (Reaffirmed 1990)
1823-1980	Floor door stoppers. (Reaffirmed - 1992)
1868-1996	Anodic coating on Aluminium & its alloy (II Rev.) (Reaffirmed 1991)
875-PET 1987	Dead locds – Unit not of bldg. & stored materials
2191-1983	Wooden flush door shutter (cellular and hollow core type). (Reaffirmed - 1991)
1837 - 1966	For light pirot (I Rev.) (Reaffirmed 1990)
2095-1982	Gypsum plaster bow (I Rev) (an.1) (Ref. 1991)
2096-1992	A.C. flat sheet (I Rev.)
3828 - 1968	Ventilator chains (Reaf. 1990)
4835 - 1979	Polyvinyl acetate dispersion base adhesive for wood (1990)
2191 (Pt.I)-1983	Plywood face panels. (Reaffirmed - 1991)
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
2202 (Pt.II)-1983	Particle board face panels for wooden flush door shutters. (Reaffirmed - 1991)
2209(Pt.I)-1976	Mortise locks (vertical type) (Reaffirmed 1992)
2380-1981	Method of test for wood particle board and boards from lignocellulosic materials (Reaf.1993)
2681-1993	Non ferrous metal sliding door bolts(aldrop) for use with pad locks
2835-1987	Flat transparent sheet glass (3rd Revision). (Reaffirmed - 1992)
3087-1985	Wood particle boards (medium density) for general purpose (1990)
3097-1980	Veneered particle boards (1st Revision).

I. S. CODE NO.	S U B J E C T
3400 (Part I)-1987	Method of test for vulcanized rubbers (1991)
3400-(Pt.II)-2003	Hardness (1981)
3400-(Pt.IV)-1 987	Accelerated aging (1993)
3400 (Pt.IX)-2003	Relative density and density. (Reaffirmed - 1990)
3564-1996	Door closers (Hydraulically regulated)
3618-1966	Phosphate treatment of iron and steel for protection against corrosion. (Reaffirmed - 1991)
3813-1967	'C' hooks for use with swivels (1992)
3818-1992	Continuous (Piano) hinges
3847-1992	Mortise night latches
4020-1998 (1 to 16)	Methods of tests for wooden flush Doors (Type tests)
4021-1995	Timber door, window and ventilator frames
4827-1983	Electroplated coating of nickel and chromium on copper and copper alloys
4948-2002	Welded steel wire fabric for general use. (Reaffirmed - 1992)
4992-1975	Door Handles for mortise locks (vertical type). (Reaffirmed - 1990)
51 87-1972	Flush bolts (1990)
5523-1983	Method of testing anodic coating on aluminium & its alloys. (Reaffirmed -1991)
5930-1970	Mortise latch (vertical types) (1991)
6318-1971	Plastic window stays & fasteners
6607-1972	Rebated mortise locks (vertical type)
6760-1972	Slotted countersunk head wood screws. (Reaffirmed - 1988)
71 96-1974	Hold fasts (1992)
71 97-1974	Double action floor springs (without oil check) for heavy doors
7534-1985	Sliding locking bolt for use with padlocks. (Reaffirmed – 1991)
8756 - 1978	Mortice bell catches for use in wooden almirah (1992)
14856-2000	Glass fibre reinforced plastic (GRP) panel type door shutters for internal use - Specifications
11. STEEL WORK (N.A)	
63-1978	Whiting for paints. (Reaffirmed - 1994)
198-1978	Varnish, gold size. (Reaffirmed - 1991)
12406 - 1988	Medium density fibre board for general purpose - (1992)
277-2003	Specification for galvanised steel sheets (plain and corrugated)
278-1978	Galvanised steel barbed wire for fencing. (Reaffirmed - 1991)
800-1984	Code of practice for use of structural steel in general building construction
806-1968	Code of practice for use of steel tube in general building construction
813-1986	Scheme of symbols for welding. (Reaffirmed – 2003).
814-1991	Covered electrodes for metal arc welding of structural steel (Reaffirmed 2003)
814 (Pt-I)-1974	For welding products other than sheets. *
814 (Pt-II)-1974	For welding sheets. *
817-1966	Code of practice for training and testing of metal arc welders. (Reaffirmed – 2003)
818-1968 (Reaf-03)	COP for safety & healthy requirements in electric & gas welding & cutting operation.
1038-1983	Steel doors, windows and ventilators
1081-1960(Reaf-91)	COP for fixing & glazing of metal (steel & aluminium) doors, windows & ventilators
1148-1982(Reaf-92)	Hot rolled steel rivet bars (upto 40 mm diameters)for structural purposes (Reaffirmed

I. S. CODE NO.	SUBJECT
1161-1998	Steel tubes for structural purposes
1182-1 983(Reaf-00)	Recommended practice for radiographic examination of fusion welded butt joints in steel
1200 (Pt-VIII)-1993	Method of measurements of steel work and iron works
1363-1992 (Pt. 1- 3)	Hexagon bolts, nuts & lock nuts (dia. 6 to 39 mm) & black hexagon screws (dia. 6 to 24
1599-1 985(Reaf-9 1)	Method for bend test for steel products other than sheet, strip, wire & tube (reaffirmed
1608-1995	Method for tensile testing of steel products (Reaffirmed 2001)
1821-1987	Dimensions for clearance holes for metric bolts. (Reaffirmed - 2003)
1852-1985	Rolling and cutting tolerance for hot rolled steel products. (Reaffirmed - 1991)
1977-1969	Structural steel (ordinary quality) (Reaffirmed 2001)
2062-1999	Structural steel (fusion welding quality). Supersedes IS 226-1 975
4351-2003	Steel door frames. (Reaffirmed – 1991)
4736-1986	Hot-dip zinc coatings on steel tubes. (Reaffirmed – 2001)
6248-1979	Metal rolling shutters and rolling grills
7452-1990	Hot rolled steel sections for doors, windows & ventilators.
12. FLOORING :	
210-1993	Grey iron casting (Reaffirmed 1999)
653-1992	Sheet linoleum
777-1988	Glazed earthen-ware tiles
809-1992	Rubber flooring materials for general purpose
1122-1974	Methods for determination of specific gravity (*and porosity of natural building stones)
1124-1974	Method of test for water absorption of natural building stones
1130-1969	Marble (blocks, slabs and tiles). (Reaffirmed – 1993)
1197-1970	Code of practice for laying of rubber floors. (Reaffirmed – 1990)
1198-1982	Code of practice for laying and maintenance of linoleum floors
1200 (Pt.XI)-1977	Method of measurements of pavings and floor finishes.
1237-1980	Cement concrete flooring tiles. (Reaffirmed – 1990)
1443-1972	Code of practice for laying and finishing of cement concrete flooring tiles
1661-1972	Code of practice for application of cement and cement lime plaster finishes
2114-1984	Code of practice for laying in situ terrazzo floor finish
2571-1970	Code of practice for laying in situ cement concrete flooring
3400-1 987 (Part 1 to	Method of Test of vulcanized rubbers. (Reaffirmed – 2003)
3400 (Pt.II)-2003	Hardness
3400 (Pt.X)-1977	Compression set at constant strain. (Reaffirmed – 2003)
3462-1986	Flexible P.V.C. Flooring. (Reaffirmed – 1991)
4631-1986	Code of practice for laying of resin floor toppings (Reaffirmed – 2001)
5318-1969	Code of practice for laying of flexible P.V.C. sheet & tiles flooring
5389-1969	Code of practice for laying of hardwood parquet and wood block floors. (Reaffirmed –
9197-1979	Specifications for epoxy resin, hardeners and epoxy resin compositions for floor topping
13630 (Pt.1 to 13)	Methods of tests for ceramic tiles (Part 1 to 13 : 1992-1993)

I. S. CODE NO.	S U B J E C T
13. ROOFING: (N.A)	
73-1 992	Paving Bitumen (Reaffirmed 1998)
277-2003	Galvanised steel sheets (plain and corrugated)
458-2003	Concrete pipes (with and without reinforcement)
459-1992	Unreinforced corrugated and semicorrugated asbestos cement sheets
651-1992	Salt glazed stone ware pipes and fittings
702-1988	Industrial Bitumen
1199-1959	Method of Sampling & Analysis of concrete. (Reaffirmed - 1991)
1200 (Pt.IX)-1973	Method of measurements of roof covering (including cladding)
1200 (Pt.X)-1973	Method of measurements of ceiling and lining
13607 - 1992	Ready Mixed Paint, Finishing, General Purposes, Synthetic (Reaffirmed 2002)
1322-1993	Bitumen felts for water proofing and damp-proofing. (Reaffirmed -1988)
1346-1991	Code of practice for waterproofing of roof with bitumen felts
1609-1991	Code of practice for laying damp proof treatment using bitumen felts
1626-1994(Part I-III)	Asbestos cement building pipes, gutters and fittings (Spigot and socket types)
1834-1984	Specification for hot applied sealing compounds for joints in concrete. (Reaffirmed - 1990)
1838-(Pt.I & II)-1983	Prefomed filler for expansion joints in concrete- non-extruding and resilient type Bitumen impregnated fiber). (Reaffirmed - 1990)
2115-1980	Code of practice for flat roof finish:mud phuska. (Reaffirmed - 1998)
2633-1986	Method of testing uniformity of coating on zinc coated articles. (Reaffirmed – 2001)
3007-(Pt.I)-1999	Code of practice for laying of corrugated asbestos cement sheets. (Reaffirmed – 1991)
3007-(Pt.II)-1 965	Code of practice for laying of semi corrugated asbestos cement sheet. (Reaffirmed - 1991)
3348-1965	Fiber insulation boards. (Reaffirmed - 1990)
3607-1979	Magnesite for chemical Industry. (Reaffirmed – 2003)
71 93-1994	Specifications for glass fiber base coal tar Pitch & Bitumen felts.
8183-1993	Bonded mineral wool. (Reaffirmed 2004)
14. FINISHING	
75-1973	Linseed oil, raw and refined. (Reaffirmed – 2003)
77-1976	Linseed oil, boiled, for paints. (Reaffirmed - 1999)
102-1962	Ready mixed paint, brushing, red, lead, non setting, priming.(Reaffirmed - 1996)
104-1979	Specification for ready mixed paint, brushing, zinc chrome, priming. (Reaffirmed - 1999)
133-1993	Enamel, interior (a) under coating (b) finishing colour as required
137-1965	Ready mixed paint, brushing, matt or egg-shell flat, finishing, interior, to Indian Standard Colour, as required. (Reaffirmed – 1999)
158-1981	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 2002)
217-1988	Cut back bitumen (reaffirmed 1999)

I. S. CODE NO.	S U B J E C T
218-1983	Creosote and anthracene oil for use as wood preservatives (Reaffirmed 1998)
290-1961	Coal tar black paint. (Reaffirmed – 1996)
337-1975	Varnish, finishing interior. (Reaffirmed – 2001)
341-1973	Black Japan, types A, B, and C (Reaffirmed 2002)
347-1975	Varnish, shellac for general purpose. (Reaffirmed – 2001)
348-1968	French polish. (Reaffirmed – 2001)
419-1967	Putty for use of window frames. (Reaffirmed – 2001)
427-1965	Distemper, dry, colour as required. (Reaffirmed – 1999)
428-2000	Washable distemper
524-1983	Varnish, finishing, exterior, synthetic. (Reaffirmed – 2000)
525-1968	Varnish, finishing, exterior and general purposes. (Reaffirmed –2001)
533-1998	Gum spirit of turpentine (oil of turpentine) (Reaffirmed 2003)
712-1984	Specification for building limes. (Reaffirmed - 1995)
1200 (Pt. XII)-1976	Method of measurements of plastering and pointing
1200 (Pt.XIII)-1994	Method of measurements of white washing, colour washing, distempering and other finishes
1200 (Pt.XV)-1987	Methods of measurements of painting, polishing & varnishing.
2095-1996 (Pt.I - III)	Gypsum plaster boards
2096-1992	Asbestos cement flat sheets.
2339-1963	Aluminium paint for general purposes, in dual container. (Reaffirmed – 1999)
2547-1976 (Pt I & II)	Gypsum building plaster (Reaff. 1992)
2932-2003	Enamel synthetic, exterior (a) Under coating (b) Finishing.
2933-1975	Enamel, Exterior (a) Under coating (b) Finishing
5410-1992	Cement paint (Reaffirmed 1999)
5411 (Pt.I)-1 974	Plastic emulsion paint for interior use. (Reaffirmed – 1993)
6278-1971	Code of practice for white washing & colour washing. (Reaffirmed -1991)
15. DEMOLITION AND DISMANTLING:	
1200(Pt.XVIII)-1974	Method of measurements of demolition and dismantling
16. SAFETY CODES	
818-1968 (Reaf-03)	Safety and healthy requirements in Electric and gas welding and cutting operations.
3696 (Pt.I)-1 987	Safety code for scaffolds
3696 (Pt.II)-1991	Safety code for ladders
3764-1992	Safety code for Excavation works
4081-1986	Safety code for blasting and related drilling operation
4130-1991	Safety code for Demolition of Building
5916-1970	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	Working with construction machinery- safety code for

Plumbing Works	
Pipes and Fittings	
IS : 458	Specification for precast concrete pipes (with and without reinforcement)
IS : 651	Salat glazed stone ware pipes and fittings.
IS : 1239 (Part 1)	Mild steel, tubes, tubulars and other wrought steel fittings : Part 1 Mild Steel tubes.
IS : 1239 (Part 2)	Mild Steel tubes, tubulars and other wrought steel fittings : Part 2 Mild Steel tubulars and other wrought steel pipe fittings.
IS : 1536	Centrifugally cast (spun) iron pressure pipes for water, gas and sewage.
IS : 1537	Vertically cast iron pressure pipes for water, gas and sewage.
IS : 1538	Cast Iron fittings for pressure pipes for water, gas and sewage.
IS : 1729	Sand Cast iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.
IS : 1879	Malleable cast iron pipe fittings.
IS : 1978	Line pipe
IS : 1979	High test line pipe.
IS : 2501	Copper tubes for general engineering purposes
IS : 2643 (Part 1)	Dimensions for pipe threads for fastening purposes: Part 1 Basic profile and dimensions.
IS : 2643 (Part 2)	Dimensions for pipe threads for fastening purposes : Part 2 Tolerances.
IS : 2643 (Part 3)	Dimensions for pipe threads for fastening purposes : Part 3 Limits of sizes.
IS : 3468	Pipe nuts.
IS : 3589	Seamless or electrically welded steel pipes for water, gas and sewage (168.3 mm to 2032 mm outside diameter).
IS : 3989	Centrifugally cast (sun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.
IS : 4346	Specifications for washers for use with fittings for water services.
IS : 4711	Methods for sampling steel pipes, tubes and fittings.
IS : 6392	Steel pipe flanges
IS : 6418	Cast iron and malleable cast iron flanges for general engineering purposes.
IS : 7181	Specification for horizontally cast iron double flanged pipe for water, gas and sewage.
Valves	
IS : 778	Specification for copper alloy gage, globe and check valves for water works purposes.
IS : 780	Specification for sluice valves for water works purposes (50 mm to 300 mm size).
IS : 1703	Specification copper alloy float valves (horizontal plunger type) for water supply fittings.
IS : 2906	Specification for sluice valves for water works purposes (350 mm to 1200 mm size)
IS : 3950	Specification for surface boxes for sluice valves.
IS : 5312 (Part 1)	Specification for swing check type reflux (non return) valves : part 2 Multi door pattern.
IS : 5312 (Part 2)	Specification for swing check type reflux (non return) valves : part 2 Multi door pattern.
I. S. CODE NO.	S U B J E C T
IS : 12992 (Part 1)	Safety relief valves, spring loaded : Design
IS : 13095	Butterfly valves for general purposes.
Sanitary Fittings	

IS : 771 (Part 1 to 3)	Specification for glazed fire clay sanitary appliances.
IS : 774	Specification for flushing cistern for water closets and urinals (other than plastic cistern)
IS : 775	Specification for cast iron brackets and supports for wash basins and sinks
IS : 781	Specification for cast copper alloy screw down bib taps and stop valves for water services.
IS : 1700	Specification for drinking fountains.
IS : 2548 (Part 2)	Specification for plastic seats and covers for water closets : Part 1 Thermoset seats and covers.
IS : 2556 (Part 1)	Specification for vitreous sanitary appliances (Vitreous china) : Part 1 General requirement.
IS : 2556 (Part 2)	Specification for vitreous sanitary appliances (vitreous china) : Part 2 Specific requirements of wash-down water closets.
IS : 2556 (Part 3)	Specification for vitreous sanitary appliances (vitreous china) : Part 3 Specific requirements of squatting pans.
IS : 2556 (Part 4)	Specification for vitreous sanitary appliances (vitreous china) : part 4 specific requirements of wash basins.
IS : 2556 (Part 6 Sec 2)	Specification for vitreous sanitary appliances (vitreous china) : part 6 Specific requirements of urinals, section 2 half stall urinals.
IS : 2556 (Part 6 Sec 4)	Specification for vitreous sanitary appliances (vitreous china) : Part 6 specific requirements of urinals, section 4 partition slabs.
IS : 2556 (Part 6 Sec 5)	Specification for vitreous sanitary appliances (vitreous china) : Part 6 Specific requirements of urinals, section 5 waste fittings.
IS : 2556 (Part 6 Sec 6)	Specification for vitreous sanitary appliances (vitreous china) : Part 6 Specific requirements of urinals, section 6 water spreaders for half stall urinals.
IS : 2556 (Part 7)	Specification for vitreous sanitary appliances (vitreous china) : Part 7 Specific requirements of half round channels.
IS : 2556 (Part 8)	Specification for vitreous sanitary appliances (vitreous china) : Part 8 Specific requirements of siphoning wash down water closets.
IS : 2556 (Part 11)	Specification for vitreous sanitary appliances (vitreous china):Part 11 Specific requirements for shower rose.
IS : 2556 (Part 12)	Specification for vitreous sanitary appliances (vitreous china) : Part 12 Specific requirements of floor traps.
IS : 2556 (Part 15)	Specification for vitreous sanitary appliances (vitreous china) : Part 15 Specific requirements of universal water closets.
IS : 2692	Specification for ferrule for water services
IS : 2717	Glossary of terms relating to vitreous enamelware and ceramic metal systems
IS : 2963	Specifications for waste plug and its accessories for sinks and wash basins.
IS : 3311	Specification for waste plug and its accessories for sinks and wash basins.
IS : 5961	Specification for cast iron gratings for drainage purposes.
IS : 6249	Specification for gel-coated glass fibre reinforced polyester resin bath tubs.
IS : 6411	Specification for gel-coated glass fibre reinforced polyester resin bath tubes.
I. S. CODE NO.	S U B J E C T
IS : 8931	Specification for copper alloy fancy single taps, combination tap assembly and stop valves for water services.
IS : 9758	Specification for flush valves and fitting for water closets and urinals.
Water Quality Tolerance	

IS : 3025 (Parts 1 to 44)	Method of sampling and test (physical and chemical) for water and waste water.
IS : 4764	Tolerance limits for sewage effluents discharged into inland surface waters.
IS : 10500	Drinking Water
Pumps & Vessels	
IS : 1520	Specification for horizontal centrifugal pumps for clear cold fresh water.
IS : 2002	Steel plates for pressure vessels for intermediate and high temperature service including boilers.
IS : 2825	Code for unfired pressure vessels.
IS : 4648 (Part 1)	Code of practice for lining of vessels and equipment for chemical processes Part 1 : Rubber lining.
IS : 5600	Specification for sewage and drainage pumps
IS : 8034	Specification for submersible pump sets for clear, cold, fresh water.
IS : 8418	Specification for horizontal centrifugal self priming pumps.
General	
SP : 6 (1)	Structural Steel Sections
IS : 325	Three Phase Induction Motors
IS : 554	Dimensions for pipe threads where pressure tight joints are required on the threads.
IS : 694	PVC insulated cables for working voltages upto & including 1100 V.
IS : 779	Specification for water meters (domestic type).
IS : 782	Specification for caulking load.
IS : 800	Code of practice for general construction in steel
IS : 1068	Electroplated coatings of nickel plus chromium and copper plus nickel plus chromium.
IS : 1172	Code of Basic requirements for water supply drainage and sanitation.
IS : 1367 (Part 1)	Technical supply conditions for threaded steel fasteners : Part 1 introduction and general information.
IS : 1367 (Part 2)	Technical supply conditions for threaded steel fasteners : Part 2 product grades and tolerances.
IS : 1554 (Part 1)	PVC insulated (heavy duty) electric cables : Part 1 for working voltages upto and including 1100 V.
IS : 1554 (Part 2)	PVC insulated (heavy duty) electric cables : Part 2 for working voltages from 3.3 KV upto and including 11 KV.
IS : 1726	Specification for cast iron manhole covers and frames.
IS : 1742	Code of practice for building drainage.
IS : 2064	Selection, installation and maintenance of sanitary appliance code of practice.
IS : 2065	Code of practice for water supply in buildings.
IS : 2104	Specification for water meter for boxes (domestic type)
IS : 2373	Specification for eater meter (bulk type)
IS : 2379	Colour code for identification of pipe lines.
I. S. CODE NO.	S U B J E C T
IS : 2527	Code of practice for fixing rainwater gutters and down pipes for roof drainage.
IS : 2629	Recommended practice for hot dip galvanizing on iron and Steel.
IS : 3114	Code of practice for laying of cast iron pipes
IS : 4111 (Part 1)	Code of practice for ancillary structures in sewerage system : Part 1 manholes.

IS : 4127	Code of practice for laying glazed stoneware pipes.
IS : 4853	Recommended practice for radiographic inspection of fusion welded butt joints in steel pipes.
IS : 5329	Code of practice for sanitary pipe work above ground for buildings.
IS : 5455	Cast iron steps for manholes.
IS : 6159	Recommended practice for design and fabrication of material, prior to galvanizing.
IS : 7558	Code of practice for domestic hot water installations.
IS : 8321	Glossary of terms applicable to plumbing work.
IS : 8419 (Part 1)	Requirements for water filtration equipment : Part 1 Filtration medium sand and gravel.
IS : 8419 (Part 2)	Requirements for water filtration equipment : Part 2 under drainage system.
IS : 9668	Code of practice for provision and maintenance of water supplies and fire fighting.
IS : 9842	Preformed fibrous pipe insulation.
IS : 9912	Coal tar based coating materials and suitable primers for protecting iron and steel pipe lines.
IS : 10221	Code of practice for coating and wrapping of underground mild steel pipelines.
IS : 10446	Glossary of terms relating to water supply and sanitation.
IS : 11149	Rubber Gaskets
IS : 11790	Code of practice for preparation of butt-welding ends for pipes, valves, flanges and fittings..
IS : 12183 (Part 1)	Code of practice for plumbing in multistoried buildings : Part 1 water supply.
IS : 12251	Code of practice for drainage of building basements.
IS : 5572	Code of practice for sanitary pipe work.
BS : 6700	Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their cartilages.
BS : 8301	Code of practice for building drainage.
BSEN : 274	Sanitary tap were, waste fittings for basins, bidets and baths. General technical specifications.
Fire Fighting & Fire Protection (N.A)	
NBC Part – IV	National Building Code of India; Part IV Fire & Life Safety
TAC	Tariff Advisory Committee fire protection manual Part-I.
TAC	Rules of Tariff Advisory Committee for automatic sprinkler system.
NFPA : 13	Installation of Sprinkler System
NFPA : 14	Installation of Standpipe & Hose System
NFPA : 20	Installation of Stationary pump for Fire Protection
IS : 636	Non-percolating flexible fire fighting delivery hose.
IS : 884	Specification for first aid hose reel for fire fighting.
IS : 901	Specification for couplings, double male and double female, instantaneous pattern for fire fi0+-6 ghting.
I. S. CODE NO.	S U B J E C T
IS : 902	Suction hose couplings for fire fighting purposes.
IS : 903	Specification for fire hose delivery couplings, branch pipe, nozzles and nozzle spanner.
IS : 904	Specification for 2-way and 3-way suction collecting heads for fire fighting purposes.

