

TECHNICAL SPECIFICATIONS
FOR
FIRE

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GENERAL TECHNICAL SPECIFICATIONS

1. In the specifications "as directed" / "approved" shall be taken to mean "as directed" / "approved by the Engineer-in-Charge".
2. Wherever a reference to any Indian Standard appears in the specifications, it shall be taken to mean as a reference to the latest edition of the same in force on the date of agreement.
3. In "Mode of Measurement" in the specifications wherever a dispute arises in the absence of specific mention of a particular point of aspect the provisions on these particular points, or aspects in the relevant Indian Standards shall be referred to
4. All measurements and computations, unless otherwise specified, shall be carried out nearest to the following limits:
 - (i) Length, width and depth (height) 0.01 meter
 - (ii) Areas 0.01 Sq. Mt.
 - (iii) Cubic Contents 0.01 Cu.Mt.

In recording dimensions of work the sequence of length, width and height (depth) or thickness shall be followed.
5. The distance which constitutes lead shall be determined along the shortest practical route and note necessarily the route actually taken the decision of the Engineer-in-charge in this regard shall be taken as final.
6. Where no lead is specific, it shall mean "all leads"
7. Lift shall be measured from plinth level.
8. Up to "floor two level" means actual height of floor (Maxi 4 M) up to 3 Mt. above plinth level.
9. Definite particulars covered in the items of work, though not mentioned or elucidated in it specifications shall be deemed to be included therein.
10. Reference to specifications of materials as made in the detailed specification of the items of works is in the form of a designation containing them number of the specification of the material and prefix 'M' e.g. 'M-5',
11. Approval to the samples of various materials given by the Engineer-in-charge shall not absolve the contractor from the responsibility of replacing defective material brought on site or materials used in the work found defective at a later date. The contractor shall have no claim to any payment or compensation whatsoever on account of any such materials being rejected by the Engineer-in-charge.
12. The contract rate of the item of work shall be for the work completed in all aspects.
13. No collection of materials shall be made before it is got approved from the Engineer-in charge.

14. Collection of approved materials shall be done at site of work in a systematic manner. Materials shall be stored in such a manner as to prevent damage, deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness for the work.
15. Materials, if and when rejected by the Engineer-in-charge, shall be immediately removed from the site of work.
16. No materials shall be stored prior to, during and after execution of a structure in such a way as to cause or lead to damage or overloading of the various components of the structure.
17. All works shall be carried out in a workmanlike manner as per the best techniques for the particular item.
18. All tools, templates, machinery and equipment for correct execution of the work as well as for checking lines, levels, alignment of the works during execution shall kept in sufficient numbers and in good working condition on the site of the work.
19. The mode, procedure and manner of execution shall be such that it does not cause damage or over-loading of the various components of the structure during execution or after completion of the structure.
20. Special modes of construction not adopted in general Engineering practice if proposed to be adopted by the Contractor, shall be considered only if the contractor provides satisfactory evidence that such special mode of construction is safe, sound and helps in speedy construction and Completion of work to the required strength and quality. Acceptance of the same by the Engineer-in-Charge shall not, however absolve the contractor of the responsibility of any adverse effects and consequences of adopting the same in the course of execution of completion of the work.
21. All installations pertaining to water supply and fixtures there of as well as drainage lines and sanitary fittings shall be deemed to be completed only after giving satisfactory tests by the contractor.
22. The contractor shall be responsible for observing the rules and regulations imposed under the "Minor Minerals Act", and such of the laws and rules prescribed by Government from to time.
23. All necessary safety measures and precautions {including those laid down in the various relevant Indian Standards) shall be taken to ensure to ensure the safety of men. Materials and machinery on the works as also of the work itself.
24. The testing charges of all materials shall be borne by the Contractor.
25. Approval to any of the executed items for the work does not in any relieve the contractor of his responsibility for the correctness, soundness and strength of the structure as per the drawings and specifications.

SPECIFICATIONS OF MATERIALS

M-1 Water

1.1 Water shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil and injurious alkalis, salts, organic matter and other deleterious material which will either weaken the mortar or concrete or cause efflorescence or attack the steel in R.C.C: Container for transport, storage and handling of water shall be clean. Water shall conform to the standards specified in I.S. 456-2000.

1.2 If required by Engineer-in-charge it shall be tested by comparison with distilled water. Comparison shall be made by means of standard cement tests for soundness, time of setting and mortar strength as specified in I.S. 269-1976. Any indication of unsoundness, change in time of setting by 30 minutes or more or decrease of more than 10 percent in strength of mortar prepared with water sample when compared with the results obtained with mortar prepared with distilled water shall be sufficient cause for rejection of water under test.