IS : 907	Specification for suction strainers, cylindrical type for fire fighting purposes.
IS : 908	Specification for fire hydrant, stand post type.
IS : 909	Specification for underground fire hydrant, sluice valve type.
IS : 910	Specification for portable chemical foam fire extinguiser.
IS : 933	Specification for portable chemical foam fire extinguisher.
IS : 1648	Code of practice for fire safety of building (general) : Fire fighting equipment and its maintenance.
IS : 2171	Specification for portable fire extinguishers dry powder (catridge type)
IS : 2190	Selection, installation and maintenance of first aid fire extinguishers – Code of practice.
IS : 2871	Specification for branch pipe, universal, for fire fighting purposes.
IS : 2878	Specification for fire extinguishers, carbon dioxide type (portable and trolley mounted).
IS : 3844	Code of practice for installation and maintenance of internal fire hydrants and hose reel on premises.
IS : 5290	Specification for landing valves.
IS 5714	Specification for coupling, branch pipe, nozzle, used in hose reel tubing for fire fighting.
IS : 8423	Specification for controlled percolation type hose for fire fighting.
IS : 10658	Specification for higher capacity dry powder fire extinguisher (trolley mounted).
IS : 11460	Code of practice for fire safety of libraries and archives buildings.
IS : 1309	External hydrant systems – Provision and maintenance – Code of practice.
IS : 5514 (Parts 1 to 7)	Reciprocating internal combustion engines : Performance.
IS : 15105 : 2002	Design & Installation of Fixed Automatic Sprinkler Fire Extinguishing System – Code of Practice.

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4.3.3.3 WATER :

Water used for both mixing and curing shall be clean and free from injurious amounts of deleterious materials.viz oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel. Potable waters are generally satisfactory for mixing and curing concrete. In case of doubt, the suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time test specified in I.S. 456 - 2000. The sample of water taken for testing shall be typical of the water proposed to be used for concreting, due account being paid to seasonal variation. The samples shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water.

Average 28 days compressive strength of at least three 150 mm. concrete cubes prepared with water proposed to be used shall not be less than 90% of the average strength of three similar concrete cubes prepared with distilled water as per IS - 516.

The initial setting time of test block made with the appropriate cement and the water proposed to be used shall not be less than 30 minutes and shall not differ by more than (+/-) 30 minutes from the initial setting time of control test block prepared with the same cement and distilled water. The test blocks shall be prepared and tested in accordance with the requirements of I.S. 4031 (Part 5).

Where water can be shown to contain an excess of acid, alkali, sugar or salt, Engineer-in-Charge may refuse to permit its use. As a guide, the following concentrations represent the maximum permissible values:

a) Limits of acidity : To neutralize 100 ml sample of water, using phenolphthalein as an indicator, it should not require more than 5 ml. of 0.02 normal NaOH. The details of test shall be as per I.S. 3025 (Part 22)

b) Limits of alkalinity : To neutralize 100 ml sample of water, using mixed indicator , it should not require more than 25 ml. of 0.02 normal H₂SO₄. The details of test shall be as per I.S. 3025 (Part 23).

c) Permissible limits for solids shall be as under (water):

Sl.No.	Type of solid	Tested as per	Permissible limit (Max.)
i)	Organic	IS 3025 (Part 18)	200 mg / l
ii)	Inorganic	IS 3025 (Part 18)	3000 mg / l
lii)	Sulphates (as SO ₂)	IS 3025 (Part 24)	400 mg / l

iv)	Chlorides (asCl)	IS 3025 (Part 32)	2000 mg / l for concrete not containing embedded steel and 500 mg/l for reinforced cement concrete work.
v)	Suspended matter	IS 3025 (Part 17)	2000mg / l

d) The PH value of water shall be not less than 6.

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GENERAL NOTE FOR ALL TILING WORKS:

Where the size of flooring files 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.

19.4 CLEANING OF SURFACE & LAYING OF CEMENT MORTAR BEDDING :

Before laying the cement mortar bedding the concrete floor surface 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 (1:4 of specified thickness or more if required to make up the level or grade) shall be laid evenly and to the required slopes as directed. The terrazzo tiles shall then be laid immediately after laying the mortar. All tiles shall be truly and evenly set in a thick slurry of cement of honey like consistency applied to the sides and bottom and over the prepared base at the rate of 4.4 kg/sqm over such an area would accommodate about 20 tiles. The tiles shall then be tamped down with wooden mallet until they are properly bedded and exactly in true plane and line, with the adjacent tiles. Care shall be taken to ensure that the tiles are solidly bedded without voids and air pockets. All tiles shall be extended upto the unplastered surfaces of masonry walls/ RCC columns/ RCC walls. Wherever full tiles / half tiles can not be fixed, tiles shall be cut /sawn from full tile to the required size and their edges rubbed smooth to ensure a straight and true joint. The tiles shall be close jointed in matching cement slurry and the cement slurry oozing out through the thin joints shall be immediately wiped clean. The joints between the tiles shall not be greater than 1.5 mm. and shall be kept in straight lines or to suit the required pattern. The junction between wall plaster and tile work shall be finished neatly and without any waviness. All tiles shall be laid as to have continuous lines from various rooms to the passage. No change of lines shall be permitted at junction between rooms and passage. The joints shall be fine and made neatly indistinguishable by grouting of the joints @ 2.20 kg/sqm of grey cement slurry mixed with suitable colouring pigments to match with the tiles. People should not be allowed to walk over the freshly laid tiles.

Adjustment of levels in thickness of mortar bedding due to different type of flooring if any, shall be done by the contractor within a reasonable limit/distance as directed by the Engineer-in-Charge without any extra cost to the Department.

19.5 CURING, POLISHING & FINISHING:

The day after the tiles are laid, all joints shall be cleaned of the grey cement grout with a wire brush or trowel to a depth of 5mm. and all dust and loose mortar removed and cleaned. Joints shall then be grouted with grey

or white cement mixed with or without pigment to match the shade of the topping of the wearing layer of the tiles.

The floor shall then be kept wet for a minimum period of 7 days. The surface shall thereafter be ground evenly with machine fitted with coarse grade grit blocks (No. 60). Water shall be used profusely with grinding. After grinding, the surface shall be thoroughly washed, remove all grindings, mud cleaned and mopped, and the joints opened out during grinding shall be grouted once again wherever necessary with matching cement. The surface shall be again cured. The second grinding shall then be carried out with machine fitted with fine grade grit blocks (No. 120) and shall be grouted again the opened out joints with matching cement.

The final grinding with machine fitted with the finest grade grit blocks (NO.320) shall be carried out the day after the second grinding described in the preceding para or before handing over the floor as ordered by the Engineer-in-charge.

For small areas or where circumstances so required, hand polishing may be permitted in lieu of machine polishing after laying, entirely at the discretion of the Engineer-in-charge. For hand polishing, the following carborundum stone shall be used. The polishing shall be done in such a manner that there are no visible scratches on the terrazzo tiles. If scratches are observed, the tiles shall be removed and replaced by new tiles.

1st Grinding	Coarse Grade stone (No. 60)
2nd Grinding	Coarse Grade stone (No. 60)
Final Grinding	Fine grade stone (No. 120)

In all other respects, the process shall be similar as for machine polishing. After the final polish, oxalic acid crystals ground into powder shall be dusted over the surface (@ 2/3 lb per 100 sft. or 32.5 gm. per sqm.), sprinkled water and rubbed hard with Namdah" block (pad of woolen rags). The following day the floor shall be wiped with a moist rag and dried with a soft cloth and finished clean. If any tile is disturbed or damaged, it shall be refitted or replaced, properly jointed and polished.

The finished floor shall not sound hollow when tapped with a wooden mallet.

19.6 TERRAZZO / CEMENT TILE SKIRTING :

Terrazzo tile in skirting shall be of size as specified in schedule of quantities or as directed by the Engineer-in-charge, hydraulically pressed and shall be obtained from the same source as for the terrazzo/ cement tiles for flooring. The design and shade of the skirting tiles shall be exactly similar to that of flooring tiles. The specifications for materials and workmanship shall be same as for flooring except that the skirting tile shall be laid against a 12 mm. thick backing of cement mortar 1:3 to the full height of skirting, thus allowing uniform projection beyond the plastered surfaces. In case of dado, the back of tiles shall be buttered with a coat of grey cement slurry/paste and edges with grey or white cement slurry/paste as the case may be, with or without pigment to match the shade of tiles and set in the backing/bedding mortar. Any cutting of brick work, concrete etc. required due to unevenness of brick surface shall be carried out at no extra cost to the Department to

maintain this uniform projection beyond the plastered surfaces.

The skirting tiles shall be true in plane, line, level and plumb or in slope. The vertical lines of skirting tiles should be in line with that of flooring tile lines. The colour of the skirting tile and floor tile shall match. The undone portion of plaster work left above the terrazzo tile skirting work shall be finished round or as directed by the Engineer-in-charge in the matching plaster. The item of plastering shall be inclusive of this plaster finishing above the skirting tiles, required to be done after laying of skirting tiles. No additional payment will be admissible for this extra operation.

19.7 SAMPLING AND TEST:

Tiles required for carrying out tests described below shall be taken by "random sampling". Each tile samples shall be marked to identify the consignment from which it was selected. Minimum quantity of tiles for carrying out the test and frequency of test shall be as per IS : 13801. Cost of these tests shall be borne by the contractor.

Mandatory Tests	No. of	Results
a) For conformity to requirements of shape and dimensions, wearing layer and general quality.	12 tiles	Concavity & Convexity shall not exceed 1 mm. Perpendicularity shall not exceed 2% of the length of edge.
b) For wet transverse strength test	6 tiles	Strength shall not be less than 30 kgf/cm ²
c) For resistance to wear test	6 tiles	Average wear shall not exceed 3.50 mm and wear on individual specimen shall not exceed 4 mm.
d) For water absorption test	6 tiles	Shall not be more than 10%

19.8 MODE OF MEASUREMENT :

The length and / or width of the flooring / skirting / dado shall be measured net between the faces of skirting or dado or plaster faces of walls which is the proudest, and height of skirting / dado shall be measured from the finished level of floor. All openings exceeding 0.1 sqm. in area where tiling is not done shall be deducted and net areas only shall be measured and paid for. Flooring under dado, skirting or plaster shall not be measured for payment. Nothing extra shall be paid for use of cut tiles nor for laying the floor at different levels in the same room.

All dimensions shall be measured correct upto 2 places of decimal of a meter and area so worked out shall be correct upto two places of decimal of a sqm. for flooring, skirting, dado etc.

Note: Wastage in tile cutting to get the required dimension of rooms etc. as specified in drawing or as directed by the Engineer-in-charge shall have to be taken into consideration by contractor while quoting the rate for work to be measured as above. No extra claim on this account will be entertained.

19.9 PLAIN CEMENT TILE FLOORING & SKIRTING :

The specifications, mode of measurements etc. in respect of terrazzo tiles in flooring and skirting shall be

applicable in general to plain cement tiles except that no marble chips & white cement shall be used in tile manufacture.

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

22.1 MATERIALS :

White Glazed Tiles : The tiles shall be of approved make and shall generally conform to IS : 777. 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 from 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 conform to I.S. 777 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.

22.2 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.

22.3 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 with the 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.

22.4 FIXING OF TILES FOR FLOORING :

The tiles before laying shall be soaked in water for at least 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 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. 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/matching colour cement slurry. After fixing the tiles, finally in an even plane or slope, the flooring shall be covered with wet sand and allowed undisturbed for 14 days.

22.5 FIXING TILES FOR DADO & SKIRTING/FACIA :

The dado work, shall be done only after fixing the tiles/slabs on the floor. The approved white glazed tiles before laying shall be soaked in water for at least 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 with this layer of cement mortar 1:2 using fine sand (table III, zone IV, I.S. 383-1963) and the edge of the tile smeared with neat white cement slurry. 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.

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.

22.6 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.

22.7 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 and floor kept wet for 7 days and then cleaned. Finished floor shall not sound hollow when tapped with a wooden mallet.

22.8 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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23 . CHEQUERED TILES IN STAIR TREADS AND LANDINGS:

23.1 SCOPE OF WORK :

The work envisaged under these specifications consists of supplying and laying chequered cement tiles in the treads of staircase steps and over landings.

23.2 MATERIALS :

Chequered Tiles: The size of tiles including nosing shall be as shown in drawing and shall have the thickness not less than 28 mm.

The nosing edge of the tile shall be rounded and the front portion of the tiles for a minimum length of 75 mm. from and including the nosing shall have groves running parallel to the nosing and at centres not exceeding 25

mm. Beyond that the nosing tiles shall have normal chequered pattern, centre to centre distance being not less than 25 mm. and not more than 50 mm. The nosing shall have the same wearing layers as the top portion of the tile.

The overall thickness of the tile as mentioned earlier shall not be less than 28 mm. with the top layer measured from the top of the chequers which shall not be less than 6 mm. The tiles shall be given the first grinding before delivery to site. The tiles shall conform to the specification for terrazzo tiles/cement tiles, in respect of method of manufacture and the mix of the backing and wearing layers, as specified in the item.

23.3 PREPARATION OF SURFACE AND LAYING :

The method of preparation of surface and laying shall generally be similar to as specified herein before under terrazzo tile flooring.

23.4 CURING, POLISHING AND FINISHING :

The specifications shall be the same as specified herein before under terrazzo tile flooring except that polishing of the treads nosing and chequered grooves, after laying shall be done by hand. Special care shall be taken to polish the nosing and the grooves in such a manner as to get a uniform erection for the grooves and the nosing and their finish shall match with the finish of the flat portion of the tiles.

23.5 MODE OF THE MEASUREMENT :

Length shall be measured from finished face of skirting, dado or wall plaster correct to a centimetre and the width shall be measured from the outer edge of the tread to the finished face of riser. In the case of tiles laid over the landing, the mode of measurement shall be as per terrazzo tiles specifications. The area shall be in square metres correct to two places of a decimal.

The rate shall include the cost of all materials and labour, transport, scaffolding etc. required in all the operations described above.

25. CERAMIC TILE FLOORING, DADO / SKIRTING / FACIA.

25-1 MATERIALS :

Ceramic Tiles : The tiles shall be of approved make and shall generally conform to IS : 13712-1998. 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 as mentioned in schedule of quantities and 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 from 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 6 mm or as specified in the items and shall conform 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.

25-2 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 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.

25-3 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 with 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 & 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 as specified in schedule of quantities and brought to correct line and plumb and the surface left rough to receive the tiles.

25-4 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 edges of the tiles shall be smeared with neat 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. 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 /matching colour cement slurry. After fixing the tiles, finally in an even plane or slope, the flooring shall be covered with wet sand and allowed undisturbed for 14 days.

25-5 FIXING TILES FOR DADO & SKIRTING/FACIA :

The dado work, shall be done only after fixing the tiles/slabs on the floor. The approved ceramic 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 with this layer of cement mortar 1:2 using fine sand (table III, zone IV, I.S. 383-1963) and the edge of the tile smeared with neat cement slurry. 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 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.

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.

25-6 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.

25-7 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 cement and floor kept wet for 7 days and then cleaned. Finished floor shall not sound hollow when tapped with a wooden mallet.

25-8 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.

* * *

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

26.1 MATERIALS :

Vitrified Tiles: The tiles shall be of approved make like Marbonite / Granamite 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.

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

TECHNICAL SPECIFICATIONS FOR VITRIFIED TILES

NO	PROPERTY	EXPECTED STANDARDS
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 / mm ²
8	Abrasion resistance	< 204 mm ²
9	Skid resistance (friction coefficient)	> 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.

26.2 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..

26.3 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 centre of the area and advanced towards the walls. 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. A white cement slurry 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 / matching colour cement slurry. After fixing the tiles, finally in an even plane or slope, the flooring shall be covered with wet sand and allowed undisturbed for 14 days.

26.4 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 BAL-ENDURA or equivalent 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.

26.5 : 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 BAL-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.

26.6 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.

26.7 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.

26.8 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 / Conc. HCL

Tea	Hydrochloric acid / Bleaching powder
Coffee	Sodium hydroxide / Potassium hydroxide
Beer	Sodium hydroxide / Potassium hydroxide
Diesel	Acetone / Petrol
Lab indicator	Acetone / Isopropyl alcohol
Cement and grouting	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

OT (other tiles), 9 TANDUR STONE/CUDDAPPA STONE/POLISHED SHAHABAD STONE / BLUE WADI STONE FLOORING / SKIRTING / DADO : The specifications for Tandur, Cudappa, polished Shahabad and blue Wadi stone flooring / skirting / dado shall be similar to those respecting specifications for Kotah stone flooring / skirting / dado specified herein before in all respects.

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31. WOOD WORK IN FRAMES, SHUTTERS AND PANELLING :

31.1 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 tenoned into the mortises to the full widths as shown in the drawing. All necessary mortising, tenoning, 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 shall be well painted with two coats of bituminous paint or solignum 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.

31.2 TEAK WOOD PANELLED SHUTTERS :

Teak wood door shutter shall generally conform to standard laid in I.S. 1002 or the latest revision 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.

31.3 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.

31.4 GLAZING :

Glazing shall be generally with 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.

31.5 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.

31.6 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.

31.7 ADHESIVES :

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

31.8 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 around 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.**

31.9 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 - 1989 specification for plywood for general purpose (revised) for commercial type and I.S. 1659 - 1990 specification for block boards for decorative type.

31.10 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 destructive tests shall be borne by the contractor.

31.11 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.

31.12 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 around the glass. The glass shall be 4 mm. thick or as specified of best quality (M/s. Triveni, I.A.G., Shree Vallabh 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 Fevicol or any other approved adhesive. 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.

31.13 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.

* * *

32. PRESSED STEEL DOOR FRAME :

32.1. Scope of work : This specification lays down the requirements regarding material, dimensions and construction of steel door frames for internal and external use.

32.2. Material : Steel door frames shall be manufactured from commercial mild steel sheets of 1.25 mm. thickness, conforming to I.S. 513 (Spn. for cold rolled carbon steel sheets) or I.S. 1079 (Spn. for hot rolled carbon steel sheet and strip). Sheets shall be galvanised for 240 g / Sqm. Zinc deposit on its surface including both sides as per IS 277 – 2003.

32.3. Standard sizes, Tolerances and Designations :

Sizes : The overall sizes and types of door frames shall be as shown in drawings. 5 mm. clearance on all the four sides shall be allowed for the purpose of fitting the frame into modular openings.

Tolerances : The sizes indicated in drawings for door frames shall not vary by more than (+/-) 2 mm.

32.4. Profile : Steel door frames with or without fanlight shall be made in the profile as per I.S. 4351 (latest version) as per drawings. Any of the three profiles mentioned in I.S. 4351 or sizes specified in the schedule of work may be supplied to suit doors of either hand, opening inwards or outwards, as specified or directed.

32.5. Construction : Each door frame shall consist of hinge jamb, lock jamb, head and, if required, angle threshold. The whole shall be rigidly fixed together by mechanical means. Where no angle threshold is required, temporary base tie shall be screwed to the feet of frames in order to form a rigid unit.

32.6. Base ties and angle thresholds : Base ties shall be of pressed mild steel 1.25 mm. thick adjustable to suit floor thickness of 25, 30, 35 or 40 mm. and removable, or alternatively, thresholds of mild steel angle of section 50 x 25 mm., minimum, shall be provided for external door frames.

32.7. Fittings: Fixing Lugs: There shall be three adjustable lugs with split end tail to each jamb without fanlight, and four for jamb with fanlight. The head of the fixing lug shall be of 120 mm. long and shall be made from flat steel strip 25 mm. wide and not less than 1.60 mm. thick.

The tail of the lugs for use with door frame profile shall be 200 mm. long and shall be made of steel strip not less than 40 mm. wide and not less than 1.0 mm. thick.

Mortar Guards: Mortar guards specified in the tender shall be provided. These shall be welded to the frame at the head of the frame for double shutter doors to make provision for bolts.

Note: The term 'double-shutter doors' indicates 'Pairs of side-hung doors', that is, two side-hung doors mounted in one frame thus forming a two-leaf door rebated together at the lock strike.

Lock Strike Plate: There shall be an adjustable lock-strike plate of steel, complete with mortar guard, to make provision for locks or latches complying with the relevant Indian Standards. Lock-strike plates may be of brass when so specified in the tender; otherwise they shall be of galvanised mild steel and fixed at 75 cm. to 90 cm. from finished floor level.

Shock Absorbers: For side-hung door, there shall not be less than three buffers of rubber or other suitable material inserted in holes in the rebate and one shall be located on the centre line of the lock-strike plate and the other two at least 45 cm. above and below the centre line of the lock-strike plate. For double-shutter doors, there shall be two buffers of rubber or similar suitable material inserted in holes in the rebate in the lock jamb only at the head and spaced 15 cm. at either side of the centre line of the door.

32.8. Mode of Measurements : The length shall be measured in running metres correct to a cm. out to out of the frames. Threshold angle/base tie will not be measured for payment, cost of which shall be included in pressed steel frame.

33 . FACTORY MADE PARTICLES BOARD PANELLED DOOR SHUTTERS.

33.1 GENERAL : Factory made particle board panelled 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). 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 authorised 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 authorised representative.

33.2 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.

33.3 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.

33.4 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.

33.5 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.

33.6 WORKMANSHIP AND FINISH :

The workmanship shall be of best quality. All members shall be in continuous 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.

33.7 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).

33.8 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.

33.9 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.

33.10 SAMPLES :

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

33.11 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.

33.12 RATE TO INCLUDE :

The rate quoted by the contractor shall be :

- i) for 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.

* * *

35 . FITTINGS AND FIXTURES:

35.1 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.

35.2 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 nodized or copper oxidised (black finish), nickel chromium plated or as specified.

Brass fittings shall be finished bright satin finish or nickel chromium plated or copper oxidised 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.

35.3 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 sprig 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.

35.4 PARLIAMENTARY HINGES : These shall be manufactured from extruded section for brass and aluminium and from M.S. sheets for iron oxidised 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.

35.5 PIANO HINGES :

These shall be generally conformed to I.S. 3818 and shall be made of either brass oxidised, aluminium anodized, iron oxidised (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.

35.6 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) Oxidised 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 anodize 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.

35.7 Door Letch :

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

35.8 ALDROPS :

These shall be oxidised brass or nodized aluminium, iron oxidised 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 conforming 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.

35.9 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 oxidised as specified. Anodised aluminium or iron oxidised (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 oxidised handles, the same shall be manufactured from m.s. sheet pressed into oval section as per I.S.

35.10 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 nodized 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, nodized aluminium or as specified.

35.11 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.

35.12 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.

35.13 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 oxidised (black) finish as specified. Normal size of the latch shall be denoted by the length of the face over the body in millimetres.

35.14 FLOOR DOORS 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 oxidised 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.

35.15 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.

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36. GLASS AND GLAZING :

36.1 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.

36.2 MATERIALS :

i) **Glass :** The glass shall be special selected / selected ordinary quantity glass of M/s. Shree Vallabh / Triveni / I.A.G. 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 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 anodised 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
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	

36.3 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.

36.4 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.

36.5 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.

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37 . STEEL DOORS, WINDOWS AND VENTILATORS:

SCOPE OF WORK :

The work covered under these specifications consist of supplying steel windows and doors and ventilators, fixing, glazing etc. complete in strict accordance with the specifications and relevant detailed/shop drawings.

37.1 GENERAL :

The contractor shall submit 6 copies of shop drawing covering all types of work under this specification before manufacture. The drawing shall show all dimensions, details of construction, installation, relating to adjoining and related work etc.

37.2 MATERIAL :

Shutters, frames etc. as dimensioned in the drawing shall be fabricated from I.S. standard sections rolled by M/s. Man Industries or other approved equivalent. No glazing bars shall be provided unless otherwise shown in drawing. Glazing used will be clear sheet glass of special selected quality manufactured by M/s. Shree Vallabh or other approved equivalent, unless otherwise specified. Steel sections shall be free from rolling or other defects. They shall be easily welded and punched and shall be cold straightened and shall conforming to latest I.S. 1038 - 1983. The anticorrosive shop coat of paint shall be given before the materials are brought to site.

37.3 COUPLING BARS FOR COMPOSITE DOORS,WINDOWS AND VENTILATORS :

All doors window, ventilators units shall be so constructed that those if required may be coupled together by means of the standard mullion and weathered transom bars and coupling pieces.

All steel hinges shall be projected steel hinges with non magnetic stainless steel pins and washers to permit complete ease in cleaning the glass and shall be welded or rivetted to the frame.

37.4 FABRICATION :

The frames shall be square and flat and shall be constructed of sections cut to length, mitred and welded at corners. All welding shall be electrical flash butt welding excepting for the welding of steel sheets for the shutters.

Sections shall be formed true to details with clean straight, sharply defined profiles and free from defects that may impair its durability. All works shall be accurately formed to the required dimensions, line and level. All joints shall be continuously reinforced, fitted and continuously welded at the edges. Surface along joints shall be ground to attain a smooth level surface even and flush with adjoining surfaces. All frames shall be properly reinforced for the attachment of hardware. The heads of frames for openings wider than 1.2 m. shall be reinforced to prevent sagging or deflection when installed.

37.5 INSTALLATION :

The doors, windows and ventilators brought to site shall be stacked up site down on wooden runner under cover. Fixing shall be done as per latest Indian Standard Specifications. The size of the prepared openings shall be checked first and these should be cleaned off all obstructions.

The doors/windows/ventilators shall not be forced into the walls but shall fixed into prepared openings in workmen like manner.

All joints between masonry/concrete and the metal shall be fully filled with approved mastic filler/putty in order to ensure water tightness. The joints shall be neatly pointed with matching cement and excess material shall be removed.

All brick jambs and sill holes shall be cut 50 mm. square and 100 mm. deep for fixing hold fasts. All concrete jambs and lintels, holes shall also be carefully drilled and if reinforcing steel is encountered, the length of the hold fasts may be decreased and existing surface made good to the original condition.

Any hard ware if fixed in position shall be removed before fixing the frames in the structural openings and moving parts shall be secured with wire or string during erection and while the building work is being completed to prevent damage to the part. Hardware shall be fixed as late as possible preferably just before the final coat of paint is applied. It shall be fitted in workmanlike manner so that it may not be marked and mutilated by hammers and screws and pins are not marked and mutilated by hammers and screwdrivers. It shall be tested for correct operations to the satisfaction of the Engineer-in-charge.

37.6 DETAILS OF COMPONENT PARTS :

37.6.1 Doors : Door shutters shall be hung on projecting hinges of 67 mm size and shall be fitted with mortise lock and two brass or bronze lever handles. In case of double leaf doors, the first closing leaf of double leaf doors shall also be provided with brass or bronze tower bolts concealed in the section at top and bottom. These shall be so constructed as not to work loose or drop by their own weight and necessary

lugs, fittings, screws etc. shall be provided and fitted properly at site.

37.6.2 Windows : Window shutters shall be hung on projecting hinges. One leaf of the hinges shall be welded into a slot in the outer frame and the other leaf of the hinges riveted to the opening shutters. Hinges may be of the friction type in which case the window shall not be fitted with peg stay. In case of non-friction projecting hinges, a brass or bronze three holes peg stays 300 mm. long with pegs and brackets, welded or rivetted to the frame shall also be provided. Handles shall be of brass or bronze and shall be of brass or bronze, and shall be mounted on a mild steel handle plate welded to the shutter in such a way that it should be fixed after the shutter is glazed. The handles shall have a two point nose which shall engage with brass, bronze or aluminium alloy as specified, striking plate, on the fixed frame so that it can hold the shutters in a slightly openable as well in a fast position.

37.6.3 VENTILATORS : a) Top hung ventilators : These shall be fixed with plain hinges, riveted to the fixed frames or welded to it after cutting a slot in it. A peg stay 300 mm. long of brass or bronze with three holes, as in case of windows shall be provided.

The locking bracket shall either be fitted to the fixed frame or to the ventilators.

b) Centre Hung Ventilators : These shall be hung on two pairs of brass or lead/tin/bronze cup pivots, riveted to the inner and outer frame of the ventilators to permit these to swing through an angle of approximately 85 deg. The opening portion of the ventilators shall be so balanced that it remains open at any desired angle under normal weather condition.

A bronze or brass spring catch shall be provided at the top centre of the ventilator. A brass cord pulley wheel in a mild steel or malleable iron brackets, shall be fitted with screws or welded at the sill and a cord eye shall be fixed to inner frame of ventilators to facilitate opening of ventilators.

37.6.4 Composite Units : Composite units consist of a combination of two or more units of doors, windows, ventilators etc. as the case may be. The different units shall be coupled by using coupling sections. The coupling sections shall be made from M.S. sheet 3.15 mm. in thickness and 56 mm. wide as per I.S. 1038-1957 para 5.2 and these shall be fixed with bolts and nuts.

Wherever the ventilators, windows and doors shall have coupling section, mastic cement shall be applied between the junctions to make the joints watertight.

To calculate height or width of composite units, add 2.5 cm. for each mullion or transom coupling bar for each unit.

37.7 FINISHING : All steel surfaces shall be thoroughly cleaned of rust, scale and dirt by pickling and marking. A shop priming coat of superior quality red oxide or equivalent shall then be given before despatch. Alternatively, where so specified, the steel surfaces shall be treated for rust proofing by the hot dip zinc spray or electro galvanising process, having a coating of not less than 60 microns thickness or as specified. Zinc spray articles shall be given one coat of priming coat of superior quality red oxide or equivalent.

Final finishing with two coats of synthetic enamel/flat oil paint of approved make and shade shall be given

after the doors, windows and ventilators are erected/fixed in final position. The rate shall be inclusive of final finishing coats including the priming coat.

In case of galvanised doors, windows and sashes, their surfaces shall be treated with copper acetate solution or other approved mordant solution to ensure proper adherence of paint, unless the galvanised surface has weathered adequately at the time of final painting.

Non-ferrous parts and working parts such as handle stays, catches, handle pins, hinge pins etc. shall not be painted.

37.8 GLASS AND GLAZING : Specifications for glazing given in this book under chapter Glass and Glazing, shall also be applicable for steel doors / windows / ventilators.

37.9 MODE OF MEASUREMENT : The mode of measurements for steel doors, windows and ventilators for complete item of supply and fixing in position shall be on area basis calculated in sqm. correct to two places of decimal. The height and width of members shall be measured outer to outer edge of the members correct to 1 mm.

The rate for steel door, window and ventilator shall include cost of all fittings, materials, hold fasts, glazing, painting, labour etc.

39. M. S. GRILLS / RAILINGS :

39.1 GENERAL :

The contractor shall submit 6 copies of shop drawings covering all types of work under this specifications before manufacture. The drawing shall show all dimensions, details of construction, installation relating to the adjoining work.

39.2 MATERIALS :

All structural steel shall conform to I.S. 226 sections for grills and shall be free from loose mill scales, rusts, pittings or any other defects affecting its strength and durability.

39.3 FABRICATION :

The grill shall be fabricated to the design and pattern shown in the drawings. All joints shall be made in best workman like manner with slotting and welding as required to the specified size and shape. The edge of the M.S. flats shall be suitably mitred before welding to get the desired shape. The joints shall be filled to remove excess stay after welding. Screws, nuts, washers, bolts, rivets and any other miscellaneous fastenings, devices shall be of steel and shall be provided by the contractor.

Manufactured M.S. grills then be fixed in between the posts, balusters, M.S. frame work etc. to correct alignment. Any undulations, bends etc. found shall be rectified by the contractor at his own cost. The complete assembly of grill/railing so fixed shall be firm and there shall not be any lateral movements.

39.4 SAMPLES :

Samples of grill and railings shall be submitted for approval of the Engineer-in-Charge and to be got approved before taking up for mass fabrication.

39.5 INSTALLATION :

The approved grills shall be fixed in position where specified and shown in drawings including in masonry walls, teakwood frames, hand railings etc. Any damages to walls, frames etc. caused during fixing the grills shall be made good by grouting with cement mortar/packing/repairing properly at the contractors cost.

39.6 PAINTING :

Painting shall be done as per the specifications specified under painting.

39.7 MODE OF MEASUREMENT :

Actual area of m.s. grill manufactured and fixed in position shall only be measured in square metre for payment. All measurements shall be taken to two places of decimal of a metre and area shall be calculated to second place of decimals of a square metre.

The rate is to include the cost of all materials, labour, transporting, fabricating, installing, scaffolding if necessary, grouting etc. complete.

39.8 FINISHING/PAINTING/POLISHING FOR RAILING :

Teak wood hand rail shall be polished with wax polish/ french polish/solignum with two or more coats over one coat of wood primer or painted with two coats of synthetic enamel paint/flat oil paint of approved make and shade over one coat of approved primer. M.S. grills, balusters etc. also to be painted as per specifications specified under painting/polishing.

39.9 MODE OF MEASUREMENTS (HAND RAILS) :

Hand railing shall be measured for payment in running metre. The length shall be measured along the top centre line of the hand rail and shall be measured between ends of balusters, newels, posts as the case may be upto two places of decimals of a metre. Rate shall include fabrication, leaving suitable pockets, grouting the same, providing and fixing suitable teak wood plugs, fixing, all labour, materials, transport, painting/polishing, finishing and scaffolding if necessary.

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40. ALUMINIUM ENTRANCE DOORS, WALL SPANS, GLAZING ETC.

40.1 SCOPE OF WORK :

The scope of work in the present tender item includes fabrication, supply and installation of white anodised matt finished aluminium entrance doors, glazing etc. strictly in accordance with these specifications and relevant detailed approved shop drawings.

40.2 GENERAL :

The material, fabrication and hardware shall conform to the IS 1948. The contractor shall submit 6 copies of shops drawings covering all type/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 of fixtures and relation to adjoining and related works. No fabrication work shall be undertaken prior to obtaining approval of the shop drawings from the Engineer-in-Charge. The tenderer shall intimate at the time of tendering, the type of sections he proposes to use on the works.

40.3 MATERIALS :

Aluminium alloy for extruded sections for the above work shall correspond to I.S. 733 & 737 specifications or any further revision thereof(extruded sections shall conform to I.S. Designation HE 9- WP. Hollow sections shall conform to I.S. Designation HV9-WP) and shall be anodised before incorporating in the work. Anodic coating shall conform to IS 1868. The frame work, stiles, mullions, beadings, transoms and handles etc. shall be of aluminium anodised sections as shown in detailed approved drawings. All aluminium sections shall be of INDAL or other equivalent make as per drawing. The contractors can also propose nearest alternative sections they manufacture/posses without changing the elevation, structural stability & functional requirement. Department reserves the right to accept the alternative section or otherwise. The sections shall be structurally suitable to withstand all the loads, the members have to sustain. Counter sunk screws, nuts, bolts, washers, rivets and other miscellaneous fastenings devices shall be of approved brass cadmium plated or stainless as specified in the approved drawing. Each door leaf shall be prepared to receive glazed panel of required thickness. Glazing shall be done with neoprene dry set glazing gasket (of best quality and approved make) with snap-in-bevelled white anodised matt finish aluminium metal glazing stops inside and outside. All doors shall have off- set pivots, double action (180° minimum swing) floor springs with oil check boxes of approved manufacture. All doors shall have 4 lever concealed brass body mortise lock without handles as per manufacturers design, with concealed flush C.P. brass tower bolts provided at suitable locations. All doors shall have push plates of design shown in the approved drawing as described in the schedule of quantities. All entrances shall be without thresholds. All aluminium surfaces in contact with masonry or concrete shall be given a thick coat of bitumastic paint. After fabrication, aluminium sections shall be protected from construction hazards that may damage their appearance or finish. All exposed surfaces of aluminium door entrance shall be protected by masking tape during transshipment and erection. All sections and hardware shall have anodic film and cover a minimum thickness of 0.015 mm.

40.4 FABRICATION :

The frames shall be manufactured square and flat, the corners of the frame being fabricated to true right angle. All the fixed, sliding and opening frames shall be constructed of sections which have been cut to length, mitred, welded and mechanically fixed 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). In case welded joints are used, anodising shall be done after fabrication as a whole. All welding shall be on unexposed sides in order to prevent pitting/discolouration of other surface imperfections after fixing etc. Necessary allowance shall be made while manufacturing the aluminium door entrances, wall spans and glazing for receiving plaster. No field fabrication of frames is permitted. A thick layer of clear

transparent lacquer based on methacrylates or cellulose butyrate shall be applied on the finished sections of the aluminium work by the contractor to protect the surfaces from wet cement, lime, dirt, dust etc. during the construction activities. The size for door, window or ventilator frames shall not vary by more than (+/-) 1.5 mm.

40.5 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 anodised finish same as for the frames and other sections. Each lock shall be supplied with two stainless steel keys and each key shall be with number stamped thereon according to the number on doors so installed. 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 the Engineer-in-Charge. Working and moving parts of locksets shall be accurately fitted to smooth, close bearings and shall be free from rattle. The floor springs shall be of heavy-duty type and should allow door operation smoothly and shall conform to IS 6315. The contractor shall furnish a guarantee for all finishing and quality of hardware covered under this section and which shall remain free from defects of any kind, either materials and/or workmanship for a period of one year (unless otherwise specified) from the date of completion/handling over of work. The contractor shall repair or replace any and all defective work and damage caused, at any time or times during that period within 3 days from the written notice. This shall be done without any extra cost to the Department and to the complete satisfaction of the Engineer-in-Charge. In case the same are not replaced immediately after the receipt of the notice to do so, the Department shall do so at the cost of contractors. The cost as certified by the Engineer-in-Charge shall be final and binding on the contractors.

40.6 FIXING :

Fixing and glazing of doors, windows and ventilators shall be conforming to IS 1081, unless otherwise specified. The frames shall be accurately fixed in the flooring / brick masonry or R.C.C. works. The fixing of the frame shall be done with cadmium plated brass counter sunk screws driven on to the teak wood rough ground, or fixed to the wall with hold fasts as directed by the Engineer-in-charge, and as shown in approved drawings. All aluminium works shall be fixed in position as per relevant Indian Standard Specifications and code of practice for fixing and glazing of aluminium work. Joints between metal and masonry shall be fully caulked with mastic / polysulphide compound in order to ensure water tight joints as directed by the Engineer-in-Charge. Joints shall be neatly painted with matching cement and excess materials shall be removed. Fixing of aluminium door entrances, hardware etc. shall be done in best workmanship like manner true to line, level, plane, plumb etc. and all as directed by the Engineer-in-Charge. Breaking of floor for providing floor springs and restoration of the floor finishes to the original specification and finishes and minor additions and alterations to the openings shall be deemed to have been included in the quoted rates.

40.7 GLASS AND GLAZING :

40.7.1 Glass : The glass shall be of selected quality/special selected quality of M/s. Triveni / Shree

Vallabh, I.A.G. or equivalent manufacture, as specified under the chapter GLASS AND GLAZING.

40.7.2 Glazing Clips/Beading : The glazing clips/beading where specified in drawings for aluminium/steel doors and windows shall be anodised aluminium beading of channel section or as specified & as per sizes mentioned in the item and/or shown in the drawing.

The junction of the beadings shall be mitre jointed. Holes for glazing clips shall be drilled prior to fabrication and shall not be done at any later stage.

40.7.3 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. Premeasurement of each panel prior to the cutting of glass is essential.

The clips/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 glass panes are fixed with wooden beadings having mitred joints or aluminium beading, a thin layer of glaziers putty shall be applied covering the area in contact between the glass and sash-bars and beadings. In case of louvers all the exposed edges of the glass shall be ground properly.

40.7.4 Glazing : The glass panes shall be fixed to the frame as mentioned above with approved Neoprene dry set glazing gasket (of best quality and approved make) with snap-in-bevelled white anodised matt finished aluminium metal glazing stops inside and outside. In the fixed side and transom light, the thickness of glass or panel shall be accommodated by the screw down glazing stops. The glass panels shall be fixed firmly and truly parallel to the plane of frames. All damages or breakages during glazing shall be made good at the contractors own cost till the work is properly taken over by the Engineer-in-Charge. All wall spans glazing and entrances, fixed glazing etc. shall be tested for water tightness. Any leakage found during testing, it is the responsibility of the contractor to rectify the same without any extra claim.

40.7.5 General : After the inspection is over and permitted by the Engineer-in-Charge, the glass panes shall be cleaned off any labels, paint smears and spots and shall be washed from both the side 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 aluminium/steel doors/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.

40.8 MODE OF MEASUREMENT :

a) **Aluminium work:** The measurement of aluminium sections shall be taken only after the frames along with shutters are fixed in its final finished position in line, level and plumb. Length of each extruded section used for fabrication shall be measured **outer to outer of cut length** correct upto 1 mm

The weight of material used shall be calculated on the basis of actual weight of extruded sections used for fabrication and shall be compared with the weights given in the catalogue of the approved manufacturer

subject to the condition that the variation in actual weight should not exceed (+ / -) 10% than the approved catalogue weights. The payment shall be made for the actual weight of the extruded section **after anodising**. The final weight shall be calculated in kgs upto two places of decimal.

b) **Glazing work:** The length and width of opening for glazing inserts shall be measured correct to a centimetre and area for payment shall be calculated in square metre nearest to 0.01 sqm.

40.9 RATE :

Unless otherwise specified, Fittings and fixtures such as window handles, hinges, peg stays, friction stays, concealed window lock, cleat angles, stiffener plates etc. shall not be measured for payment and rate quoted shall include cost of all such fittings, accessories and hardware. However, door handles, mortise lock, dead lock, door closer, floor springs, concealed door tower bolts shall be measured separately as specified in the item and paid for.

The rate quoted shall include all taxes, duties etc. tools, plants, labour involved in all the operations described above, fixing in final position including submitting shop drawings etc. and all incidentals to the job involved.

40.10 TESTING :

Aluminium sections shall be tested for its unit weight, anodic coating etc. as per relevant IS codes.

40.11 GUARANTEE :

All materials used in above work shall be **guaranteed for one year** (unless otherwise specified) from the date of handing over the work. Any defect found in the guarantee period shall be replaced/repaired to original condition/position entirely at the contractors cost.

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

41.1 SCOPE OF WORK :

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

41.2 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.

41.3 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 anodised 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 INDAL 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.

41.4 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 tenoned 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 anodised 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.

41.5 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 anodised 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.

41.6 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. 1081-1960 (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 or polysulphide compound in order to ensure water tight joints. 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.

41.7 SAMPLES :

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

41.8 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. Triveni/Shree Vallabh/I.A.G. or other approved equivalent. The specifications specified here-in-before shall hold good as far as applicable.

41.9 MODE OF MEASUREMENT :

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

41.10 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.

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

44.1 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.

44.2 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 (Pt. III) (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.

44.3 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 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, 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 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 plaster of paris/epoxy putty/silicon sealants, Rubber based sealants (brand name TECHMAT/TECHCOAT) by caulking guns or by approved methods as instructed/approved by Engineer-in-Charge.

44.4 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 and shall be paid extra in the rates given in schedule of quantities.

44.5 MIX PROPORTIONS :

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

44.6 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 platform. 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.

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.

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, ironite 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.

44.7 (A) NEERU FINISH :

Wherever specified, the surface rendered shall be finished smooth with good quality lime neeru class 'C' conforming to I.S. 712-1956. The lime shall be tested in an approved testing laboratory for the chemical analysis of the lime and test certificate submitted regarding suitability of lime for plaster work. The cost of testing shall be borne by the contractor. Neeru shall be prepared at site out of best quality pure fat lime slaked at site with fresh water and slaked in accordance with the relevant I.S. code for slaking of lime. The slaked and sifted lime shall be reduced to a fine paste by grinding 150 turns in a mortar mill. Sufficient quantity, which can be used within 10 days only shall be prepared at a time. Chopped hessian or jute fibre in the required quantity may also be added to neeru and properly ground to pure paste as per directions of the Engineer-in-Charge.

An entire unobstructed area shall be plastered in one operation. Neeru shall be applied to the prepared and partially set but somewhat plastic surface with steel trowel to a thickness slightly exceeding 1.5 mm. (1/16") and rubbed down to 1.5 mm. It shall be polished to perfectly smooth and even finish working from top to bottom for at least 3 days. All corners shall be truly brought to desired lines and levels in the base plaster along and the thickness of neeru shall not exceed 1.5 mm., at these locations. Moistening shall be commenced as soon as the plaster has hardened sufficiently and is not susceptible to injury. The surfaces shall be kept sprinkled with water for 7 days to prevent excessive evaporation. On the sunny or wind-ward side of the building in hot dry weather, matting or gunny bags may be hung over on the outside of the plaster and kept them wet. If blow holes are observed in neeru plaster at any time during the contract period and during the defect liability period, the contractor will have to rectify the defective neeru plaster work including redoing of the white washing/colour washing/distempering work etc. as the case may be, entirely at his own cost.

It shall be the contractors responsibility to ensure that cracks do not develop during the execution or subsequently during the defect liability period and the cracks if any observed shall be rectified including finishing, white washing/painting as specified, without any extra cost to the Department, to the entire satisfaction of the Engineer-in-charge.

44.7 (B) TEROL FINISH OF TERRACO :

Wherever specified, the surface rendered shall be finished smooth with 0.5 to 3 mm. thick coat of TEROL of TERRACO as per manufacturers specification. It shall be ensured that the surface to be covered is free of loose particles, dust, dirt, grease, oil and paint. TEROL shall be applied on top of finished coat of plaster which should be levelled without any scratch/key marks. Adequate care should be taken that the first coat is levelled well to enable the thin layer TEROL plaster to give smooth finish, substrata/sub base should be moistened with water prior to the application of TEROL thin layer plaster.

1 Mixing : Put water into a clean empty drum. Add TEROL start stirring with paddle. Gradually add water and TEROL alternatively in the required proportion to get desired creamy consistency, convenient for application and stir continuously and ensure that no lumps remain. TEROL should not be allowed to stand without stirring for longer than 60 minutes. In normal condition let TEROL set for 5 minutes then stir and use. Where rapid drying conditions are prevalent, it is advisable to mix TEROL 20 minutes before using.

2 Application : TEROL is sprayed or hand applied and smoothened with a steel float. Smooth finishing

shall be achieved with wooden floating or troweling when TEROL has set. The float should be moistened during the smoothing operation.

Curing the surface shall be carried out after 24 hours of application at least for 4 days using light water spray.

44.7 (C) PLASTER OF PARIS (POP – CaSO₄ , 1 / 2H₂O) 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.

44.7 (D) GYPSUM PLASTERS

1.0 Material:

Requirement of premixed light weight gypsum shall be conforming to IS: 2547, Part-I & II latest revision. Product Package shall be ISI marked and material shall be got approved prior commencement of work.

Physical and Chemical requirement, sample testing to be carried out as per the IS: 2547 Part I&II cost of all test shall be born by contractor.

1.1 Surface Preparation for RCC: Smooth RCC surface to be hacked for bonding (50 hacks per Sq. Ft.).

1.1.1 Any mould oil (Release oil) or other agents presents should be washed.

1.1.2 Normal ballast concrete should be given sufficient time to cure prior to application of plaster.

1.1.3 Any kind of loose masonry, foreign material adhering to the surface to be removed.

1.1.4 Recommending to use bonding agents to avoid any issue of debonding..

1.2 Application Methodology: The powder should be mixed with clean water preferably in clean plastic buckets to avoid mixing with impurities.

1.2.1 Mix gypsum plaster powders to water ensure through mixing by help of mixing rod has to avoid formation of lumps and unmixed residues.

1.2.2 Material should be thoroughly mixed and free from lumps and impurities before use.

1.2.3 Water to plaster ratio should be as per manufacture recommended.

1.2.4 When the mix has begun to set it should not be further added with additional water or dry material.

1.2.5 Material should always apply above 6" from skirting level.

1.2.6 Can apply gypsum in the thickness range of 3.25 mm. However when applying gypsum plaster in thickness excess of 12-13 mm it has to be applied in layers of 10 mm each and not the whole thickness of 25-30 mm in one single layer.

1.2.7 Similar will be the application process for RCC columns and wall where it has to be applied in layers. However in ceiling it is not recommended to go beyond thickness of 13 mm even it applied on Bond IT or Hacked surface.

1.3 RATE: - Rate quoted shall be all heights and floors including cost of material, scaffolding, transporting, testing, labour and of additional thickness due to variation in plain and plumb etc.

1.4 MODE OF MEASUREMENT: Mode of measurement will remain same as per 44.10.

SAND FACED CEMENT PLASTER:

44.8.1 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:

44.8.2 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, mullions, 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.

44.8.3 WORKMANSHIP : The surface to be plastered shall first be dubbed out with cement mortar to cover all irregularities and faces upto proud 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.

44.9 ROUGH CAST PLASTER :

All materials shall conform to the standards already specified for plaster described above. The preparation of the surface to receive the rough cast plaster shall be as described under sand face plaster. Rough cast plaster shall be carried out in two coats. First coat shall consist of 1 part of cement to 3 parts of clean sand or as specified otherwise. The finished thickness of the first coat shall be 12mm. and shall be laid by throwing the mortar (By using strong whipping motion) on the prepared surface with a trowel in a uniform layer but shall not be smooth. The second coat consists of 1 part of cement and 3 part of 6 mm. to 10 mm. down gravel all as approved by the Engineer-in-Charge. The gravel shall thoroughly be got cleaned with water removing all dirt and other organic materials. All these ingredients shall be mixed into a paste which shall be flung upon the first coat with large trowels to form an even protective coat. The second coat must be applied while the first coat is still soft and unset. The thickness of this coat shall be 10 mm. only. Due care shall be taken to avoid concentration of either large size or small size of gravel in one place. A sample of rough cast plaster shall also be got approved by the Engineer-in-Charge as regards the texture etc. before proceeding further with the work. All subsequent work shall generally conform to the approved sample panel. The finished work shall be cured for a minimum period of seven days.

General workmanship, scaffolding, preparation of surface, curing etc. shall conform to the specification already laid down under sand faced plastering.

The contractor shall take special care at the time of plastering or pointing to keep the m.s./aluminium window/wallspan etc. fixed by other agency in correct shape, position and to cover the same with required hessian cloth/gunny bags to keep away from sprinkling of plasters/paint etc. The damage caused to the above if any, shall be made good by the contractor at his own cost.