1.3 Water for curing mortar, concrete or masonry should not be too acidic or too alkaline. It shall be free of elements which significantly affect the hydration relation or otherwise interfere with the hardening of concrete during curing or those which produce, objectionable stains or other unsightly deposits on concrete or mortar surfaces.

1.4 Hard and bitter water shall not be used for curing.

1.5 Potable water will be generally found suitable for curing mortar or concrete.

M-2. Lime

2.1 Lime shall be hydraulic lime as per I.S. 712-1973. Necessary test shall be carried out as per I.S. 6,932 (Parts I to X) 1973.

2.2 The following field tests for limes are to be carried out:

(1) A very rough idea can be formed about the type of lime by its visual examination i.e. fat lime bears pure white color, lime in form of porous lumps of dirty white color indicates quick lime, and solid lumps are the unburnt lime stone.

(2) Acid tests for determining the carbonate content in lime. Excessive amount of impurities and rough determination of class of lime.

2.3 Storage shall comply with I.S. 712-1973. The slaked lime, if stored, shall be kept in a weather proof and damp-proof shed with impervious-floor and sides to protect it against rain, moisture, weather and extraneous materials mixing with it. All lime that has been damaged in any way shall be rejected and all rejected materials shall be removed from site of work.

2.4 Field testing shall be done according to I.S. 1624- 1974 to show the acceptability of materials.

M-3. Cement

3.1 Cement shall be ordinary Portland slag cement as per I.S. 269-1976 or Portland slag cement as per I.S. 455-1976.

M-4. White Cement

4.1 The white cement shall conform to I.S., 80412"-E 1978.

M-5. Coloured Cement

5.1 Coloured cement shall be with white or gray Portland cement as specified in the item of the work.

5.2 The pigments used for coloured cement shall be of approved quality-and shall not exceed 10% of cement used in the Mix, The mixture of pigment shall be properly grounded to have a uniform color and shade. The pigments shall have such properties to provide-for durability under exposure to sunlight and weather.

5.3 The pigment shall have the property such that it is neither affected by the cement nor detrimental to it.

M-6. Sand

6.1 Sand shall be natural sand, clean, well graded, hard strong durable and gritty particle free from injurious-amounts of dust clay, kankar nodules, soft or flaky particles Shale, alkali, salts-organic matter, loam, mica or other deleterious substance and shall be got approved, from the Engineer-in-charge. The sand shall not contain more than 8 percent of silt as determined by field test. If necessary the sand shall be washed to make it clean.

6.2 Coarse Sand :

The fineness, modulus of coarse sand shall not be less than 2.5 and shall not exceed 3.00.

The sieve analysis of coarse shall be as under:

I.S. Sieve Designation	Percentage by Weight Passing I.S. Sieve	Percentage by Weight Passing sieve
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4.75 mm	100 600 Micron	30-100
2.36 mm.	90 to 100 300 Micron	5-70
1.18 mm.	70-100 150 Micron	0-50
6.3. Fine Sand		

6.3 The fineness modulus shall not exceed 1.0. The sieve analysis of fine sand shall be as under :

I.S Sieve Designation	Percentage by weight Passing I.S. Sieve Designation through	Percentage by Weight Passing through
4.75 mm.	100 600 Micron	40-85
2.36 mm	100 300 Micron	5-50
1.18 mm	70 - 100 150 Micron	0-10

M-7. Stone Dust

7.1. This shall be obtained from crushing hard black trap or equivalent.. It shall not contain- more than 8% of silt as, determined by field test with measuring cylinder. The method of determining silt contents by field test is given as under:

7.2. A sample of stone dust to be tested shall be placed without drying in 200mm. measuring cylinder. The quantity of. The sample shall be such that it fills the cylinder upto 100 mm. mark. The clean water shall be added upto 150 mm. mark. The mixture shall be stirred vigorously and the content allowed to settle for 3 hours.

7.3 The height of silt visible as settled layer above the stone dust shall be expressed as percentage of the height of the stone dust below. The stone dust containing more than 8% silt shall be washed so as to bring the silt content within the allowable limit.

7.4 The fineness modulus of stone dust shall not be less than 1.80.

M-8 Stone Grit

8.1 Grit shall consist of crushed or broken stone and be hard strong, dense, durable, clean, of proper gradation and free from skin or coating likely to prevent adhesion of mortar Grit shall generally be cubical in shape and as far as possible flaky elongated pieces shall be avoided. It shall generally comply with the provisions of I.S. 383-1970. Unless special stone of particular quarries is mentioned, grit shall be obtained from the best black trap or equivalent hard stone as approved by the Engineer-in-charge. The grit shall have no deleterious reaction with cement.