44.10 MODE OF MEASUREMENT:

44.10.1: Area of plastering will be measured net and shall be paid for. The measurement of length of wall plastering shall be taken between walls or partitions (dimensions before plastering shall be taken) for the length and from top of the floor or skirting or dado as the case may be to the underside of ceiling for the height. All openings more than 0.1 sqm. shall be deducted and all jambs, soffits, sills of these openings if done, will be measured to arrive to the net area for payment. No opening less than 0.1 sqm. shall be deducted and no jambs etc. for such openings shall be measured for payment. The rate shall include the cost of finishing all the edges, corners, cost of all materials, labours, scaffolding, transport, curing etc.

44.10.2 : The rate shall include the cost of finishing all the edges, corners, cost of all materials,

labour, transport, scaffolding, curing etc. and grooves if so specified in the item of schedule of quantities.

The rate for plastering should include the cost of work towards the following items for co-ordination with electrical item:

1. Neatly plastering around DBs, junction boxes, M.S. boxes etc. should be done and made matching with the wall finish after installation of electrical equipments.
2. All DBs, service boxes, covers etc. should be covered by a plastic cloth or other suitable covering materials such that water or materials should not splash the same during brick work and plastering work. This is to be done in such a way that electrical equipments as well as painted surfaces are not spoiled.
3. For fixing M.S. boxes, DBs etc. Thiyya should be given such that the required face of the M.S. box, DB covers etc inline with final finished plastered surface.
4. The rate for the item shall also include rounding up of corner and angles making sharp corners and angles finishing around ceiling rose and electrical fittings etc. fixed by other agencies, finishing of top of dado and skirting (zad finishing), junctions of roof and wall or beam with the finish as specified in the item. Plastering of brick and concrete cornice and copings and plastering in restricted areas if any shall not be measured separately. Architectural bands and narrow widths of plaster over structural as well as non-structural and the line when prepared in the same thickness of plaster shall not be measured separately and shall be covered by respective plaster items.

44.10.3 ROUGH CAST PLASTER : The area of surfaces actually plastered will be measured net and shall be paid for. The measurements of length and height of wall plastered shall be correct to a centimeter taken between walls or projections including the width of corner edge strips including the areas of grooves. All the openings more than 0.1 sqm. shall be deducted and all jambs, soffits and sills of these openings, if plastered will be measured to arrive at the net area for the payment. No opening less than 0.1 sqm. shall be deducted and no jambs etc. for such openings shall be measured for payment. Corner/edges finishing will not be measured separately and the rate shall include the cost of finishing all the edges, corner strips in addition to the cost of all materials, labour, transport, scaffolding, curing etc. and grooves if so specified in the item of schedule of quantities.

46. WALL CARE PUTTY

46.1 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.

46.2 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.

46.3 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 authorised 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.

46.4 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.

46.5 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.

46.6 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 smoothed. 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 number.
- 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.

• 46.7 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/M ² . 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.

* * *

47. PAINTING :

47.1 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.

47.2 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 Engineerin-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.

47.3 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.

47.4 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.

47.5 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 atleast 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.

47.6 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.

47.7 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.

47.7.1 Table of multiplying Co-efficients to be applied over areas of different surfaces to get equivalent plain areas is given in the Appendix-“C-2” of this book.

47.7.2 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.

47.8 PRECAUTIONS :

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

47.9 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.

47.10 (A) PAINTING PRIMING COAT ON WOOD, IRON OR PLASTERED SURFACES :

47.10.1 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 I.S.3536-1966
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. **47.10.2 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.

47.10.3 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.

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

47.11 (B): PAINTING WITH SUPERIOR QUALITY & FLAT OIL READY MIXED PAINTS ON NEW SURFACE :

47.11.1 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.

47.11.2 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.

47.11.3 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.

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

47.12 (C) 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 : 1932-1 964.

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.

47.13 (D) 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.5411-1969.

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 Engineer-in-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.

47.14 WHITE WASHING WITH LIME

47.14.1 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.

47.14.2 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.

47.14.3 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.

47.14.4 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.

47.14.5 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.

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

47.15 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.

47.16 DRY DISTEMPERING :

(a) **Distemper :** Dry distemper (IS:427-1965) of approved brand and manufacture, colour and required shade shall be used. The dry distemper shall be stirred slowly in clean water using 0.6 litre of water per kg. of distemper or as specified by the manufacturers. Warm water shall preferably be used. It shall be allowed to stand for atleast 30 minutes before use. The mixture shall be invariably well stirred before and during use to maintain an even consistency.

(b) **Preparation of surface :** This shall be as for Painting work mentioned here-in-before in so far as it is applicable.

(c) **Application :** In case of new work, the treatment shall consist of a priming coat followed by the application of two or more coats of distemper till the surface shows an even colour.

i) **Priming coat :** Priming coat of whiting shall be applied over the prepared surface. The whiting (ground white chalk) shall be dissolved in sufficient quantity of warm water and thoroughly stirred to form a thin slurry which shall then be screened through a clean coarse cloth. Two kg. of gum and 0.4 kg. of copper sulphate dissolved separately in hot water shall be added for every cum. of the slurry which shall then be diluted with

water to the consistency of milk so as to make a wash ready for use. No white washing coat shall be used as a priming coat for distempering.

ii) The application of each coat as mentioned in the specifications for painting (General) here-in-before, shall hold good, as far as it is applicable.

47.17 OIL EMULSION (OIL BOUND) DISTEMPERING :

(a) Oil bound distemper (IS:428-1969) of approved brand and manufacture, colour and required shade shall be used. The primer where used as on new work shall be cement primer or distemper primer as specified in the item. These shall be of the same manufacture as distemper. The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by manufacturer. Only sufficient quantity of distemper required for days work shall be prepared.

(b) **Preparation of surfaces :** The surface shall be prepared as described here- in- before for Painting work in so far as it is applicable and approved putty/filler shall be applied to the entire area to get uniform and smooth surface before application of primer.

Application: The cement primer or distemper primer shall be applied by brushing and not by spraying. Hurried priming work shall be avoided, particularly on absorbent surfaces. New plaster patches in old work before applying oil bound distemper shall be treated with cement primer/distemper primer. The surface shall be finished as uniformly as possible leaving no brush marks. priming coat shall be allowed to dry for at least 48 hours before oil bound distemper is applied. Before applying distemper, the surface shall be lightly sand prepared to make it smooth for receiving the oil bound distemper, taking care not to rub out the priming coat. A time interval of at least 24 hours shall be allowed between consecutive coats to permit the proper drying of the preceding coat. Two or more coats of distemper as are found necessary shall be applied over the priming coat to obtain an even shade.

c) **Other details :** The specifications for "Painting (General)" mentioned here-in-before shall hold good as far as it is applicable.

47.18 WATER PROOFING CEMENT BASED PAINT :

a) **Material:** Cement based paint (IS:541 0-1 969) 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.

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

47.19.1 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.

47.19.2 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.

47.19.3 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.

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

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

47.20.1 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.

47.20.2 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.

47.20.3 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.

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

NOTE: Consumption of paint for some painting items is given in Appendix – “C-1”.

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47.21 RESIN BASED THERMO PLASTIC PAINT (DECORATIVE AND PROTECTIVE FINISH) :

47.21 .1 Materials : Resin based thermo plastic paint such as Sandtex Matt or other equivalent approved manufacture, colour and shade shall only be used.

47.21.2 Preparation of Surface & General : The Specifications for Painting (General)described here-in-before shall hold good as for as they are applicable.

47.21.3 Protective Coatings : On surfaces such as ferrous metals, brass, copper and phospher bronze, a protective coating of suitable bituminous compound or chromated red oxide should be given. New wood should be treated with a leafing grade aluminium primer or a water based acrylic emulsion primer.

The surfaces with algae growth shall be thoroughly cleaned down to remove as much growth as possible and effective solution of stabilized house hold bleach (calcium hypochloride) of approved quality with approximate 35% chlorine content @ 2 kgs. per 50 ltrs. (or as per manufacturers recommendations) should be used to treat the surfaces.

On chalky or friable surfaces after removing the loose materials by stiff brushing or scraping the surface should be treated with one coat of advanced solvent based material such as snowsol stabilizing solution or other approved equivalent with white spirit.

47.21.4 Application: The ready mix Sandtex Matt or other equivalent approved resin based thermo plastic paint shall be applied on clean and wetted surfaces by means of brushes or roller. The solution shall be kept well stirred during the period of application. To avoid direct heat of the sun, the paint shall be applied on the side in shade.

On rough and textured surfaces, one under coat of cement based paint such as Snowcem or other equivalent shall be applied before application of undiluted Sandtex Matt finish coat. In case of application of two coats of Sandtex Matt at normal temperatures, the first one shall be diluted by addition of 25% water and the second coat direct. In extremely hot environs, the second coat shall be diluted @ 2.5 ltrs. of water to 20 ltrs. of paint or as directed.

Painting with resin based thermo plastic paint shall be carried out generally as per manufacturers specifications.

47.21.5 Other Details : The specification for Painting (general) mentioned here-in-before shall hold good as far as they are applicable.

Snowsol stabilized solution shall not be applied over bitumen. Snowsol stabilized solution treated surfaces shall not be left unpainted for more than 2 (two) days. Gypsum based materials shall not be used for filling of exterior cracks while preparation of surfaces.

47.21.6 Mode of Measurement : The painting unless otherwise mentioned shall be measured by area in sqm. upto two places of decimal. Length and breadth shall be measured correct upto two places of decimal

of a meter. Deduction will be made from the areas of fixtures, grills, ventilation, outlets individually more than 0.05 sqm.

The item shall include removing nails, making good holes, cracks, patches etc. not exceeding 0.1 sqm. each with materials similar in composition to the surface to be prepared.

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

* * *

48. VINERATEX OR VITROBRITE DECORATIVE TEXTURE COAT :

48.1 GENERAL :

Vineratex or vitrobrite decorative treatment/coating consisting of coating the plaster finished surfaces with decorative textured coat of ready mixed mixture of approved aggregate with bonding compound/synthetic adhesive manufactured by M/s. Vinera Industries & Co. or other approved manufacturer. The vineratex or vitrobrite treatment coating shall be got done through approved agency as per manufacturers recommendations.

The vineratex or vitrobrite treatment shall be applied/coated directly over the sub-base of reasonably smooth/levelled and clean surface like plastered brick work (plaster not being raked or scratched) in-situ concrete, precast concrete units, light weight blocks, asbestos cement sheet etc. as specified.

48.2 MATERIAL :

The various aggregate and special bonding media/synthetic resin shall be strictly as per manufacturers recommendations. Only such aggregates shall be used, which are weather and corrosion resistant viz. glass, ceramic marble, chips, granite, quartz and flint, hametites, pyrites or one in natural vitrified, coloined or other processed forms as specified. The aggregate shall vary in sizes from 0.5 mm. to 2.5 mm. and shall be applied in shades as specified. The finish shall have a film thickness of 3 mm. average.

48.3 SURFACE PREPARATION :

Before commencing, the surfaces should be cleaned thoroughly to remove any grease, dirt, dust or loose particle and should be free from surface water. Extremely porous surfaces should be pre-sealed with a thin coat of suitable primer. Previous painted surfaces if any, should be prepared by thoroughly scrapping off all loose flaking paint film, washing down with a suitable detergent and rinsing thoroughly with clean water and allowed to dry.

48.4 APPLICATION :

Vineratex or vitrobrite shall be brought to site in sealed containers. Addition of thinner at site will not be permitted. The material in the containers shall be mixed thoroughly before use, to off-set the settlement occurred due to heavy vibration while transporting and during storage.

A small amount of Vineratex or vitrobrite mixture shall be placed on a spot board. The spot board shall be held against the surface on which the treatment/coating is to be applied. The mixture shall be applied to the surface evenly with the help of laying on trowel to uniform thickness of about 3 mm. on an area of about 0.18 sqm. Scrap off the excess material with the help of the steel float to obtain an even film thickness of 3 mm. This shall be achieved by using the steel float held slightly on the trailing edge, putting an even pressure and scrapping off the excess material/mixture, left on the spot board shall be immediately put back into drum and shall be mixed well before reuse.

Level of the vineratex or vitrobrite film to a smooth and even finish using the flat edge of steel float. It is important that only small areas of about 0.18 sqm. shall be treated at a time. Wherever possible, whole work should be completed without stop in one operation by engaging sufficient number of workers, so that flowing edge may be maintained without forming any joint. If this is unavoidable, a suitable natural break in the application should be chosen and the joint shall be made using a straight edge, which can be continued when application is resumed the following day. Over lap or over troweling at joints shall be avoided. This treatment shall always be carried out in shade, away from full effect of hot sun.

At all times the completed work of vineratex or vitrobrite shall be protected against rain fall until complete hardness has been obtained which takes about 24 hours.

Once the treatment/coating is completed and set hard, no other treatment like polishing, cleaning, washing with acid etc. shall be resorted to in this area. The treatment/coating shall be taken up in hand when all other construction works viz. plastering, electrical wiring, plumbing, painting etc. have been completed.

After the whole work is completed, the vineratex/vitrobrite shall be given a coat of anti-fungus gel to avoid fungus growth on surfaces. The contractor shall be responsible to protect the finished surface from any damages for whatever reason whatsoever.

48.5 MODE OF MEASUREMENT :

Mode of measurement shall be similar to sand faced/roughcast plaster items.

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52. FALSE CEILING WITH FLEXO BOARDS / A.C. SHEETS : (N.A)

52.1 SCOPE OF WORK :

The work envisaged under these specifications refer to supplying and fixing in position false ceiling at any floor, any location and at any height.

52.2 MATERIAL :

The plain A.C. sheet or flexo board shall be of the thickness as mentioned in the relevant items of the schedule of quantities and the size of panels and the arrangement of panels etc. for different area of the building shall be as indicated by the Engineer-in-Charge. Plain A.C. sheet or flexo board shall be of approved quality and shall be free from cracks, bends and other defects. Samples of materials to be used on the work

shall first be furnished by the contractor and got approved by the Engineer-in-Charge. All materials which are used on the works shall strictly conform to the samples, other-wise the materials shall be summarily rejected.

The plain A.C. sheet or flexo board shall be fixed to the angle iron frames (frame work paid separately) work by means of suitable counter sunk brass self tapping screws not more than 200 mm. centre to centre or as directed, and all holes after fixing the screws be filled with approved filler. Necessary openings in the ceiling shall be left for trap doors, ducts etc.

52.3 ERECTION :

The flexo boards/A.C. sheets when brought to site shall be stacked carefully on floor over wooden sleeper supports. The boards shall be cut to required sizes either by sawing or by score and snap method. The edges shall be smoothed by wood rasp file or with emery paper. Wherever required the edges of each panel may require bevelling which also shall be done carefully to the correct line and dimensions.

The flexo boards/A.C. sheets shall be fixed to ridge frames either wooden or metallic or mentioned in the item description. In case of metallic frame, the flexo boards are held to the frame by means of self tapping screws or by the ordinary machine screws and nuts, as directed by the Engineer-in-Charge.

Teak wood or aluminium beadings if required to be fixed shall be as mentioned in the item description and shall be carried out in best workman-like manner.

Any other treatment for finishing such as gluing of wall papers, cement or oil based paint etc. shall be as specified in the item description and shall be done as per relevant specifications.

52.4 MODE OF MEASUREMENT :

Unless otherwise mentioned, the wooden or metallic-frame work shall be separately measured and paid for. The flexo board/A.C. sheet false ceiling shall be measured in square metre as actually laid over the frame work. The area being worked out correct to two places of decimal with length and breadth measured correct to a centimeter. The rates shall include the cost of all materials, labour, scaffolding etc. as mentioned above and in item description, unless otherwise specified.

52-A A.C.SHEET FALSE CEILING AND MASKING ETC. WITH PRESSED STEEL FRAME WORK/ANODIZED ALUMINIUM FRAME WORK : (N.A)

52.A-1 GENERAL:

The work covered by these specifications shall consist of furnishing all labour, materials and equipment necessary for installation of the suspended false ceiling and vertical masking, with A.C. sheet on pressed steel frame work, inter locking, Aluminium frame work suspended by adjustable M.S. suspenders with necessary cut outs in the A.C. sheet for lighting fixtures, trap doors, A.C. grills etc., providing m.s. lighting troughs etc., erecting to proper line and level in the specified areas, floors and levels as indicated in the drawing and as directed by the Engineer-in-Charge.

52.A-2 MATERIALS :

All materials which are to be in-cooperated in work shall be got approval prior to bulk procurement.

52.A-2.1 Fabrication of Pressed Steel Frame : The frame work for “snap grid” false ceiling shall be made out of tested special springs grade steel or approved cold rolled sheets of specified gauge as per schedule, accurately formed and die cuts with identical ends in automatic machine with precision tools. All workmanship shall be best quality as followed in a modern sheet metal shops equipped with all machines such as press, dies, spot welding machine, baking oven etc. All materials shall be done by a process approved by the Engineer-in-Charge and in a manner that will not damage the materials. All work shall be accurately formed to the required dimensions, true to line, level and plane in all directions and properly sized to suit the exact dimension within permissible tolerances. Twisted or bent sections shall not be permitted to be used on work. Main runners and cross tees shall be of sizes as specified in the schedule/shown in the drawing. The main runners shall be slotted for cross tees and punched for hangers/suspenders. Cross tees shall have identified die formed ends accurately cut for easy, correct and proper fit assembly. Shearing, cropping shall be clean, reasonably square and free from distortion. Surfaces and joints to be welded shall be free from loose scale, slag, rust, grease, paint and any other foreign materials. The surface shall be wire brushed vigorously. Welding sequence shall be followed to avoid needless distortion and minimise shrinkage stresses. Holes to be made in pressed M.S. sheet shall not be made by flame cutting. The flame cut or unfair holes are not acceptable connection of supported members with erection clearance for all members. Where for practical reasons greater clearance is necessary, suitable designed seating should be provided. Any damages done to the walls/ceiling shall be reinstated to original condition. The contractor shall not be entitled for any extra cost on this account.

52.A-2.1.1 Suspended Aluminium Grid system : Aluminium grid system shall be of BESTLOK/EEZILOCK or equivalent approved standard suspended aluminium grid system. The suspended ceiling grid shall be of self interlocking anodised aluminium T bars for main runners and cross runners of specified section and pattern as required to suit the span as per drawing.

52.A-2.2 A.C. Sheets : A.C. sheet shall be plain and of specified thickness, approved best quality and shall conform in all respect to the relevant Indian Standard Specifications.

The sheets shall be free from cracks, chipped edges or corners, twist dents, rough patches and other damages etc.

52.A-2.3 M.S. Works : All MS works shall conform to relevant specification mentioned under Structural Steel here-in-before.

52.A-2.4 Fastening : All bolts, nuts, screws, fittings & fixtures shall be of best quality and of approved manufacture.

52.A-3 FIXING :

The contractor shall take all necessary field measurements before the commencement of the frame work to ensure proper fittings of the work to actual condition of work at site. Particular care should be taken to examine the positions of all recessed lighting, trap doors and other openings indicated on drawings or as directed by the Engineer-in-Charge. The correct panel sizes shall be decided to suit each location. The false ceiling levels shall then be marked on walls. Mark the position of the runners to suit the span of the area. Fix

up the wall angles with approved metal fasteners and level then correctly. The position of suspender shall then be marked on the R.C. slab as per the sizes of the panels decided for each area with due consideration to location of air-conditioning ducts, grills etc. Suspenders of type and design fabricated as per drawing and approved by the Engineer-in-Charge, shall then be securely fixed at correct points with approved metal fasteners/expansion bolts of specified dia., as per manufacturers specifications. It shall be ensured that the hanger/suspender shall remain perpendicular and not pulled by the suspension system to any side. Fix up the runner to the suspenders and lock up the runners at the joints, complete the levelling starting from the fixed points and proceed towards the other end. Fix up the the cross tees to every runner joints to have stability while levelling. Neoprene rubber gasket shall then be fixed all along the frame work with approved type of adhesive. Approved A.C. sheets cut to correct sizes shall then be placed on the runner, starting from the centre of the width and work side wards. Connect all cross tees and put on the approved spring type hold down clip/pins as per drawing. Holes if required to be provided in A.C. sheets shall be drilled and on no account holes shall be punched. Lock the runner tees and tiles with hold down clips/pins as required. Wherever grouting for frame work, suspenders etc. is required to be done in masonry walls columns/beams etc., the same shall be done after the entire frame work is properly levelled.

The contractor shall take into consideration all wastage in the A.C. sheets, aluminium grid system frame work/pressed steel frame work, M.S. suspenders, screws, nuts, bolts, washers etc. required for fixing A.C. sheet false ceiling and vertical masking while quoting his rates. A.C. sheet false ceiling and vertical masking shall be fixed to pressed steel frame or Aluminium grid system by means of spring clip (brass counter sunk machine screws in case of masking) of approved size, make and at approved spacing or as shown in drawing or as instructed. After fixing the A.C. sheets, all holes of screws etc. shall be filled with approved putty, levelled with the A.C. sheets and sand papered, so that no sign of screw is visible on the A.C. sheets. For all the A.C. sheets false ceiling and vertical masking work, the A.C. sheet of required size and shape shall be cut as per approved panel size shown in drawing and fixed on pressed steel frame in the best workman like manner.

Trap doors/lighting recesses/troughs of approved size and shape with approved matching work, shall be provided in the false ceiling and vertical masking at the specified places.

Any damage done to the walls/columns/ceilings/plasters/floors etc. shall be made good to the original condition at his own cost. The contractor shall not be entitled for any extra cost on this account. During the execution of this work, the contractor shall take all the precautions to prevent damage to the painted surface, plaster, floor tiles, doors etc. Contractor should specifically note that the area where the false ceiling is required to be provided will be in advance stage of completion with various finishing items such as painting, floor polishing etc. Any damage to these finishes will have to be made good by him at no extra cost to the Department.

52.A-4 SAFETY PRECAUTIONS :

No person other than workman employed by the false ceiling contractor shall be permitted access to any area over which the sheeting is being laid. The contractor should take protective measures during the progress of work. Cat ladders or roof boards, scaffolding etc. should invariably be used by men working on the roof/false ceiling/masking etc.

52.A-5 WORK TO INCLUDE :

Cost of all approved A.C. sheets with anodized aluminium/pressed steel frame work, adjustable m.s. suspenders m.s. cleats, nuts, bolts, washers, screws, all labour, materials, tools, plants, approval scaffoldings, providing m.s. cleats and fixing them with metal fasteners/expansion bolts, nuts, washers, screws etc. to the concrete/wall surfaces and then fixing the adjustable suspenders in m.s. clamps, painting two coats of synthetic enamel paint on m.s. work as directed/as shown in drawing.

52.A-6 MODE OF MEASUREMENT :

A.C. Sheet false ceiling with snap grid pressed steel/anodized aluminium internal grid system frame work completed and accepted as per above specifications shall be measured in square metre upto two places of decimals. The line measurements shall be taken upto two places of decimal of a metre. The width shall be measured, from wall angle to wall angle and length shall be measured as per actual. Areas of trap doors, lighting troughs, Air conditioning diffusers, Air conditioning grills and other openings shall be deducted and net areas of false ceiling so computed shall be paid for unless other wise specified.

Areas of false ceiling with additional horizontal M.S. angle supports as per relevant drawing shall be measured separately between such additional supports. Mode of measurement for this item shall also be in square metre as described above.

52.B LIGHTING TROUGHS / FIXTURES :

Lighting troughs/fixtures shall be fabricated out of anodized aluminium sheet or out of m.s. sheet of specified gauge and shall be free from scale, blisters, laminations, cracked edges, defects of any sort and shall conform to relevant I.S. specifications.

Lighting troughs shall be fabricated in a modern, well equipped workshop, as per the size and profile given in the drawing. The M.S. lighting trough shall be stove enamelled in the shop with approved type of colour & shade on both the surfaces. Aluminium troughs shall be anodized as per standard practice. Sample of lighting trough fabricated as per drawing shall be got approved by the Engineer-in-Charge before manufacturing on large scale. Aluminium/M.S. frame work sections and sizes, as per drawing, shall be fabricated and got approved before fixing in position.

The m.s. lighting troughs along with m.s. frame or aluminium lighting troughs with aluminium frame shall be fixed in position to correct line and level with m.s. suspenders as per drawings. One or more sample lighting troughs shall be fixed in position and got approved before fixing all the lighting troughs. The end of the lighting troughs on both sides shall be provided with m.s. covers of the same gauge as per drawings.

The materials and fabrication of lighting trough, m.s. aluminium frame and suspenders shall conform to the relevant specification given in this tender. The m.s. work shall be painted with two coats of synthetic enamel paint of approved make and shade over a coat of approved primer as per specification under relevant head.

52.B-1 MODE OF MEASUREMENT :

The lighting troughs along with m.s. or aluminium frame work, suspenders, end covers etc. duly fixed in position shall be measured along the length of the trough in running metres upto two places of decimal of a

metre and paid for unless otherwise specified in schedule of work.

52.D FIBRE GLASS THERMAL INSULATION WORK AT CEILING WITH T.W. BATTENS FRAME WORK AND COVERING WITH A.C. SHEET : (N.A)

52.D-1 SCOPE OF WORK :

The work envisaged under these specification covers providing and fixing fibre glass thermal insulation to ceiling at any floor, location and height as specified including T.W. battens frame work in required grid and insulation work covered with A.C. sheet/flexo board of specified thickness.

52.D-2 MATERIALS :

i) **T.W. battens for frame** : Battens required for frame work shall be as specified under chapter "Wood work in frames, shutters and panelling".

ii) **Thermal insulation media** : The thermal insulation media shall be of fibre glass Crown 150 or equivalent approved make with K value of 0.0285 K. Cal/[sqm. hr.](#)^{0C}, 50 mm. thick and density of 24 kg/cum. or as specified in the description of item/ in drawing. Sample of fibre glass to be used on the work shall first be furnished by the contractor and got approved from Engineer-in-Charge before mass procurement.

iii) **A.C./Flexo board sheet covering** : The plain A.C. sheet or flexo board shall be as specified here-inbefore.

iv) **Fire resisting paint** : The fire resisting paint shall be of M/s. Garware Paints Ltd. or any other approved equivalent make and shall conform to I.S. 163. Sample of fire resisting paint to be used on work shall first be got approved from Engineer-in-Charge before bulk procurement. Ready mixed paint as received from the manufacturer without any admixture shall be used.

52.D-3 ERECTION / FIXING OF INSULATION :

i) **Frame work** : The workmanship shall be of best quality. All wrought timber is to be sawn, 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. All necessary mortising, tenoning, grooving, matching, tonguing, housing rebate and other necessary work for correct jointing shall be carried out in the best workmanship like manner. The frame work shall be made in required grid as specified in schedule item and in drawing. The frame work shall be rigidly screwed to the ceiling with 100 mm. long G.I. wood screws and rawl plugs @ 300 mm. centre to centre (or as specified) both ways by drilling holes in ceiling through frame work. The wood work shall be painted all over with fire resisting paint of M/s. Garware Paints Ltd. or any other approved equivalent make before erection of the same in position as per manufacturers specifications and as directed by Engineer-in-Charge.

If after fixing the frame work in position, any shrinking or substandard material or bad workmanship is

detected, the contractor shall forth with remove them and replace the same at his own cost.

ii) Sticking of insulation material & fixing of A.C./flexo board : After fixing of the frame work as above, a thick coat of bitumen of approved grade shall be applied as vapour barrier in the grids of frame work and then fibre glass of required thickness shall be stuck to ceiling and panel of grids as directed by the Engineer-in-Charge. The panels of fibre glass shall be cut exact to grid size and evenly pressed.

Approved A.C./flexo board sheets cut to correct sizes as specified in item description shall then be placed on the frame works starting from the centre of the width and work side-wards. Holes required in A.C. sheet/flexo board shall be drilled and on no account holes shall be punched. A.C. sheet shall be fixed to wooden frame work with suitable size of C.P. brass screws @ 300 mm. c/c. 4 mm. wide groove or as shown in the drawing shall be kept to correct line, level and plane at the junctions of sheets.

Any damage done to the finishes and to walls, columns, ceilings, plasters, floors etc. shall be made good to the original condition by the contractor at his own cost. The contractor should take protective measures during the progress of work. Cat ladders or roof boards scaffolding should invariably be used by men working on the thermal insulation work.

52.D-4 MODE OF MEASUREMENT :

This work shall be measured on square metre basis. The length and width shall be measured between plastered surfaces of walls upto two places of decimal of a metre for working out the area.

52.D-5 RATES :

Rates quoted by the contractor for the work shall include cost of all materials and labour required to complete the work as per item description, as per above specifications and as shown in the drawing.

* * *

53. METAL FALSE CEILING SYSTEM & THERMAL INSULATION : (N.A)

METAL FALSE CEILING SYSTEM (LUXALON 150 C / EQUIVQLENT):

53.1 MATERIALS

Manufacturing and Product: Hunter Douglas India Private Ltd. or equivalent

- a) **PRODUCT :** Luxalon 150 C lineal aluminium false ceiling or equivalent
- b) **COLOUR :** As specified or as approved by the Engineer-in-Charge

Material Description: All components shall be made of aluminium and manufactured by **M/s. Hunter Douglas India Private Limited OR Equivalent** and as per manufacturer's specification.

LUXALON 150 C METAL CEILING :

- i). **PANEL:** The panel shall be cold roll formed panels 150mm wide and 15,5mm deep with a 5mm beveled edge creating an 8mm V groove made from corrosion resistant Al.-Mg. Alloy AA5050, The length of each panel shall be upto 6000mm. The aluminium panels shall be chromatised for maximum bond between metal and paint enameled twice under high temperature, one side with a full primer and finish coat in a polyester paint for a dry film thickness of 20 microns, the other side (inner side) with a primer coating and skin coat on a Continuous Paint Line.
- ii). **CARRIER :** The carrier on which the panels shall be clipped on to will be 32mm wide, 39mm deep, made of black stove enameled 0.95mm thick aluminium alloy AA5050. When two or more carriers are to be joined, they shall be joined together by means of splices, which will clip on to holes provided for the same.
- iii). **WALL TRIM :** The wall trim shall be 15mm deep x 30mm wide x 15mm deep x 0.4mm thick Aluminium Alloy AA5050 with square edges and length of 5 mtr.
- iv). **ROD HANGER :** The rod hanger of suitable length shall be made of 4mm dia. galvanised steel (Zinc coating 120 gms/Sqm.)
- v). **SUSPENSION CLIP :** The adjustment suspension clip shall be made of galvanised spring steel V shaped with two holes to accommodate the rod hanger.
- vi). **ANCHOR FASTNERS :** The single piece sleeve anchor with assembled hanger taper bolt and nut which has smaller driller dia. Anchor fastener shall be of arrow make or equivalent with thread size 5mm.
- vii). **SUSPENSION SYSTEM :** The carriers would be suspended from the roof by 4mm dia galvanised (Zinc coating 120gms/Sqm.) steel wire rod hangers with height adjustment springs out of galvanised spring steel. Hangers shall be fixed to roof by 'J' hooks and Anchor Fasteners

53.2. FINISHING OF SURFACE OF STRIPS FOR INTERNAL USE (ALUMINIUM)

The coils from which aluminium panels are made shall be cold roll formed & stove enameled on a continuous coil coating paint line with dried in place roller coated application for pre-treatment. The coils to go through four stages of pre-treatment, three times oven baked through conversion coating, priming and finished coat, ensuring superior adhesion, high corrosion resistance and good colour retention. The coils shall be painted on both sides after being degreased. Prime coat of at least 5 microns to be applied on both sides and a back coat of 5 micron of neutral colour to be applied on the inside surface and 5 micron of binder and 15 microns of top coat of desired colour shall be additionally provided on the exposed surface.

Pencil Hardness. : phh > F

Light Fastness. : Light fastness of at least 6 according to international wool scale.

Colour Fastness : All finishes shall have a colour fastness of at least 6.

Colour Variation. : Colour diff, Bet batches + 4 units Colour diff. Within one batch + 2 units.

Colour Uniformity	: Maximum allowable deviation is 2 NBS units.
Specular Glose.	: 10 deg/00 (matt) ; 25 deg/00 (satin)
Resistance to Salt Spray Test	: After 100 hrs testing under creep from the edges or the Cross, shall exceed 2mm. Blistering shall not exceed F 8.
Impact resistance	: To withstand an impact test of 5mN/mm metal thickness Without loss of adhesion.
Paint adhesion.	: Better than or equal rating 1
Humidity Resistance.	: No formation of blister.
Chemical Resistance.	: No loss of adhesion or gloss and no colour change or Staining.

53.3. FIXING : The panels shall be clipped on to a carrier. The carriers to be suspended with an adjustment spring of galvanised spring steel, V shaped with two holes to accommodate the rod hanger. The rod hanger to be made of 4mm dia, galvanised steel and suspended form the ceiling by J hooks fixed at 1.5mm centre to centre.

53.4. WORKMANSHIP : The ceiling shall be erected in continuous sequence. Spans would not exceed those recommended by M/s. Hunter Douglas India Pvt. Ltd. All work in this section shall be performed in an efficient manner by the installing agency approved by the manufacturers and as per manufacturer's recommended procedures.

53.5. FIRE RESISTANCE : The false ceiling including the paint shall be fire resistant as per DIN 4102. Class A2. It should also be classified as P-NOT EASILY IGNITABLE - AS PER BS 476. Part 6 and should have a fire propagation classification of Class as per BS 476. Part 6.

* * *

53.6. THERMAL INSULATION

(A) UNDERDECK INSULATION :

I. METHOD OF APPLICATION :

- i) Clean the surface and make it free from dust and loose particles.
- ii) Apply a coat of Shalicoat to the underside of the roof.
- iii) Apply CPRX compound to the underside of each prelaminated Phenolic Foam panel and press the slabs in position. But the joints well together.
- iv) Secure panel in position with the help of screws, rawl plug and washers.

- v) Deal all the joints with the help of self adhesives Aluminium tapes

(B) INSULATION ABOVE FALSE CEILING :

- i) The insulation tiles shall be placed above the A1 carriers, which are a one meter c/c.
- ii) The insulation tiles should be cut to the required size for placement over carriers as per the spacing and pattern of false ceiling lay out.
- iii) The rate quoted shall be inclusive of cutting to the required size, wastage etc.
- iv) The tiles shall abut each other to provide a continuous barrier for effective thermal insulation

GENERAL :

- i. Extremely low 'K' value 0.018 Kcal/hrM.C.
- ii. Low water vapour transmission level.
- iii. Should be available in a single component system.
- iv. Should be approved by both TAC and NIC.
- v. Should be mildly antiseptic with resistance to fungal and bacterial growth and should not attract rodents / insects.
- vi. Should have good acoustic properties.
- vii. Temperature Range : + 125 degrees C to - 190 degrees C.
- viii. Material shall be classified as P [not easily ignitable] - BS 476 Part 5.
- ix. Material should conform to Building Classification "O" based on the propagation index BS 476 Part 6.
- x. Material shall have a Class I surface spread of flame, the highest rating possible BS 476 Part 7.
- xi. Lowest smoke obscuration 5% (almost negligible) - BS 5111 Part 1 .
- xii. Toxicity index of 0.04478 - Naval Engineering Standards 713 (NES) Ministry.

54. 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.

54.1 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 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..

* * *

SECTION 'C'- PLUMBING AND FIRE FIGHTING WORK

1. SANITARY FIXTURES & FITTINGS

1. SCOPE

The scope of this section consists of but is not necessarily limited to supply, installation, testing and commissioning of following items:

- a. Sanitary appliances and fixtures for toilets.
- b. Chromium plated brass fittings
- c. Stainless steel sinks
- d. Accessories e.g. towel rods, toilet paper holders, soap dish, liquid soap dispensers, towel rails, coat hooks etc.
- e. Hand driers, drinking water fountains etc.

Whether specifically mentioned or not the Contractor shall provide for all appliances and fixtures all fixing devices, nuts, bolts, screws, hangers as required.

All exposed pipes within toilets and near appliances/fixtures shall be of chromium plated brass or copper unless otherwise specified.

2 GENERAL REQUIREMENT

Sanitary appliances and fixtures for toilets, chromium plated brass fittings, stainless steel sinks, bathroom accessories like towel rods, toilet paper holders, soap dish, liquid soap dispensers, towel rails coat hooks etc and mirrors, hand driers, drinking water fountains etc as listed in the relevant items in the Schedule of Quantities shall be supplied free of cost by the Owner's Site Representative. The rates shall be inclusive of accessories (in such case) required for installation. All sanitary fixtures and fittings shall received from the Owner's Site Representative and thereafter be stored under covered roof and handled carefully to prevent

any damage by the Contractor.

All appliances, fixtures and fittings shall be provided with all such accessories as are required to complete the item in working condition whether specifically mentioned or not in the Schedule of Quantities, specifications, drawings. Accessories shall include proper fixing arrangements, brackets, nuts, bolts, washers, screws and required connection pieces.

The sanitary fixtures and fittings shall be installed at the correct assigned position as shown on the drawings and as directed by the Architect / Owner's Site Representative and shall fully meet with the aesthetic and symmetrical requirements as demanded by the Architect / Interior Designer

All fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per Architect requirements. Wherever necessary, the fittings shall be centered to dimensions and pattern as called for.

Fixing screws shall be half round head chromium plated (CP) brass screws, with CP brass washers unless otherwise specified.

Fixtures shall be installed by skilled workman with appropriate tools according to the best trade practice.

All appliances, fittings and fixtures shall be fixed in a neat workmanlike manner true to level and to heights shown on the drawings and 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, tiling, plaster, paint, insulation or terrace shall be made good by the Contractor at his own cost. Fixtures shall be mounted rigid, plumb and true to alignment.

All materials shall be rust proofed ; materials in direct or indirect contact shall be compatible to prevent electrolytic or chemical (bimetallic) corrosion.

Wall flanges shall be provided on all walls, floors, columns etc. wherever supply and disposal pipes pierce through them. These wall caps shall be or chromium plated brass fittings and the receiving pipes and shall be large enough to cover the punctures properly.

Sanitary appliances, subject to the type of appliance and specific requirements, shall be fixed in accordance with the relevant standards and the following :

- i. Contractor shall, during the entire period of installation and afterwards protect the appliances by providing suitable cover or any other protection so as to absolutely prevent any damage to the appliances until handing over (The original protective wrapping shall be left in position for as long as possible)
- ii. The appliances shall be placed in correct position or marked out in order that pipe work can be fixed or partially fixed first.
- iii. The appliance shall be fixed in a manner such that it will facilitate subsequent removal if necessary.

- iv. The appliance shall be securely fixed. Manufacturer's brackets and fixing methods shall be used wherever possible. Compatible rust-proofed fixings shall be used. Fixing shall be done in a manner that minimize noise transmission.
- v. Appliances shall not be bedded (e.g. WC pans, pedestal units) in thick strong mortar that could crack the unit (e.g. ceramic unit)
- vi. Pipe connections shall be made with demountable unions. Pipe work shall not be fixed in a manner that it supports or partially supports and appliance.
- vii. Appliances shall be fixed true to level firmly fixed to anchor or supports provided by the manufacturer and additional anchors or supports where necessary.

Sizes of sanitary fixtures given in the Specifications or in the Schedule of Quantities are for identification with reference to the catalogues of make considered. Dimensions of similar models of other makes may vary within $\pm 10\%$ and the same shall be provided and no claim for extra payment shall be entertained NOR shall any payment be deducted on this account.

The contractor shall fix all plumbing fittings such as water faucets, shower fittings, mixing valves etc. in accordance with manufacturer's instructions and connect to piping system. The contractor shall supply all fixing materials such as screws, rawl plugs, unions, collars, compression fittings etc., as required.

Joints / gaps between all sanitary appliances / fixtures and the floor / walls shall be caulked with an approved mildew resistant sealant, having antifungal properties, of colour and shade to match that of the appliances / fixture and the floor / wall to the extent possible.

2.1 Water Closet

Water Closet shall be wash down or symphonic wash down type floor or wall mounted set, as shown in the drawings, designed for low volume flushing from 5-7 litres of water, flushed by means of a porcelain flushing cistern or an exposed or concealed type (as detailed in the drawings or as directed by the Owner's Site Representative) 32 mm size CP brass flush valve with regulator valve. Flush pipe / bend shall be connected to the WC by means of a suitable rubber adaptor. Wall hung WC shall be supported by CI floor mounted chair which shall be fixed in a manner as approved by the Owners Site Representative.

Each WC set shall be provided with approved quality of seat, rubber buffers and chromium plated hinges. Seat shall be so fixed that it remains absolutely stationary in vertical position without falling down on the WC.

Each WC shall be provided with 110 mm dia (OD) PVC Pan connector connecting the ceramic outlet of WC to CI pipe.

2.2 Urinals

Urinals shall be lipped type half stall with glazed vitreous China of size as called for in the Bill of Quantities.

Half stall urinals shall be provided with urinal sensors, 15mm dia CP spreader, 32mm dia CP domical waste

and CP cast brass bottle trap with pipe and wall flange and shall be fixed to wall by CI brackets, CI wall clips and CP brass screws as recommended by manufacturer complete as directed by the Owner's Site Representative.

Flushing for urinals shall be by means of no hand operation, infrared electric flush valve with complete kit of plumbing, electrical and electronic items, infrared photo cells, solenoid valve transformer and electrical connection. The automatic flush sensor plate shall be flush and press fitted and be of high quality mirror polish finish. Each urinal shall be provided with one flush valve unit.

Flush pipes shall be GI pipes concealed in wall chase but with chromium plated bends at inlet and outlet.

2.3 Cisterns

Low level flushing cistern (exposed or concealed) shall be provided for WC in specified toilets. Contractor shall install cistern in accordance to the manufacturer's specification to the satisfaction of the Owner Site Representative. Provision of flush valve shall be made for Public / Staff toilets.

2.4 Wash Basin

Wash basins shall be white glazed vitreous china of size, shape and type specified in the Schedule of Quantities.

Each basin shall be provided with painted MS angle or CI brackets and clips (unless otherwise specified) and the basin securely fixed to wall/counter slab. Placing of basins over the brackets without secure fixing shall not be accepted. The MS angle shall be provided with two coats of red oxide primer and two coats of synthetic enamel paint of make, brand and colour as approved by the Owner's Site Representative. The cost of fixing the basin shall be inclusive of supply and installation of brackets as described above.

Each basin shall be provided with 32mm dia CP waste with overflow, pop-up waste or rubber plug and CP brass chain as specified in the Schedule of Quantities.

Each basin shall be provided with hot and cold water mixing fitting or as specified in the Schedule of Quantities.

2.5 Flow Control Device

Approved / rated flow control fitment in brass body, chrome outer cover, rated for flow / discharge of the fixture.

2.6 Toilet Paper Holder

Toilet paper holder shall be white glazed vitreous china or chrome plated of size, shape and type specified in the Schedule of Quantities.

Porcelain toilet paper holder shall be fixed in walls and set in cement mortar 1:2 (1 cement : 2 coarse sand) and fixed in relation to the tiling work.

The latter (chrome) shall be fixed by means of screws/capping having finish similar to the toilet paper holder in wall/temper partitions with raw l plugs or nylon sleeves. When fixed on timber partition, it shall be fixed on a solid wooden base member provided by the Owner's Site Representative.

2.7 Towel Rail

Towel rail shall be chromium plated brass or of stainless steel or powder coated brass of size, shape and type specified in the Schedule of Quantities.

Towel rail shall be fixed with screws/capping having finish similar to the towel rail in wall with rawl plugs or nylon sleeves and shall include cutting and making good as required or directed by the Owner's Site Representative.

2.8 Janitor's Sink

Janitor's sink shall be stainless steel, single bowl type of size as called for in the Schedule of Quantities , provided with painted R.S. or CI brackets and clips and securely fixed. Each sink shall be provided with 40mm dia CP waste. Fixing shall be as directed by the Owner's Site Representative.

The supply fittings for Janitor's sink shall be wall mounted type of size as mentioned in Schedule of Quantities.

2.9 Drinking Water Fountain

Drinking water fountain shall be well mounting type made of vitreous china, stainless steel or any other material as given in the Schedule of Quantities.

The drinking water fountain shall be with anti-squirt bubble less, self-closing valve type with automatic volume regulator.

The drinking water fountain shall be provided with an anti-splash back and integral strainer with 32mm or 40mm cast brass trap.

2.10 Liquid Soap Dispenser_

Liquid Soap Dispenser shall be wall/counter mounted suitable for dispensing liquid soaps, lotions, detergents. The cover shall lock to body with concealed locking arrangement, opened only by key provided.

Liquid soap dispenser body and shank shall be of high impact resistance material. The piston and spout shall be stainless steel with 1 litre capacity polyethylene container.

The valve shall operate with less than 2.27 Kg (5 lbs) of force.

2.11 Hand Drier

The hand drier shall be no touch operating type with solid state time delay to allow user to keep hand in any position.

The hand drier shall be fully hygienic, rated for continuous repeat use (CRU).

The rating of hand drier shall be such that time required to dry a pair of hands up to wrists is approximately 30 seconds.

The hand drier shall be of wall mounting type suitable for 230 V, single phase, 50 Hz, AC power supply.

3. MOCKUP AND TRIAL ASSEMBLY

The installation of the Sanitary fixtures and fittings shall be as per the shop drawings approved by the Architect/Consultant.

The contractor shall have to assemble at least one set of each type of sanitary fixtures and fittings in order to determine precisely the required supply and disposal connections. Relevant instructions from manufacturers shall be followed as applicable. This trial assembly shall be developed to determine the location of puncture holes, holding devices etc. which will be required for final installation of all sanitary fixtures and fittings. The above assembly shall be subject to final approval by the Architect / Interior Designer.

The fixtures in the trial assembly can be re-used for final installation without any additional payments for fixing or dismantling of the fixtures.

4. SUPPORTING AND FIXING DEVICES

The contractor shall provide all the necessary supporting and fixing devices to install the sanitary fixtures and fittings securely in position. The fixing devices shall be rigidly anchored into the building structure. The devices shall be rust resistant and shall be so fixed that they do not present an unsightly appearance in the final assembly SS:304 Nut Bolts & screw. Where the location demands, the Architect may instruct the contractor to provide chromium plated or other similarly finished fixing devices. In such circumstances the contractor shall arrange to supply the fixing devices and shall be installed complete with appropriate vibration isolating pads, washers and gaskets.

5. FINAL INSTALLATION

The contractor shall install all sanitary fixtures and fittings in their final position in accordance with approved trial assemblies and as shown on drawings. The installation shall be complete with all supply and waste connections. The connection between building and piping system and the sanitary fixtures shall be through proper unions and flanges to facilitate removal/replacement of sanitary fixtures without disturbing the built in piping system. All unions and flanges shall match in appearance with other exposed fittings.

Fixtures shall be mounted rigid, plumb and to alignment. The outlets of water closet pans and similar appliances shall be examined to ensure that outlet ends are butting on the receiving pipes before making the joints. It shall be ensured that the receiving pipes are clear of obstruction. When fixtures are being mounted, attention shall be paid to the possibility of movement and settlement by other causes. Overflows shall be made to ensure that necessary anchoring devices have been provided for supporting water closets, wash basins, sinks and other appliances.

6. PROTECTION AGAINST DAMAGE

The contractor shall take every precaution to protect all sanitary fixtures against damage, misuse, cracking, staining, breakage and pilferage by providing proper wrapping and locking arrangement till the completion of the installation. At the time of handing over, the contractor shall clean, disinfect and polish all the fixtures and fittings. Any fixtures and fittings found damaged, cracked chipped stained or scratched shall be removed and new fixtures and fittings free from defects shall be installed at his own cost to complete the work.

7. MEASUREMENT

- 7.1. Rate for fixing only of sanitary fixtures accessories, CP fittings shall etc. include all items, and operations stated in the respective specifications and bill of quantities and nothing extra is payable.
- 7.2 Rates for all items under specifications para above shall be inclusive of cutting holes and chases and making good the same, CP screws, nuts, bolts and any fixing arrangements required and recommended by manufacturers, testing and commissioning and making good to the satisfaction of the Owner's Site Representative.

8. TESTING

All appliances, fixtures and fittings shall be tested before and after installation. Water seals of all appliances shall be tested. The contractor shall block the ends of waste and ventilation pipes and shall conduct an air test.

2. WATER SUPPLY

1. SCOPE

The scope of this section comprises the supply, installation, testing and commissioning of piping network for water supply for internal & external services as follows:

- a Municipal Water supply.
- b Drinking Water Supply.
- c Flushing Water Supply

The Contractor shall make all necessary application and arrangements for his work to be inspected by the Local Authorities.

The Contractor shall be solely responsible for obtaining the Authorities approval of his works prior to the handing over of the complete water supply / distribution installation to the Owner.

2. PIPING MATERIALS

The piping system shall consist of copper pipes conforming to BS 2871, class 1, table X, half hard for domestic plumbing and fittings shall confirm to BS 864 Part-II

The piping system shall also consist of CPVC SDR 11.0 piping from 15 mm to 50 mm & Schedule 40 from 65 mm to 150 mm for cold water supply & schedule 80 from 65 mm to 150 mm for hot water supply.

The piping system shall also consist of heavy class galvanized iron pipes and fittings conforming to IS:1239. The sizes and makes is specified in the Schedule of Quantities.

For any internal works, the CPVC pipes / copper pipes / galvanized iron pipes and fittings shall be embedded in the wall chase or run on the floor/ceiling unless otherwise specified. No unsightly exposed runs shall be permitted.

A Copper Pipes & Fittings

The pipes shall be hard tempered copper pipes and tubes conforming to requirements of EN 1057; BS 2871 Table 'X' Part -I-1971 and the fittings shall confirm to EN 1252 Part 1 / 2 / 5 & BS 864 Part 2. The flux shall be NSF 6 or equivalent.

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. Endbrazed 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.

Laying 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 cm 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 may be 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 / 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 flame. 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).

B. CPVC Pipes & Fittings

The pipes shall be CPVC (Chlorinated Poly Vinyl Chloride) material for hot & cold water supply piping system with pipes as per CTs SDR -11 at a working pressure of 320 PSI at 23 deg C and 80 PSI at 82 deg.C, using solvent welded CPVC fittings i.e. Tees, Elbows, Couples, Unions, Reducers, Brushing etc. including transition fittings (connection between CPVC & Metal pipes / GI) i.e. Brass adapters (both Male & Female threaded and all conforming to ASTM D-2846 with only CPVC solvent cement conforming to ASTM F-493, with clamps / structural metal supports as required /directed at site including cutting chases & fitting the same with cement concrete / cement mortar as required, including painting of the exposed pipes with one coat of desired shade of enamel paint. All termination points for installation of faucets shall have brass termination fittings. Installation shall be to the satisfaction of manufacturer & Project Manager. Pipes from 65 mm to 150 mm dia shall be Schedule 40 for CWC & Schedule 80 for HWS / HWR.

i. Joining Pipes & Fittings

a. Cutting:

Pipes shall be cut either with a wheel type plastic pipe cutting or hacksaw blade and care shall be taken to make a square cut which provides optimal bonding area within a joint.

b. Deburring / Beveling:

Burrs and fittings should be removed from the outside and inside of pipe with a pocket knife or file otherwise burrs and fittings may prevent proper contact between pipe and fittings during assembly.

c. Fitting preparation:

A clean dry rag/cloth should be used to wipe dirt and moisture from the fitting sockets and tubing end. The tubing should make contact with the socket wall 1/3 or 2/3 of the way into the fitting socket.

d. Solvent Cement Application:

Only CPVC solvent cement confirming to ASTM-F493 should be used for joining pipe with fittings. An even coat of solvent cement should be applied on the pipe end and a thin coat inside the fitting socket, otherwise too much of cement solvent can cause clogged water ways.

e. **Assembly:**

After applying the solvent cement on both pipe and fitting socket, pipe should be inserted into the fitting socket within 30 seconds, and rotating the pipe $\frac{1}{4}$ to $\frac{1}{2}$ turn while inserting so as to ensure even distribution of solvent cement with the joint. The assembled system should be held for 10 seconds (approximately) in order to allow the joint to set up.

An even bead of cement should be evident around the joint and if this bead is not continuous remake the joint to avoid potential leaks.

Set & Cure times:

Solvent cement set and cure times shall be strictly adhered to as per the below mentioned table.

Minimum Core prior to pressure testing at 150 PSI

Ambient Temperature during Core period	Pipe Size	
	$\frac{1}{2}$ " - 1"	1.¼" - 2"
Above 15 deg. C	1 Hr	2 Hrs
4-15 deg.C	2 Hrs	4 Hrs
Below 4 deg C	4 Hrs	8 Hrs

Special care shall be exercised when assembling flow guard systems in extremely low temperature (below 4°C) or extremely high temperature (above 45°C) In extremely hot temperatures, make sure that both surfaces to be joined are till wet with cement solvent when putting them together.

f. **Testing**

Once an installation is completed and cored as per above mentioned recommendations, the system should be hydrostatically pressure tested at 150 psi(10 Bar) for one hour. During pressure testing, the system should be fitted with water and if a leak is found, the joint should be cut out and replacing the same with new one by using couplers.

ii. **Transition of Flow guard CPVC to Metals**

When making a transition connection to metal threads, special Brass / plastic transition fitting (Male and female adapters) should be used. Plastic threaded connections should not be over torqued Hard tight puts one half turn should be adequate.

iii. **Threaded Sealants**

Teflon tape shall be used to make threaded connections leak proof.

iv. **Solvent Cement**

Only CPVC solvent cement conforming to ASTM F 493 should be used for joining pipe with fittings and valves. Flow guard CPVC cement solvent have a minimum shelf life of 1 year. Aged cement solvent will often change colour or being to thicken and become gelatinous or jelly like and when this happens, the cement should not be used. The cement solvent should be used within 30 days after opening the company's seal and tightly close the seal after using in order to avoid its freezing. The frozen cement solvent should be discarded immediately and fresh one should be used. The CPVC solvent cement usage should be adhered to as given in table below

Diameter of pipe in inch (flow guard)	½"	¾"	1"	1¼"	1½"	2"
Approx. nos. of joints which can be mode per litre of solvent cement.	200 Nos	180 Nos	150 Nos	130 Nos	100 Nos	70 Nos

v. **Hangers and supports**

For Horizontal runs, support should be given at 3 foot (90 cm) intervals for diameters of one inch and below and at 4 foot (1.2m) intervals for larger sizes.

Hangers should not have rough or sharp edges which come in contact with the tubing.

Supports should be as per the below mentioned table:

Size of Pipe	21°C	49°C	71°C	82°C
Inch	Ft.	Ft.	Ft.	Ft.
½"	5.5	4.5	3.0	2.5
¾"	5.5	5.0	3.0	2.5

1"	6.0	5.5	3.5	3.0
1¼"	6.5	6.0	3.5	3.5
1½"	7.0	6.0	3.5	3.5
2"	7.0	6.5	4.0	3.5

SCHEDULE - 40

Recommended Support spacing (in feet)

Nom. Pipe Size		Temperature °C					
(In)	(mm)	23	38	49	60	71	82
2 ½	65	7 ½	7	7	6 ½	6	3 ½
3	80	8	7	7	7	6	3 ½
4	100	8 ½	7 ½	7 ½	7	6 ½	4
6	150	9 ½	8	8	7 ½	7	4 ½
8	200	9 ½	8	8	7 ½	7	5

SCHEDULE - 80

Recommended Support spacing (in feet)

Nom. Pipe Size		Temperature °C					
(In)	(mm)	23	38	49	60	71	82
2 ½	65	8	7 ½	7 ½	6 ½	4 ½	4
3	80	8	8	7 ½	7	4 ½	4
4	100	9	9	8 ½	7 ½	5	4 ½
6	150	10	9 ½	9	8	5 ½	5

C. Galvanised Iron Pipes & Fittings

The pipes shall be galvanised mild steel welded (ERW) or (HFW) screwed and socketed conforming to the requirements of IS:1239. The Galvanising shall conform to IS:4736, the zinc coating shall be uniform, adherent reasonably smooth and free from such imperfections as flux, ash and drop inclusions, bare patches, black spots, pimples, lumpiness, runs, rust strains, bulky white deposits and blisters. The pipes and sockets shall be cleanly finished, well galvanised in and out and free from cracks, surface flaws laminations and other defects. All screw threads shall be clean and well cut. The ends shall be cut cleanly, and square with the axis of the pipe.

The fittings shall be malleable iron and comply with all the requirements of the pipes. The sizes of pipes and fitting is specified in the schedule of quantities.

Laying And Jointing Of GI Pipes

The galvanised 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 cm 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 may be 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, 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 painted with anticorrosive bitumastic paints of approved quality. Under the floors the pipes shall be laid in layer of sand filling.

Galvanised iron pipes shall be jointed with threaded and socket joints, using threaded fittings. Care shall be taken to remove any burr from the end of the pipes after threading. Teflon tape, White lead or an equivalent jointing compound of proprietary make shall be used, according to the manufacturer's instructions, with a grommet of a few strands of fine yarn while tightening. Compounds containing red lead shall not be used because of the danger of contamination of water. Any threads exposed after jointing shall be painted with bituminous paint to prevent corrosion.

D. Polybutylene pipes and fittings.

Jointing pipes & fittings

The Polybutylene pipes and fittings are joined through a Electro-fusion welding machine and the below mentioned steps need to be adhered to while installing the system:

- a. **Cutting & edge preparation:** First the pipe need to be cut through a sharp cutter and the two end of the pipe need to be cleaned with the tangit cleaner provided by the manufacturer. The pipe cut should be a proper square cut only. Then the corresponding fitting to be connected with the fitting should also be cleaned with the same tangit cleaner. Cleaning removes all the dust particles on the pipe and the fitting for proper jointing. Then use the chamfering tool on the pipe to peel off a thin layer out of the pipe.
- b. **Fitting:** unpack the fitting and position it on the pipe, so that the sleeve end matches the pipe end.

Insert the end of the other pipe. Make sure both the ends of the pipe are lined up and secure the fitting and the pipe.

- c. Assembly:** Fix the electro-fusion machines cables so that the cables do not weigh on the clamps. Connect the clamps to the resistor terminals on the fitting and make sure that the connection is correct. Follow the instructions to the program and operate the welding machine.
- d. Testing:** Once the assembly is made pressure test it at double the working pressure so as to confirm the leak proof jointing of the system. This pressure testing should be done for 12 hours and then put into operation on regular basis.
- e. Minimum cooling time without moving sleeve and pipe:**

External diameter	minutes
16mm	10
20mm	10
25mm	10
32mm	15
40mm	15
50mm	20
63mm	25
75mm	30
90mm	35
110mm	35
125mm	45
160mm	45
225mm	50

- f. Supporting structure in Horizontal PB pipes:**

Supporting structures should be steel clamps with rubber fitted inside in order to hold the pipe tightly.

Mentioned below are the distances required to be maintained as per the temperatures:

External diameter	Temperature of the Flowing water in degree centigrade					
	20	30	40	50	60	80
16mm	75cm	70cm	70cm	65cm	65cm	55cm
20mm	80cm	75cm	70cm	70cm	65cm	60cm
25mm	85cm	85cm	85cm	80cm	75cm	70cm
32mm	100cm	100cm	95cm	90cm	85cm	75cm
40mm	110cm	110cm	105cm	100cm	95cm	85cm
50mm	125cm	125cm	115cm	110cm	105cm	90cm
63mm	140cm	140cm	130cm	125cm	120cm	105cm
75mm	155cm	155cm	145cm	135cm	130cm	115cm
90mm	170cm	170cm	160cm	155cm	150cm	145cm
110mm	190cm	190cm	180cm	175cm	160cm	155cm
125mm	225 cm	225cm	200cm	200cm	175cm	160cm
160mm	225cm	225cm	200cm	200cm	175cm	175cm
225mm	250cm	250cm	220cm	220cm	200cm	200cm

g. Supporting structures for Vertical Pipes:

The supporting structures for the vertical pipes is more or less similar to horizontal pipes. However in this case we can increase the distance between the supports by approximately by 30%. At branching point at each floor a compensatory arm in the form of u loop should be formed.

3. PIPING INSTALLATION SUPPORT (VALID FOR GI / COPPER PIPING ONLY)

Tender drawings indicate schematically the size and location of pipes. The Contractor, on the award of the work, shall prepare detailed working drawings, showing the cross-sections, longitudinal sections, details of fittings, locations of isolating and control valves, drain and air valves, and all pipe supports. He must keep in view the specific openings in buildings and other structure through which pipes are designed to pass.

Piping shall be properly supported on , or suspended from , on stands, clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchor, clamps and hangers, and be responsible for their structural stability.

Pipe work and fittings shall be supported by hangers or brackets so as to permit free expansion and contraction. All accessories and ancillaries of support system such as brackets, saddles, clamps, hangers etc. shall be hot dip galvanized after fabrication. Further to permit free movement of common piping, support shall be from a common hanger bar, fabricated from galvanised steel sections.

Pipe hangers shall be provided at the following maximum spacings:

Pipe Dia (mm)	Hanger Rod Dia (mm)	Spacing between Supports (m)
Up to 25	6	2
32 to 50	10	2.7
80 to 100	12	2.7
125 to 150	16	3.6
200 to 300	19	5.3

Insulated piping shall be supported in such a manner as not to put undue pressure on the insulation. 14 gauge metal sheet shall be provided between the insulation and the clamp, saddle or roller, extending atleast 15 cm. on both sides of the clamps, saddles or roller.

All pipe work shall be carried out in a proper workman like manner, causing minimum disturbance to the existing services, buildings, roads and structure. The entire piping work shall be organized in consultation with other agencies work, so that area can be carried out in one stretch.

Cut-outs in the floor slab for installing the various pipes area 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.

Pipe sleeves, larger diameter than pipes, shall be provided wherever pipes pass through walls and slab and annular space filled with fiberglass and finished with retainer rings.

The contractor shall make sure that the clamps, brackets, saddles and hangers provided for pipe supports are adequate or as specified / approved by Consultants. Piping layout shall take due care for expansion and contraction in pipes and include expansion joints where required.

All pipes shall be accurately cut by pipe cutting machine 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 reduces shall be used for the piping to drain freely. In other locations, concentric reduces may be used.

All buried pipes for CWS shall be cleaned and coated with two coats of bitumen and then wrapped with two layers of 400 micron polythene sheet coating.

Automatic air valves shall be provided at all high points in the piping system for venting. All valves shall be of 15mm pipe size and shall be associated with an equal size isolation ball valve. Automatic air valves shall also be provided on hot water risers.

Discharge from the air valves shall be piped through a galvanized steel pipe to the nearest drain or sump. All pipes shall be pitched towards drain points.

Pressure gauges shall be provided as shown on the approved drawings and include in Bill of Quantities. Care shall be taken to protect pressure gauges during pressure testing.

Temperature gauge as specified shall be provided at the hot water supply and return and as shown on drawings and included in Bill of Quantities.

4. FERRULES

The ferrules for connection with main shall generally conform to IS:2692. It shall be of non-ferrous materials with a bell mouth cover and shall be of nominal bore as specified. The ferrule shall be fitted with a screw and plug or valve capable of completely shutting of the water supply to the communication pipe, as and when required.

4.1 Fixing Ferrules

For fixing ferrule in cast iron mains, the empty main shall be drilled and tapped at 45 deg to the vertical and the ferrule screwed in. The ferrule must be so fitted that no portion of the shank shall be left projecting within the main into which it is fitted.

5. WATER METERS

Water meters of approved make and design shall be supplied for installation at locations as shown. The water meters shall meet with the approval of local supply authorities. Suitable valves and chambers or wall meter box to house the meters shall also be provided along with the meters.

The meters shall conform to Indian Standard IS:779 and IS:2373. Calibration certificate shall be obtained and submitted for each water meter.

Provision shall also be made to lock the water meter. The provision shall be such that the lock is conveniently operated from the top. Where the provision is designed for use in conjunction with padlocks, the hole provided for padlocks shall be a diameter not less than 4mm.

5.1 Installation Of Water Meter And Stop Cock

The G.I. lines shall be cut to the required lengths at the position where the meter and stop cock are required to be fixed. Suitable fittings shall be attached to the pipes. The meter and stop cock shall be fixed in a position by means of connecting pipes, jam nut and socket etc. The stop cock shall be fixed near the inlet of the water meter. The paper disc inserted in the ripples of the meter shall be removed. And the meter installed exactly horizontal or vertical in the flow line in the direction shown by the arrow cast on the body of the meter. Care shall be taken that the factory seal of the meter is not disturbed. Wherever the meter shall be fixed to a newly fitted pipe line, the pipe line shall have to be completely washed before fitting the meter.

6. TESTING

The Contractor shall notify the Architect three days in advance of any test so that the Architect can witness the tests if he so wishes.

All water supply system shall be tested to hydrostatic pressure test of at least one and a half (1.5) times the maximum pressure but not less than 10Kg/Sq.cm for a period of not less than 8 hours. All leaks and defects in joints revealed during the testing shall be rectified and got approved at site by retest. Piping required subsequent to the above pressure test shall be retested in the same manner.

System may be tested in sections and such sections shall be entirely retested on completion.

The Contractor shall make sure that proper noiseless circulation of fluid is achieved through the entire piping network of the system concerned. In case of improper circulation, the contractor shall rectify the defective connections. He shall bear all expenses for carrying out the above rectifications including the tearing up and refinishing of floors and walls as required.

In addition to the sectional testing carried out during the construction, contractor shall test the entire installation after connections to the overhead tanks or pumping system or mains. He shall rectify all leakages and shall replace all defective materials in the system. Any damage done due to carelessness, open or burst pipes or failure of fittings, to the building, furniture and fixtures shall be made good by the contractor during the defects liability period without any cost.

After commissioning of the water supply system, contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently. Valves which do not effectively operate shall be replaced by new ones at no extra cost and the same shall be tested as above.

A test register shall be maintained and all entries shall be signed and dated by Contractor(s) and Owner's site representative.

7. DISINFECTION OF PIPING SYSTEM AND STORAGE TANKS

Before commissioning the water supply system, the contractor shall arrange to disinfect the entire system as described in the succeeding paragraph.

The water storage tanks and pipes shall first be filled with water and thoroughly flushed out. The storage tanks shall then be filled with water again and disinfecting chemical containing chlorine added gradually while tanks are being filled to ensure thorough mixing. Sufficient chemical shall be used to give water a dose of 50 parts of chlorine to one million parts of water.

If ordinary bleaching powder is used, the proportions will be 150 gm of powder to 1000 liters of water. The powder shall be mixed with water in the storage tank. If a proprietary brand of chemical is used, the proportions shall be specified by the manufacturer. When the storage tanks are full, the supply shall be stopped and all the taps on the distributing pipes are opened successively working progressively away from the storage tank. Each tap shall be closed when the water discharged begins to smell of chlorine. The storage tank shall then be filled up with water from supply pipe and added with more disinfecting chemical in the recommended proportions. The storage tank and pipe shall then remain charged at least for three hours. Finally the tank and pipes shall be thoroughly flushed out before any water is used for domestic purpose.

The pipe work shall be thoroughly flushed before supply is restored.

8. STERILIZATION OF MAIN

After the pipe work has been tested and approved, but before it is coupled, it shall be sterilized with a solution of chloride of lime.

9. CUTTING CHASES IN MASONRY WALLS

Cold water distribution pipes to fixtures and equipment exposed to view in the bathrooms, kitchens, and sanitary compartments shall be chased into walls or floors or placed in wall cavities. The Contractor shall be responsible for cutting all notches, chases, and recesses in walls and floors and only a diamond cutter shall be used. The maximum size of conduit or pipe permitted to be concealed in floor slabs shall be 32 mm diameter unless otherwise approved by the Architect.

The chases upto 7.5 x 7.5 cm shall be made in the walls for housing GI pipes etc. These shall be provided in correct positions as shown in the drawings or directed by the Architects. Chases shall be made by chiselling out the masonry to proper line and depth. After the pipes etc are fixed in chases, the chases shall be filled with cement mortar 1:2:4 or as may be specified, and made flush with the masonry surface. The concrete surface shall be roughened with wire brush to provide a key for plastering.

Where pipes pass through beams or structural walls, subject to the approval of the Structural Consulting Engineer, the Contractor shall ensure that sizes and locations of openings required are formed in when the relevant beams or walls are cast.

10. VALVES

All valves (gate, globe, check, safety) shall be of gun metal suitable for the particular service as specified. All valves shall be of the particular duty and design as specified. Valves shall either be of screwed type or flanged type, as specified, with suitable flanges and non-corrosive bolts and gaskets. Tail pieces as required shall be supplied along with valves. Gate, globe and check valves shall conform to Indian Standard IS:776 and non-return valves and swing check type reflux to IS:5312.

Sluice valves, where specified shall be flanged sluice valves of cast iron body. The spindle, valve seat and wedge nuts shall be gunmetal. They shall generally have non-rising spindle and shall be of the particular duty and design as specified. The valves shall be supplied with suitable flanges, non-corrosive bolts and asbestos fibre gaskets. Sluice valves shall conform to Indian standard IS:780 and IS:2906.

Ball valves with floats to be fixed in storage tanks shall consist of cast brass lever arm having copper balls (26 SWG) screwed to the arm integrally. The copper ball shall have bronze welded seams. The closing/opening mechanism incorporating the piston and cylinder shall be non-corrosive metal and include washers. The size and construction of ball valves and float shall be suitable for desired working pressure operating the supply system. Where called for brass valves shall be supplied with brass hexagonal back nuts to secure them to the tanks and a socket to connect to supply pipe.

Globe valves on Hot-water line shall be union bonnet with stem/disc and body seat ring of SS. Suitable for temperature upto 80° C.

S.No	Type of Valve	Size	Construction	Ends
a.	Isolating Valve	15 mm to 50 mm	Gun Metal	Screwed
		65 mm and above	Gun Metal	Flanged
b.	Sluice Valve & Butterfly Valve	65 mm and above	Cast Iron	Flanged
c.	G.M. non return valve	15 mm to 50 mm	Gun Metal	Screwed
		65 mm above	Gun Metal	Flanged
d.	Flap Type – Non return valve	65 mm and above	Cast Iron	Flanged

All valves shall be suitable for the working pressure involved.

10.1 Pressure Reducing Valve Set

Each pressure reducing valve set shall be complete with pressure reducing or pressure regulating valve, isolating valves, pressure gauges (fix with symphonic check) on inlet and outlet, pressure relief valve on outlet and filter on inlet.

Each pressure reducing valve shall contain loading neoprene diaphragm and a full floating, self aligning, ignition resistant seat and shall be of the single stage, pressure reduction type with provision for manually adjusting the delivery pressure. The valve shall fail safe to the low pressure.

Valves shall be capable of operating at the maintaining automatically the respective delivery pressure and flow rates as indicated and shall not be liable to creep. Valves shall also be capable of maintaining the pre-set down stream pressure under static condition.

The filter on each inlet to a pressure reducing valve shall be of replaceable porous sintered metal type.

10.2 Pressure Relief Valves

Each pressure relief valve shall be of the fully enclosed type and fitted with hand easing gear.

Each pressure relief valve in a pressure reducing station shall have a flow capacity equal to that of the pressure reducing valve.

Pressure relief valves in locations other than reducing stations shall have flow capacities equal to that of the associated equipment.

10.3 Pressure Gauge

The pressure gauge shall be constructed of die cast aluminium and stove enamelled. It shall be weather proof with an IP 55 enclosure. It shall be a stainless steel Bourden tube type pressure gauge with a scale range from 0 to 16 Kg / cm square and shall be constructed as per IS:3524. Each pressure gauge shall have a siphon tube connection. The shut off arrangement shall be by Ball Valve.

Calibration certificate shall be obtained and submitted for each pressure gauge.

11. WATER FITTINGS

Unless otherwise specified all Gunmetal fittings such as gate, globe, check & safety valves shall be fitted in pipe line in workman like manner. Necessary unions shall be provided on both ends of the valves for easy replacement. The joints between fittings and pipes shall be leak-proof when tested to desired pressure rating. The defective fittings and joints shall be replaced or redone.

12. PAINT:

Used paints and coatings that comply with the following limits for VOC content and the following chemical restrictions:

- Non-Flat Paints and Coatings: VOC not more than 150 g/L.
- Anti-Corrosive Coatings VOC not more than 250 g/L.
- Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).

- Paints and coatings shall not contain any of the following:

Acrolien

Acrylontrile

Antimony

Benzene

Buty benzyl phthalate

Cadmium

Di (2-ethylheyl) phthalate

Di-n-butyl phthalate

Di-n-octy phthalate

1,2-dichlorobenzene

Diethy phthalate

Dimenthyl phthalate

Ethyl benzene

Painting:

Water supply pipes in exposed, in shafts shall be painted with two or more coats of ready mix Low-VOC oil paint to give an even shade before painting all dust and extraneous matter shall be removed.

Paint shall be of approved quality and shade. Where directed by the Owner's site representative pipes shall be painted in accordance with approved pipe colour code.

Pipe in chase shall be painted with two coats of bitumen paint, covered with polythene tape and a final coat of bitumen paint. Exposed pipes shall be painted with synthetic enamel paint after removing dust and extraneous matter.

Water supply pipes below ground and covered in cement concrete shall not be painted.

12. CONNECTIONS TO VARIOUS MECHANICAL EQUIPMENT SUPPLIED BY OTHER AGENCIES

All inlets, outlets, valves, piping and other incidental work connected with installation of mechanical equipment supplied by other agencies all be carried out by the contractor in accordance with the drawings, requirements for proper performance of equipment, manufacturers instructions and the directions of the Owner's site representative / Architect. The equipments to be supplied by the other agencies consist mainly for Kitchen,

Back-of-the-House area and other similar areas. The work of connections to the various equipments shall be effected through proper unions and isolating valves. The work of effecting connections shall be executed in consultation with and according to the requirement of equipment suppliers, under the directions of the Owner's site representative / Architect. The various aspects of connection work shall be executed in a similar way to the work of respective trade mentioned elsewhere in these specifications.

Tiling of Walls

The floor and the walls of the tanks shall be tiled with glazed tiles up to the overflow level. Alternatively food grade epoxy to be applied to the floor and the walls of the tanks.

14. MEASUREMENTS

The length above ground shall be measured in running meter correct to a cm for the finished work, which shall include pipe and fittings such as coupling, bends, tees, elbows, reducers, crosses, plugs, sockets, nipples and nuts, unions. 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.

All 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.

15. LAWN HYDRANTS

Lawn hydrants shall be of 25mm size unless otherwise indicated. All hydrants shall be provided with gate valves and threaded nipple to receive hose pipes. Lawn hydrant valves shall be of approved make and design. Where called for lawn hydrants shall be located in masonry chambers of appropriate size.

16. PIPE PROTECTION (FOR COLD WATER PIPES BURIED IN TRENCHES / GROUND / EARTH)

All buried pipes shall be cleaned with zinc chromate primer and bitumen paint, wrapped with three layers of fiber glass tissue, each layer laid in bitumen and placed on concrete blocks with PUF saddles dipped in bitumen at every 2 meters. The pipes where laid under floor shall be encased with 100 mm thick jamuna sand all around in addition to protective coating as described above. Alternatively pypcoat / coatek insulation for protection of pipe would also be acceptable as per final approval of project engineer / consultant.

17. 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 Owner's site representative.

18. 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 Owner's site representative.
- iii. Concrete shall be of cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size).
- iv. Brick shall be of class designation 75 in cement mortar 1:5 (1 cement : 5 fine sand)
- v. Inside Plastering not less than 12 mm thick shall be done in cement mortar 1:3 (1 cement : 3 fine sand) finished with a floating coat of neat cement.

19. SHIFTING OF EXCAVATED SURPLUS MATERIAL

Contractor shall make his own arrangement to shift the surplus excavated material within the site limits as directed by Owner's site representative at free of cost within time limit.

04. INTERNAL DRAINAGE (SOIL, WASTE, VENT & RAIN WATER PIPES)

1. SCOPE

The scope of this section comprises the supply, installation, testing and commissioning of internal drainage services.

Work under this section shall consist of furnishing all labour, materials, equipments and appliances necessary and required to completely install all soil, waste, vent and rainwater pipes and fittings as required by the drawings, and given in the schedule of quantities.

2. BASIC PIPING SYSTEM

Soil, waste and vent pipes in shafts, ducts and in concealed areas i.e. false ceilings etc. shall consist of cast iron pipes & fittings as called for. In general wastes and vents smaller than and upto 50mm dia shall be of heavy class GI.

The soil pipes shall be circular with a minimum diameter of 100mm. Pipes shall be fixed by means of stout GI clamps in two sections, bolted together, built into the walls, wedged and neatly jointed as directed and approved by the Owner's site representative / Architect. All bends, branches, swan neck and other parts shall conform to the requirement and standards as described for the pipes. Pipes shall be rested against the walls on suitable wooden cradles. Local authority regulations applicable to the installations shall be strictly followed.

Where indicated, the soil pipes shall be continued upwards without any diminution in its diameter, without any bend or angle to the height shown in the drawings. Joints throughout shall be made with molten lead as described under jointing of cast iron pipes. Soil pipes shall be painted as provided under 'painting'. The soil pipes shall be

covered on top with cast iron terminal outlets as directed and approved. All vertical soil pipes shall be firmly fixed to the walls with properly fixed clamps, and shall as far as possible be kept 50mm clear of wall. Waste pipes and fittings shall be of cast iron or galvanised mild steel pipes. Pipes shall be fixed, jointed and painted as described in installation of soil, waste & vent pipes.

Every waste pipe shall discharge above the grating of properly trapped gully. The contractor will ensure that this requirement is adequately met with. Wherever floor traps are provided, it shall be ensured that atleast one wash is connected to such floor traps to avoid drying of water seal in the trap. Ventilating pipes shall be of cast iron or galvanised mild steel pipes, conforming to the requirements laid down earlier. Anti-syphon vent pipes/relief vent pipes where called for on the drawings shall be of cast iron or galvanised mild steel pipes as specified. The pipes shall be of the diameter shown on the drawings.

All traps on branch soil and waste pipes shall also be ventilated at a point not less than 75mm or more than 300mm from their highest part and on the side nearest to the soil pipe or waste pipes.

Access doors for fittings and clean outs shall be so located that they are easily accessible for repair and maintenance. Any access panel required in the civil structure, false ceiling or marble cladding etc. shall be clearly reported to the Owner in the form of shop drawings so that other agencies are instructed to provide the same.

All the fittings used for connections between soil, waste and ventilation pipes and branch pipes shall be made by using pipe fittings with inspection doors for cleaning. The doors shall be provided with 3mm thick rubber insertion packing and when closed and bolted shall be air and water tight.

Where soil, waste and ventilating pipes are accommodated in shafts ducts, adequate access to cleaning eyes shall be provided.

Head (starting point) of drains and sewage / waste water sumps (as and where applicable) having a length of greater than 4 m upto it connection to the main drain or manhole shall be provided with a 80 / 100 mm vent pipe.

3. PIPING MATERIALS

3.1 Cast Iron Pipes

Cast iron pipes and fittings shall be of good and tough quality and dark grey on fracture. The pipes and fittings shall be true to shape, smooth and cylindrical, their inner and outer surface being as nearly as practicable concentric. They shall be sound and nicely cast, shall be free from cracks, taps, pinholes and other manufacturing defects.

The pipes and fittings shall conform to IS:3989 / IS:1729 as called for. Fittings shall be of required degree with or without access door. All access doors shall be made up with 3mm thick insertion rubber gasket of white lead and tightly bolted to make the fittings air and water tight. The fittings shall be of the same manufacture as the pipes used for soil and waste.

All CI pipes and fittings shall bear the manufacturer's name and ISI specification to which it conforms.

All pipes and fittings shall be coated internally and externally with the same material at the factory, the fittings

being preheated prior to total immersion in a bath containing a uniformly heated composition having a tar/other suitable base. The coating material shall have good adherence and shall not scale off. The coating shall be smooth and tenacious and hard enough not to flow when exposed to a temperature of 77 degree C but not so brittle at a temperature of '0' degree C as to chip off when scratched lightly with a pen knife.

All pipes and fittings before installation at site shall be tested hydrostatically to a pressure of 0.45 Kg/sq. cm without showing any sign of leakage, sweating or other defects of any kind. The pressure shall be applied internally and shall be maintained for not less than 15 minutes. All these tests shall be carried out in the presence of the representative of the Project Manager. Alternatively a test certificate from manufacturers be obtained before dispatch of material to site.

Cast Iron Specialities

If required, Cast iron speciality items such as deep seal floor traps, urinal traps, trap integral pieces with integral inlet/outlet connections, manhole cover with frame, chamber cover etc. shall be fabricated to suit individual location requirements. The contractor shall arrange the fabrication of these items from an approved source.

Lead Caulked joints with pig lead:

The approximate depth and weights of pig lead for various diameters of CI pipes and specials shall be as follows:

<u>Nominal size of Pipe (mm)</u>	<u>Lead per Joint (Kg)</u>	<u>Depth of Lead Joint (mm)</u>
50	0.77	25
80	0.88	25
100	0.99	25
150	1.5	38

Drip Seal Joints :

Drip seal (pipe joint sealant) shall be used for joining various diameters of C.I. pipes and specials. This sealant replaces the standard Drip seal caulked joints. The application is by Homogenously mixing the two pack system in cold condition.

Application Procedure:

Clean the pipe joints thoroughly to ensure it is free from any traces of oil, dirt or any other foreign body. Mix two parts of Drip Seal thoroughly with an iron flat to get a homogenous compound. * Place Spun yarn in the pipe joint as a filler and then take the required quantity of the compound and push it in the joint with a caulking tool, MS flat / damp finger uniformly all over to obtain a smooth and uniform joint. Dip the fingers in water every often to ensure the compound does not stick to the hands of the workmen, but this will ensure perfect sealing and the smooth surface for the joint cement. (* The compound prepared from the two mixtures is to be used within 30 minutes) Precaution to be taken to wash hands thoroughly with soap before and after use. Preferably use disposable

gloves for hand application.

3.2 Galvanised Iron Pipes

Waste pipes of 50mm dia and below and where called for shall be galvanised iron pipes screwed and socketed conforming to the requirements of IS:1239 of heavy grade. The pipes and sockets shall be cleanly finished, well galvanised in and out and free from cracks, surface flaws, laminations and other defects. All screw thread shall be clean and well cut. All pipes and fittings shall bear manufacturer's trade mark and conform to the IS as specified.

3.3 UPVC Pipes and Fittings

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, free from groovings and other defects. The ends shall be cleanly cut and square with the axis of the pipe. The pipes shall be designed by external diameter and shall conform to IS:4985-1981 or IS:13592. The pipes shall be of Class-III; 6 Kg/sqm pressure rating or type B.

Fittings

Fittings shall be of the same make as that of pipes, injection moulded and shall conform to IS:14735.

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 Owner's site representative. Where UPVC pipes are to be used for rain water pipes, the pipe shall be finished with GI adopter for insertion in the RCC slab for a water proof joint complete as directed by Owner's site 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 shall be made by replacement of the damaged section. If any split or chip out occur 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.

HDPE PIPES AND FITTINGS

Materials

All pipes and fittings to be HDPE manufactured to DIN 19535, DIN 19537, DIN 8074, DIN 8075 fittings to carry a BBA certificate No. 92/2796.

All materials should be manufactured under a BS 5750 / ISO 9000 approved scheme.

All component parts of the system shall be covered by a manufacturer's warranty.

Installation

All pipes and fittings to be fusion welded by either electro sleeve coupling or butt weld.

Fixed points must be provided at a maximum of 5 metre intervals and / or changes in direction.

Intermediate sliding supports must be provided in accordance with the manufacturer recommendations/ application technique manual

All operatives to be trained in welding and jointing techniques by the manufacturer.

Inspection & testing

The work shall be inspected and tested during installation at agreed stages. All work which will be concealed shall be tested before it is finally enclosed.

Work to be inspected regularly by the manufacturer who is to verify compliance with manufacturer's installation guidelines

3.4 Cast Iron Class (LA) pipes

All drainage passing under building floor and passing through retaining wall shall be cast iron class (LA) pipes (IS : 1536)

Cast iron class (LA) pipe shall be such that they could be cut, drilled or machined. Pipe centrifugally cast in unlined water cooled moulds shall be heat treated in order to achieve the necessary mechanical properties and to relieve casing stress; provided that the specified mechanical properties are satisfied.

Material

Cast iron pipe shall be centrifugally spun cast iron pipe and conforming to IS:1536-1976

Fittings

Fittings shall be used for cast iron class (LA pipes shall conform to IS:1538-1976). Whenever possible junction from branch pipe shall be made by wyes.

All cast iron water main pipes and fittings shall be manufactured to IS:1536 of tested quality. The pipes and fittings shall either be spigot and socket type or as called for. The pipes and fittings shall be of uniform material throughout and shall be free from all manufacturing defects.

Joints

Cast iron class (LA) pipe used for soil and waste pipes shall be jointed with **drip seal** / lead joints sufficient skin of jute rope shall be caulked to leave minimum space of 25 mm for the **drip seal**. Lead to be poured in.

Laying

- i. Fittings used for CI drainage pipe shall conform to IS:1538-1976. Wherever possible junction from branch pipes shall be made by a Y/tee.

Drip Seal Joints :

Drip seal (pipe joint sealant) shall be used for joining various diameters of C.I. pipes and specials. This sealant replaces the standard Drip seal caulked joints. The application is by Homogenously mixing the two pack system in cold condition.

Application Procedure:

Clean the pipe joints thoroughly to ensure it is free from any traces of oil, dirt or any other foreign body. Mix two parts of Drip Seal thoroughly with an iron flat to get a homogenous compound. * Place Spun yarn in the pipe joint as a filler and then take the required quantity of the compound and push it in the joint with a caulking tool, MS flat / damp finger uniformly all over to obtain a smooth and uniform joint. Dip the fingers in water every often to ensure the compound does not stick to the hands of the workmen, but this will ensure perfect sealing and the smooth surface for the joint cement. (* The compound prepared from the two mixtures is to be used within 30 minutes) Precaution to be taken to wash hands thoroughly with soap before and after use. Preferably use disposable gloves for hand application.

- ii. Lead Caulked joints with pig lead :

The approximate depth and weights of pig lead for various diameters of CI pipes and specials shall be as follows:

<u>Nominal size of Pipe (mm)</u>	<u>Lead per Joint (Kg)</u>	<u>Depth of Lead Joint (mm)</u>
80	1.8	45
100	2.2	45

125	2.6	45
150	3.4	50
200	5.0	50
250	6.1	50

- iii. The spigot of pipe of fittings shall be centered in the adjoining socket by caulking. Sufficient turns of tarred gasket shall be given to leave a depth of 45 mm when the gasket has been caulked tightly home. Joining ring shall be placed round the barrel and against the face of the socket. Molten Lead shall then be poured to the remainder of the socket.
- iv. For lead wool joints the socket shall be caulked with tarred gasket, as explained above. The lead wool shall be inserted into the sockets and tightly caulked home skin by skin with suitable tools and hammers of not less than 2 Kg weight until joint is filled.

4. PIPES HANGERS, SUPPORTS, CLAMPS ETC.

All vertical pipes shall be fixed by galvanized clamps and galvanized angle brackets 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).

Horizontal pipes running along ceiling shall be fixed on galvanized structural adjustable clamps of special design shown on the drawings or as directed. Horizontal pipes shall be laid to uniform slope and the clamps adjusted to the proper levels so that the pipes fully rest on them.

Contractor shall provide all sleeves, openings, hangers, inserts during the construction. He shall provide all necessary information to the building contractor for making such provisions in the structure as necessary. All damages shall be made good to restore the surfaces.

All pipes clamps, supports and hangers shall be galvanized. Factory made prefabricated clamps shall be preferred. Contractor may fabricate the clamps of special nature and galvanize them after fabrication but before installation. All nuts, bolts, washers and other fasteners shall be factory galvanized.

Clamps shall be of approved design and fabricated from MS flats (which shall be galvanized after fabrication) of thickness and sizes as per drawings or contractor's shop drawings. Clamps shall be fixed in accordance to manufacturer's details/shop drawings to be submitted by the contractors.

When required to be fixed on RCC columns, walls or beam they shall be fixed with approved type of galvanized expansion anchor fasteners (Dash fasteners) of approved design and size according to load.

Structural clamps e.g.. trapeze or cluster hangers shall be fabricated by electro-welding from MS structural members e.g. rods, angles, channels flats as per contractors shop drawings shall be galvanized after fabrication. All nuts, bolts and washers shall be galvanized.

Galvanized slotted angle/channel of approved sizes supports on walls shall be provided wherever shown on shop drawings. Angles/channels shall be fixed to brick walls with bolts embedded in cement concrete blocks and to RCC walls with anchor fasteners mentioned above. The spacing of support bolts on support members fixed horizontally shall not exceed 1 m.

5. INSTALLATION OF SOIL, WASTE & VENT PIPES

Soil, waste & vent pipes in shafts under the floors / suspended below slab shall consist of cast iron pipes as described earlier. Waste pipes from bottle trap to floor/urinal traps for wash basin, urinal and sink shall be GI pipes and fittings.

All Horizontal pipes running below the slab and along the ceiling, shall be fixed on structural adjustable clamps, sturdy hangers of the design as called for in the drawings. The pipes shall be laid in uniform slope and proper levels. All vertical pipes shall be truly vertical fixed by means of stout clamps in two sections, bolted together, built into the walls, wedged and neatly jointed. The branch pipes shall be connected to the stack at the same angle as that of fittings. All connections between soil, waste and ventilating pipes and branch pipes shall be made by using pipe fittings with inspection doors for cleaning. Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts. Where the horizontal run off the pipe is long or where the pipes cross over building expansion joints etc. suitable allowance shall be provided for any movements in the pipes by means of expansion joint etc. such that any such movement does not damage the installation in any way.

All cast iron pipes and fittings shall be jointed with drip seal / Best Quality pig lead free from impurities conforming to IS 27.

Before jointing, the interior of the socket and exterior of the spigots shall be thoroughly cleaned and dried. The spigot end shall be inserted into the socket right up to the back of the socket and carefully centered by two or three laps of threaded spun yarn, twisted into ropes of uniform thickness, well caulked into the back of the socket. No piece of yarn shall be shorter than the circumference of the pipe. The jointed pipe line shall be at required levels and alignment. The remainder of the socket is left for the lead caulking. Where the gasket has been tightly held, a jointing ring shall be placed round the barrel against the face of the socket. Molten Lead shall be poured to the remainder of the socket.

The depth of the lead joints for the cast iron pipes shall be 45mm for the pipes upto 100mm dia and 50mm for the pipes beyond 100mm dia respectively.

The joint shall not be covered till the pipe line has been tested under pressure. Rest of pipe line shall be covered so as to prevent the expansion and contraction due to variation in temperature.

Rainwater Pipes

All open terraces shall be drained by rain water down takes.

Rainwater down takes are separate and independent of the soil and waste system and will discharge into the underground storm water drainage system of the complex.

Rainwater in open courtyards shall be collected in catch basins and connected to the Storm Water Drains.

Any dry weather flow from waste appliances, e.g. AHU's pump rooms, waste water sumps shall be connected to sewers after traps and not in the storm water drainage systems.

Balcony / Planter drainage

Wherever required, all balconies, terraces, planters and other frontal landscape areas will be drained by vertical down takes or other type of drainage system shown on the drawings and directed by the Project Manager.

6. TRAPS

6.1 Floor Traps

Floor traps where specified shall be siphon type full before P or S type cast iron having a minimum 50 mm deep seal. The trap and waste pipes when buried below ground shall be set and encased in cement concrete blocks firmly supported on firm ground or when installed on a sunken RCC structural slab. The blocks shall be in 1:2:4 mix (1 cement : 2 coarse sand : 4 stone aggregate 20 mm nominal size).

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.

6.2 Floor Trap Inlet /Hopper

Bath room traps and connection shall ensure free and silent flow of discharging water. Where specified, contractor shall provide a special type of floor inlet fitting fabricated from GI pipe, with one, two or three inlet sockets welded on side to connect the waste pipe. All joint between waste hopper and CI inlet socket shall be drip seal/Lead Caulked. Inlet shall be connected to a CI "P" trap. Floor trap inlet and the traps shall be set in cement concrete blocks where buried in floors without extra charge. Floor trap for the shower cubicle shall suit site and as per the approval of Owner's site representative. All fabricated hopper shall be hot dip galvanized.

6.3 Floor Trap Grating

Floor and urinal traps shall be provided with 100 – 150 mm square or round stainless steel gratings, with frame and rim of approved design and shape or as specified in the schedule of quantities approved by the Owner's site representative.

6.4 Cleanout Plugs

Floor Clean Out Plug

Clean out plug for soil, waste or rain water pipes laid under floors shall be provided near pipe junctions bends, tees, "Y" and on straight runs at such intervals as required as per site conditions. Cleanout plugs shall terminate flush with the floor level. They shall be threaded and provided with key holes for opening. Cleanout plugs shall be cast brass suitable for the pipe dia. With screwed to a GI socket. The socket shall be drip seal joined/ Lead Caulked to the drain pipes.

Cleanout on Drainage Pipes

Cleanout plugs shall be provided on head of each drain and in between at locations indicated on plans or directed by Owner's site representative. Cleanout plugs shall be of size matching the full bore of the pipe but no exceeding 150 mm dia CO plugs on drains of greater diameters shall be 150 mm dia. Fixed with a suitable reducing adapter.

Floor cleanout plugs shall be cast brass.

Cleanouts provided at ceiling level pipe shall be fixed to a CI flanged tail piece. The cleanout doors shall be specially fabricated from light weight galvanized sheets and angles with hinged type doors with fly nuts, gasket etc. as per drawing.

7. PIPE SLEEVES

Pipe sleeves, next larger diameter than pipes shall be provided wherever pipes pass through walls & slabs and annular space filled with fiberglass & finished with retainer rings. 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 pipe shall be closed as the pipe is installed to avoid entrance of foreign matter.

8. PIPE PROTECTION

Cast iron soil and waste pipes under floor in sunken slabs and in wall chases (when cut specially for the pipe) shall be encased in cement concrete 1:2:4 mix (1 cement : 2 coarse sand : 4 stone aggregate of 12 mm size) 10 cm bed and around. When pipes are running well above the structural slabs, the encased pipes shall be supported with suitable cement concrete pillars of required height and size at intervals directed by the Project Manager.

9. CUTTING AND MAKING GOOD

Pipes shall be fixed and tested as building proceeds. The contractor shall provide all necessary holes, cutouts and chases in structural members as building work proceeds. Wherever holes are cut or left originally they shall be made good with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 stone aggregate 20 mm nominal size) or cement mortar 1:2 (1 cement : 2 coarse sand). Cured and the surface restored to original condition.

10. PAINTING

Used paint and coatings that comply with the following limits for VOC content and the following chemical restrictions:

- Non-Flat Paints and Coatings: VOC not more than 150 g/L.
- Anti-Corrosive Coatings VOC not more than 250 g/L.
- Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
- Paints and coatings shall not contain any of the following:

Acrolien
Acrylontrile
Antimony
Benzene
Buty benzyl phthalate
Cadmium
Di (2-ethylheyl) phthalate
Di-n-butyl phthalate
Di-n-octy phthalate
1,2-dichlorobenzene
Diethy phthalate
Dimenthyl phthalate
Ethyl benzene

Soil, waste, vent and rain water pipes in exposed location, in shafts shall be painted with two or more coats of ready mix Low – VOC oil paint to give an even shade. Before painting all dust and extraneous matter shall be removed.

Paint shall be of approved quality and shade. Where directed by the Owner's site representative pipes shall be painted in accordance with approved pipe colour code.

Pipe in chase shall be painted with two coats of bitumen paint, covered with polythene tape and a final coat of bitumen paint. Exposed pipes shall be painted with synthetic enamel paint after removing dust and extraneous matter.

C.I. Soil and waste pipes below ground and covered in cement concrete shall not be painted.

11. TESTING

Testing shall be done in accordance with IS:1172 and IS:5329 except as may be modified herein under.

Entire drainage system shall be tested for water tightness and smoke tightness during and after completion of the installation. No portion of the system shall remain untested. Contractor must have adequate number of expandable rubber bellow plugs, manometers, smoke testing machines, pipe and fitting work tests,

All materials obtained and used on site must have manufacturer's hydraulic test certificate for each batch of

materials used on the site.

Before use at site all CI pipes shall be tested by filling up with water for at least 30 minutes. 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. Pipes with minor sweating may be accepted at the discretion of the Project Manager.

Soil and waste pipes shall be tested in sections after installation, by filling up the stack with water. All openings and connections shall be suitably plugged as approved by the Project Manager. The total head in the stack shall be 4.5 m at the highest point of the section under test. The period of test shall be minimum for 30 minutes or as directed by the Project Manager. If any leakage is visible, the defective part of the work shall be cut out and made good.

On completion of the work the entire installation shall be tested by smoke testing machine. The test shall be conducted after the plumbing fixtures are installed and all traps have water seal or by plugging the outlets with bellow plugs. Apply dense smoke keeping the top of stack open and observe for leakages. Rectify or replace defective sections.

After the installation is fully complete, it should be tested by flushing the toilets, running atleast 20% of all taps simultaneously and ensuring that the entire system is self draining, has no leakages, blockages etc. rectify and replace where required.

A test register shall be maintained and all entries shall be signed and dated by the Contractor and the Project Manager or his representative.

All pipes in wall chase or meant to be encased or burried shall be hydro tested before the chase is plastered or the pipe encased or burried.

12. PIPING MATERIAL

12.1 UPVC Pipes and Fittings

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, free from groovings and other defects. The ends shall be cleanly cut and square with the axis of the pipe. The pipes shall be designed by external diameter.

Fittings

Fittings shall be of the same make as that of pipes, injection moulded and shall conform to Indian Standard.

Laying in Trenches

UPVC pipes shall be laid on cement concrete bed of width 300mm over the outside diameter of pipe, and 100 mm thickness. Fine sand shall be carefully filled around the lower half of the pipes so as to buttress them to the sides of the trench.

The filling shall then be continued to 150mm over the top of the pipe using fine sand, watered and rammed on

both sides of the pipes. The process of filling and ramming with fine hand picked material shall proceed evenly in layers not exceeding 150mm thickness, each layer being watered and consolidated so as to maintain an equal pressure on both sides of the pipe line.

12.2 Cast Iron Class (LA) Pipe:

All drainage line passing under building, floors and roads with heavy traffic shall be Cast Iron Class (LA) Pipe.

Cast Iron Class (LA) pipe shall be such that they could be cut, drilled or machined. Pipe centrifugally cast in unlined water cooled moulds shall be heat treated in order to achieve the necessary mechanical properties and to relieve casting stresses; provide that the specified mechanical properties are satisfied.

Material

Cast iron pipe shall be centrifugally spun cast iron pipes and conforming to IS:1536-1976.

Fittings

Fittings shall be used for Cast Iron Class (LA) Pipes shall conform to IS:1538-1976. Whenever possible junction from branch pipe shall be made by Wyes.

Laying

Fittings used for C.I drainage pipe shall conform to IS:1538-1976. Whenever possible junction from branches pipes shall be made by a Wyes.

All cast iron pipes and fittings shall be jointed with best quality soft pig lead (conforming to IS 782-1966) which shall be free from impurities. In wet trenches joints shall be made from lead wool. Nothing extra will be paid for lead wool joints. Depth of pig lead and weight for joints shall be as given in table below:

Lead caulked Joints with Pig Lead

The approximate depth and weights of Pig Lead for various diameters of C I pipes and specials shall be as follows:

<u>Nominal Size of Pipe</u>	<u>Lead per joint</u>	<u>Depth of Lead Joint</u>
<u>mm</u>	<u>Kg</u>	<u>mm</u>
80	1.8	45
100	2.2	45
125	2.6	45

150	3.4	50
200	5.0	50
250	6.1	50

The spigot of pipe or fittings shall be centred in the adjoining socket by caulking. Sufficient turns of tarred gasket shall be given to leave a depth of 45 mm when the gasket has been caulked tightly home. Joining ring shall be placed round the barrel and against the face of the socket. Molten pig lead shall then be poured to fill the remainder of the socket. This shall then be done in one pouring. The lead shall then be solidly caulked with suitable tools and hammers weighting not less than 2 Kgs.

Drip Seal Joints :

Drip seal PJS-43 (pipe joint sealant) shall be used for joining various diameters of C.I. pipes and specials. This sealant replaces the standard Drip seal caulked joints. The application is by Homogenously mixing the two pack system in cold condition. Drip seal PJS - 43 is the proprietary item of M/s. Vinod Cement Co., Chandigarh.

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S.W. Gully Trap

Gully trap shall be stoneware conforming to IS:651. These shall be sound and free from visible defects such as fire cracks, or hair cracks. The glaze of the traps shall be free from cracks. They shall give a sharp clear note when struck with light hammer. There shall be no broken blisters. Each gully trap shall have one CI grating of square size corresponding to the dimensions of inlet of gully trap. It will also have a water tight CI cover with frame inside dimensions 300 x 300mm the cover weighing not less than 4.5 kg and the frame not less than 2.7kg. The grating cover and frame shall be of good casting and shall have truly square machined seating faces.

Fixing of S.W. Gully Trap

The excavation for gully traps shall be done true to dimensions and levels as indicated on plans or as directed by the Project Manager /Consultant / Architect. The gully traps shall be fixed on cement concrete foundation 65cm square and not less than 10cm thick. The mix for the concrete will be 1:4:8. The jointing of gully outlet to the branch drain shall be done similar to the jointing of S.W. Pipes described earlier. After fixing and testing gully and branch drain, a brick work of specified class in cement mortar 1:5 shall be built with a half brick masonry work round the gully trap from the top of the bed concrete upto ground level. The space between the chamber and trap shall be filled in with cement concrete 1:3:6. The upper portion of the chamber i.e. above the top level of the trap shall be plastered inside the cement mortar 1:3 finish with a floating coat of neat cement. The corners and bottom of the chamber shall be rounded off so as to slope towards the grating.

CI cover with frame 300 x 300 mm (inside) shall then be fixed on the top of the brick masonry with cement concrete 1:2:4 and rendered smooth. The finished top cover shall be so as to prevent the surface water from entering the gully trap.

Measurements

Gully traps shall be measured by the number and rate which shall include all excavation, foundation, concrete, brick masonry, cement plaster inside and outside, C I grating and sealed cover and frame.

13 Making Connections

Contractor shall connect the new sewer line to the existing manhole by cutting the walls benching and restoring them to the original condition. A new channel shall be cut in the benching of the existing manhole for the new connection. Contractor shall remove all sewage and water if encountered in making the connection without additional cost.

A. Civil, Interior Finish Work

S. No.	Description	Approved Makes
1.	Cement (Grey)	ACC/L&T/J.K / BIRLA / Vasvdatta, Ambuja and other ISI marked make
2.	Cement (White)	Birla / J.K.
3.	T.M.T. Steel	SAIL/TATA/RINL/IISCO/ Vizag
4.	Structural steel	SAIL/TATA/JRINL/IISCO/ Vizag
5.	Ready Mixed Concrete	ACC/L&T /Ultratech/ Lafarge /RMC / Godrej
6.	Precast Concrete Products	Siporex Ind.; B.G. Shirke & Co.; Supreme Concrete Minato Blocks-
7.	Antitermite Treatment	Chemical and agency - Approved by IPCA.
8.	Stainless Steel	Jindal/SAIL/Golden
9.	Ceramic Tiles	Nitco /Kajaria /Euro
10.	Vitrified Tiles	R.A.K./ Kajaria/Euro
11.	Terrazzo & Cement Tiles	NITCO; Automatic Tiles; NIMCO; GICO Tiles, Kolkata; National Tiles, Delhi; Alankar Tiles Pvt. Ltd., Indore; Super Tiles; Shirwadkar Tiles; Kirti Tiles, Pune
12.	Kotah Stone	As approved by Architect
13.	Telephone Black Granite	As approved by Architect
14.	ABD Paint	Asian Paints / Nerolac / ICI
15.	Texture Paint - External	Nitco
16.	Enamel Paint	Asian Paints / ICI

17	Glass for Window	Saint Gobain / Modi / Ashi
18	Aluminium Sections For Doors, Windows & Wall Spans	Indal; Jindal; Hindalco; Geeta; Bengal Rolling Shutters-Kolkata
19	Anodized aluminum fittings for doors/windows	Crown/ALANS/Classic/Bharat/ Argent
20	Laminate	Formica/Greenlam/Merinolam
21	Flush Doors	Duraboard /Kit ply / Merino Ply / Shreeji Doors, Anand Wood Craft and other ISI marked make
22	Steel Doors, Windows & Pressed	Sen Harvic; AGEW; Hopes Metal; Multiwyn; R.L. Vala & Sons; Modern
S. No.	Description	Approved Makes
23	PVC / FRP Doors & Frames	Deep Doors; Fibroplast-Latur
24	Polycarbonate Sheet	Danpalon / Alcox / Polygal / Sabic and other ISI marked make
25	Mild Steel Butt Hinges/Piano Hinges	Jolly/Garg/AMIT/ASI Supreme
26	Water Proof cement paint	Snowcem/Asian Paints/Berger
27	Nuts Bolts /Screws	Kundan/Puja/Atul
28	Mineral Fiber Ceiling	Lloyd/Nittobo/ Armstrong
29	Welding Rods	ADOR/ Cosmos/ Esab/ Super Bond (S)
30	Fastner	Fisher/ Hilti
31	A.C. Sheet :	Asbestos Cement Ltd. (Everest); Chaminar.
32.	Expansion Joint & Tarfelt Waterproofing	Shalitex; Tiki Tar Industries; STP Ltd., (Shalimar Tar Products); Lloyd Insulation (I).
33	Integral Water Proofing Compound	Accoproof; Cico; Impermo; Pidilite; Roff.; Mc Bouchmie; Fosroc.

Note : Preference will be given to use maximum number of available products/ accessories from the selected manufacturer for projects. Any other Make can also be used with prior approval of Engineer-in-Charge

C. Plumbing Work

S. No.	Description	Approved Makes
1	W.C.	Parryware / Cera / Neycer
2	WC Connectors	Prince / Supreme
3	Urinal	Parryware / Cera / Neycer
4	Flush Valve	Jaguar
5	Toilet Paper Holder	Jaguar
8	Wash Basin	Parryware / Cera / Neycer
9	Jet Spray	Jaguar
10	Pillar Tap	Jaguar
11	Bottle Trap	Jaguar
12	Urinal Sensors	Jaquar
13	Auto Urinal Flush System	AOS Auto Robo Flushing System / Askon Engineers / Euronics / Toshi / UTEC System
14	CP Brass Fittings	Ess-Ess / Gem / Jaguar / Crabtree / Parko / Kingston
15	Floor Drain Fixture, Rain Water Outlets	ACO / GMGR / Geberit / Viega
16	C.P. Grating for Floor Trap	Chilly / GMGR / Neer
17	Cast Iron Pipes & Fittings Manhole covers and frames	
	a. As per IS:3989 (Pipes & Fittings)	NECO / Kapilash
	b. As per IS:1729 (Manhole covers and frames)	NECO / SRIF / Raj Iron Foundry Agra
	c. As per IS:1536 (CIClass LA Pipes)	Electro Steel Calcutta / IISCO / NECO / Kesoram Calcutta
	d. D.I. Manhole Covers & Frames	Kartar valves & fittings / NECO
	e. CILA fittings	Kartar valves & fittings
	f. Suspended Manhole and Gully	Patel Pattern
18	Drip Seal	ACQUA Bond / Vinod Cement Co. Chandigarh
19	GI / M.S Pipes (IS : 1239 and IS : 3589)	Jindal / Tata Steel / Surya / AST Pipes / Hitech Swastik
20	GI pipes fittings	Jain Sons / Kirti / Unik / Zoloto M
21	GI pipe sealent	Henkel - LOCTITE 55
S. No.	Description	Approved Makes

22	Pipe clamp & supports	Chilly / Euroclamp / Easyflex / Gripple
23	D. I. Pipes	Electro Steel / Jindal / Lanco Kalahasthi
24	Copper Pipes & Fitting	Flowflex – Rajco / Viega – Max flow
25	UPVC Pipe	Astral / Finolex / Prince / Supreme
26	CPVC pipes	Ajay / Ashirwad / Astral
27	HDPE Pipe	Duraline / Kimplas / Reliance
28	PB Pipe	Flexalen – Thermaflex / George Fisher
29	RCC Pipe	K K / Local & Approved Pranali
30	Stoneware Pipes, Gully Traps	Perfect Potteries, JABALPUR / Rajura
31	SS Pipes	Remi / Viega
32	GM / Forged Brass Ball Valves	CIM / Danfoss / Jayhiwa / Kitz / RB / Sant / Tiemme / TSB / Zoloto
33	Sluice Valves	IVC / Kirloskar
34	Butterfly Valve	Audco / Danfoss / Honeywell / Jayhiwa
35	Check Valve – WaferType	Advance / Danfoss / Kirloskar / Jayhiwa
36	Check Valve – Dual Plate	Advance / SKS
37	Check Valve Forged Screwed	CIM / Leader / RB / Sant / TBS / Zoloto
38	Pressure Reducing Valve	Fouress / Honeywell / RB / SKS / OR / Zoloto
39	Solenoid Valve	Avcon / Danfoss
40	Thermostatic valve	Oventrop
41	Air Release Valve	Arco / CIM / Fouress OR / SKS
42	Ball Float Valve	Esseti / HBD / Zoloto
43	NRV – Ball type – Sewage application	Danfoss / Silverspark
44	Y Strainer CI	Emerald / Sant / SKS / Zoloto
45	Self-Priming Pumps	Johnson / Kirloskar
46	Drinking Water Cooler	Blue Star / Usha / Voltas
47	Anti Vibration Mounting & Flexible Connections	Cori / Dunlop / Flexionics / Kanwal Industrial Corporation / Resistoflex / VIMPA
48	Pressure Gauge	Emerald / Fiebig / H Guru / Wika
S. No.	Description	Approved Makes
49	Water Meter (Mechanical Type)	Actaris / Capstan / Kaycee / Kranti / Kent

50	Electronic Flow Meter	Krohne (Forbes Marshall) / Rockwin
51	Level Controller & Indicator (Water)	Auto Pump / Cirrus Engineering / Elegent Controls / Technika / Techtrol
52	Paints	Asian Paints / Berger / ICI / Shalimar Paints
53	MH / Water Tank Plastic Steps	KGM / Patel / Pranali Industries
54	Fastner	Fisher / Hilti
55	Fire Sealant	Birla 3 M / Hilti / Promat / STI (USA)/ Fire master
56	Manhole (Prefabricated)	OK Play / Supreme
57	Temperature Sensor/ Gauge	Forbes Marshall / Danfoss / Wika

Note :

1. Make of Electrical Accessories for Plumbing work to be followed as specified in the List of Approved Make of Electrical Work.

~~**2. Preference will be given to use maximum number of available products/ accessories from the selected manufacturer for projects. Any other Make can also be used with prior approval of Engineer in Charge.**~~

APPENDIX "B"

THEORETICAL STANDARD REQUIREMENT OF CEMENT FOR VARIOUS ITEMS OF WORK

S.NO.	BRIEF DESCRIPTION OF ITEM	UNIT	CEMENT IN BAGS
1	Cement Concrete 1:5:10	Cum	2.60
2	Cement Concrete 1:4:8	Cum	3.40
3	Cement Concrete 1:3:6	Cum.	4.40*
4	Cement Concrete 1:2:4	Cum	6.40*
5	Reinforced Cement Concrete 1:2:4	Cum	6.40*
6	Reinforced Cement Concrete 1:1.5:3	Cum.	8.00*
7	Reinforced Cement Concrete 1:1:2	Cum	12.20*
* Note : For controlled concrete items like M-10, M-15, M-20, M-25 etc., the consumption of cement will have to be assessed by the Engr-in-Charge on the basis of design mixes approved for individual work.			
8	Brick masonry in C.M. 1:4	Cum.	1.90
9	Brick masonry in C.M. 1:6	Cum	1.25
10	Half brick masonry in C.M. 1:4 with RCC 1:2:4 stiffeners	Sqm.	0.27
11	Half brick masonry in C.M. 1:4	Sqm	0.21
12.(a)	R.R. Masonry in C.M. 1:6	Cum.	1.65
12.(b)	C.R. Masonry in C.M. 1:6	Cum.	1.56
13.	IPS Flooring (C.C. 1:2:4, finished smooth)		
(a)	30mm. thick	Sqm	0.23
(b)	40mm. thick (smooth/broom finish)	Sqm	0.30
(c)	50mm. thick	Sqm	0.36
(+)	20mm. thick skirting/dado in cm.1 :3	Sqm	0.30
14	Hardonate flooring -50mm. thick (C.C. 1:2:4, finished smooth)	Sqm.	0.41
15	Kota stone:		
(a)	Flooring (with lime mortar bedding pointed with matching cement slurry)	Sqm	0.13
(b)	Skirting with 20mm. thick C.M. 1:3 backing	Sqm	0.27
(c)	Coping	Sqm.	0.13
16	Terrazzo tile :		
(a)	Flooring (with lime mortar bedding & pointed with cement slurry).	Sqm	0.18
(b)	Skirting with 20mm. thick C.M. 1:3	Sqm	0.28
(c)	Treads, hydraulically pressed with C.M. 1:3 bedding	Sqm.	0.37
(d)	Treads in one piece	Sqm	0.28
(e)	Risers, hydraulically pressed with C.M. 1:3 backing	Sqm.	0.28
(f)	Risers in one piece	Sqm	0.23
17.	Cast-in-situ terrazzo		

(a)	Flooring, 40mm. th. (28mm C.C. 1:2:4 + 12mm with marble chips & powder)	Sqm	0.26
S.NO.	BRIEF DESCRIPTION OF ITEM	UNIT	CEMENT IN BAGS
(b)	Skirting, 20mm. thick (12mm CM1:3+ 8mm marble chips with cement & marble powder)	Sqm	0.25
18.	White glazed tile flooring and dado over 20mm. C.M.1 :3 bedding	Sqm	0.31
19.	Cement tile :		
(a)	flooring (lime mortar bedding).	Sqm	0.18
(b)	skirting with 20mm thick C.M. 1:3	Sqm	0.28
20	Plaster skirting, 20mm. thick in C.M.1 :3.	Sqm	0.30
21.	Cuddapah stone kitchen platform over 20mm. thick C.M. 1:4	Sqm	0.30
22	Cuddapah stone window sill over 20mm. thick C.M. 1:4	Sqm	0.27
23	Fixing hold fasts in CC 1:3:6 of size 300x100x150 mm. for doors & windows	100 Nos	2.20
24.	Cement Plaster in C.M. 1:4/1:5 with neeru finish		
(A)	Cement Mortar 1:4		
(a)	12 mm. thick	Sqm	0.11
(b)	15 mm. thick	Sqm	0.13
(c)	20 mm. thick.	Sqm	0.17
(B)	Cement Mortar 1:5		
(a)	12 mm. thick	Sqm	0.09
(b)	15 mm. thick	Sqm	0.11
(c)	20 mm. thick	Sqm	0.14
25.	Cement plaster in C.M. 1:4 in two coats with neat cement punning		
a)	15 mm. thick.10mm + 5mm (for ceiling	Sqm	0.18
(b)	20 mm. thick.15mm + 5mm (for internal walls	Sqm	0.22
26	Cement plaster in C.M. 1:4, 20mm. thick rough finish (for external brick/concrete surfaces)	Sqm.	0.17
27.	Sand faced plaster, 20mm. thick (12mm C.M. 1:4 + 8 mm C.M. 1:3)	Sqm	0.21
28.	Rough cast plaster, 25 mm thick (12mm C.M. 1:4 + 13 mm C.M.1 :3)	Sqm	0.27
(+)	(+) 10 mm wide & 18 mm thick plain or moulded cement mortar band in CM 1:4	100 R.M	0.152
29.	Cement plaster in C.M. 1:3 with water proofing compound finished smooth with neat cement		
(a)	12mm. thick	Sqm	0.19
(b)	20mm. thick	Sqm	0.27
30.	Cement pointing in C.M. 1:3		
(a)	Ruled pointing (groove pointing)	Sqm	0.02
(b)	Raised & cut pointing	Sqm	0.04

S.NO.	BRIEF DESCRIPTION OF ITEM	UNIT	CEMENT IN BAGS
31.	Cement based waterproofing works (Through the agency approved by the Department)		
(a)	Terrace type average 115 mm. thick	Sqm	0.45
(b)	Basement type (Box type).	Sqm	0.70
(c)	Basement type (surface).	Sqm	0.60
(d)	In sunken floor of toilets, chajjas, parapets	Sqm	0.30
(e)	Brickbat coba in toilets, extra in roof terrace	Cum	3.00
(f)	O.H. Water tanks	Sqm	0.50
(g)	Expansion joints.	R.M	0.50
32.	Damp proof course in C.C. 1:2:4		
(a)	25mm. thick	Sqm	0.16
(b)	38mm. thick	Sqm	0.24
33.	Laying R.C.C. spun pipes in C.M. 1:1/1:2		
(a)	100 mm dia.	10m	0.10
(b)	150 mm dia	10m	0.12
(c)	250 mm dia.	10m	0.18
(d)	300 mm dia	10m	0.22
(e)	450 mm dia	10m	0.48
(f)	600 mm dia	10m	0.64
34.	Cement mortar 1:4 screed		
(a)	20mm. thick	Sqm	0.16
(b)	50mm. thick	Sqm	0.38
35.	Chain link fencing/barbed wire fencing - C.C. 1:2:4 pockets of 450x450x600 mm.:		
(a)	Angle iron posts	m	0.21
(b)	Cement Concrete 1:2:4 posts	m	0.37
36	Kerb stone in CC 1:3:6 of size 125x375mm	m.	0.21
37.	Shahabad stone paving, pointed in C.M.1 :3, 15x10 mm groove.	Sqm	0.02
38	Pointing & grouting stone pitching in C.M. 1:3	Sqm	0.14

APPENDIX – “C-1”

**CONSUMPTION OF PAINT FOR SOME PAINTING ITEMS :
(PARA 47.7.1 OF PAINTING)**

Coverage Achieved Per Litre or Per Kg of Paint / Material				
Sl. No.	Name of Paint	Area coverage For one coat (Old work)	Area coverage For two coats (New Work)	Area coverage Per addl. coat
1	Synthetic enamel paint	1 4m ² per Ltr.	8.5m ² per Ltr.	1 8m ² per Ltr.
2	Plastic emulsion paint	14m ² per Ltr.	8.5m ² per Ltr.	18m ² per Ltr.
3	Oil Bound distemper	10m ² per Ltr.	6.0m ² per Ltr.	12 m ² per Ltr.
4	Dry Distemper	10m ² per kg	6.5 m ² per kg	12 m ² per kg
5	White wash	5m ² /kg of lime	3.5m ² / kg of lime	10 m ² /kg of lime
	Note : Following things to be added in lime (i) Adhesive (DDL/SDL) – 5% of lime (ii) Neel (Blue) – 3 gm per kg of lime (iii) Water – 5 kg of water per kg of lime			
6	Cement based paint	4.5 m ² per kg	2 m ² per kg	6 m ² per kg
7	Aluminium paint	20m ² per Ltr.	12.5 m ² / Ltr.	28 m ² per Ltr.
8	Bitumen Paint/Black Japan	14 m ² per Ltr.	14 m ² per Ltr.	28 m ² per Ltr.
9	Neeru (or lime punning with slacked lime) over plaster	0.5 m ² per kg of slacked lime		
10	Red oxide metal primer	16 m ² per Ltr.		
11	Cement primer	12 m ² per Ltr.		
12	Wood primer	13 m ² per Ltr.		
13	Wax polishing of new wood work with ready made polish	20m ² per kg	20m ² per kg	20m ² per kg
14	French or spirit polish	10.5 m ² / Ltr.		
15	Varnish	14 m ² per Ltr.	8.5 m ² per Ltr.	18 m ² per Ltr.
16	Requirement of paint per coat in Structural steel work on tonnage basis. (i) Truss and Lattice girder work – 4.5 litres per tonne. (ii) Plane Beam/plane girder work – 2.5 litres per tonne			

APPENDIX – “C-2”
CO-EFFICIENT FOR EQUIVALENT PLAIN AREAS FOR PAINTING ITEMS :
(PARA REFERRED TO CHAPTER 47 - PAINTING)

SN	DESCRIPTION OF WORK	MULTIPLYING CO-EFFICIENTS
I. WOOD WORK : DOORS, WINDOWS ETC.		
1	Panelled or framed and braced doors, windows etc.	
2	Ledged & battened or ledged, battened & braced doors, windows etc.	1.30 (for each side)
3	Flush doors etc	1 .20 (for each side)
4	Part panelled and part glazed or gauzed doors, windows etc.	1.00 (for each side)
5	Fully glazed or gauzed doors, windows etc.	0.80 (for each side)
6	Fully venetioned or louvered doors, windows etc.	1.80 (for each side)
7	Trellis (or Jaffri) work one way or two way.	2.00 (for painting all over)
8	Carved or enriched work:	2.00 (for each side)
9	Weather boarding:	1.20 (for each side)
10	Wood shingle roofing:	1.10 (for each side)
11	Boarding with cover fillets and match boarding.	1.05 (for each side)
12	Tile and slate battening:	0.80 (for painting all over)
II. STEEL WORK: DOORS, WINDOWS ETC.		
13	Plain sheeted steel door or windows:	1.10 (for each side)
14	Fully glazed or gauzed steel doors and windows	0.50 (for each side)
15	Partly panelled and partly gauzed or glazed doors and windows.	0.80 (for each side)
16	Corrugated sheeted steel doors or windows.	1.25 (for each side)
17	Collapsible gates	1.50 (for painting all over)
18	Rolling shutters of inter locked laths.	1.10 (for each side)
III. GENERAL WORKS :		
19	Expanded metal, hard drawn steel wire fabric of approved quality, grill work and gratings in guard bars, balusters, railings, partitions and m.s. bars in window frames.	1.00 (for painting all over)
20	Open palisade fencing and gates including standards, braces, rails, stays etc. in timber or steel.	1.00 (for painting all over)
NOTE: The height shall be taken from the bottom of the lowest rail, if the palisades do not go below it (or from the lower end of palisades, if they project below the lowest rail) upto the top of palisades but not upto the top of standards, if they are higher than the palisades.		
SN	DESCRIPTION OF WORK	MULTIPLYING CO-EFFICIENTS
21	Corrugated iron sheeting in roofs, side cladding etc.	1.14 (for each side)
22	A.C. Corrugated sheeting in roofs, side cladding etc.	1.20 (for each side)

23	A.C. Semi-corrugated sheeting in roofs, side cladding etc. or Nainital pattern using plain sheets.	1.10 (for each side)
24	Wire gauze shutters including painting of wire gauze.	1 .00 (for each side).

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