8.2 The grit shall conform to the following gradation as per sieve analysis :

I.S Sieve Designation	Percentage by weight Passing through	I.S. Sieve Designation	Percentage by Weight \Passing through
12.50 mm.	100%	4.75 mm	0-20%
10.00 mm	85-100%	2.36 mm.	0-25%

8.3. The crushing strength of grit will be such as to allow the concrete in which it is used to build up the specified strength of concrete.

8.4. The necessary tests for grit-shall carried out as per the requirements of I.S. 2386 (Parts I to VII) 1963, as per instructions of the Engineer-in-charge. The necessity of test will be decided by the Engineer-in-charge.

M-9 Cinder:

9.1 Cinder is well burnt furnace residue which has- been fused or sintered into lumps of varying sizes. .

9.2. Cinder aggregates shall be well burnt furnace residue obtained from furnace using coal fuel only. It shall be sound clean free from clay, dirt, ash or other deleterious matter.

9.3. the average grading for cinder aggregates shall be as mentioned below :

I.S Sieve Designation	Percentage Passing	I.S. Sieve Designation	Percentage Passing
20 mm.	100	4.75 mm	70
10 mm	86	2.36 mm.	52

M.10. Lime Mortar

10.1 Lime shall conform to Specification M-2. Water shall conform to specification M-1.

10.2 Sand shall conform to specification M-6.

10.3 Proportion of Mix :

10.2.1 Mortar shall consist of such proportions of slaked lime and sand as may be specified in the item. The slaked lime and sand be measured by volume.

10.4 Preparation of mortar :

10.3.1 Lime mortar shall be prepared by wet process as per I.S. 1625-1971. Power driven mill shall be used for preparation of

Lime mortar. The slaked lime shall be placed in the mill in an-even layer .and ground for .the 180 revolution's with a

Sufficient water. Water shall be added as required during grinding (care being taken not to add more water) that will bring the

Mixed material to-a consistency-of stiff paste. Thoroughly wetted sand shall then be added evenly and the mixture ground for another 180 revolutions.

10.5 Storage:

10.5.1. Mortar shall always be kept damp, protected from sun and rain till used up, covering it by tarpaulin or open sheds.

10.6 Use :

10.6.1. All mortar shall be used as soon as possible after grinding. It should be used off the day on which it is prepared. But in no case mortar made earlier than 36 hours shall be permitted for use.

M-11 Cement Mortar:

11.1. Water shall conform to specification M-1. Cement shall conform to specification M-3. Sand shall conform to M-6.

11.2. Proportion of Mix :

1-1.2.1. Cement and sand shall be mixed to specified proportion, sand being measured by measuring boxes. The proportion of cement will be by volume on the basis of 50 Kg. /Bag of cement being equal to 0.0342 Cu.m. The mortar may be hand mixed or machine mixed as directed.

11.3. Preparation of mortar:

11.3.1 In hand mixed mortar cement and sand in the specified proportions shall be thoroughly mixed dry on a clean impervious platform by turning over at least 6 times or more till a homogenous mixture of uniform color is obtained. Mixing platform shall be so arranged that no deleterious extraneous material shall get mixed with mortar-or mortar shall flow out. While mixing, the water shall be gradually added and thoroughly-mixed to form a stiff plastic mass of uniform color so that each particle of sand shall be completely covered with a film of wet cement. The water cement ratio shall be adopted as directed.

11.3.2 The mortar so prepared shall be used within 30 minutes of adding water. .Only such quantity of mortar shall be prepared as can be used within 30 minutes.

M-12. Stone Coares Aggregate for Nominal Mix Concrete

12.1 Coarse aggregate shall be machine crushed stone of black trap or equivalent and be hard, strong, dense, durable, clean and free from skin and coating likely to prevent proper adhesion of mortar.

12.2 The aggregate shall generally be cubical in shape. Unless special stones of particular quarries are mentioned aggregates shall be machine crushed from the best black trap or equivalent hard stone as approved. Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain-cement concrete and ordinary reinforced cement concrete shall generally be as per the table given below. "However in case of reinforced cement concrete the maximum limit may be restricted to 6 mm. less than the minimum lateral clear distance between bars or 6 mm. less

than the cover, whichever is smaller.

TABLE

I.S. Sieve Designation	Percentage passing for single sized aggregates of Nominal size.			I.S. Sieve Designation	Percentage passing for single sized aggregates of Nominal size.		
	40 mm	20mm	16 mm		40mm	20mm	16mm
80 mm.	—	—	—	12.5 mm.	—	—	—
63 mm.	100	—	—	10 mm.	0.5	0.02	0.30
40 mm.	85-100	100	—	4.75 mm.	—	0.5	0.5
20 mm.	0-20	85-100	100	2.35mm	—	—	—
16 mm.	—	—	85-100				

Note: This percentage may be varied somewhat by Engineer-in-charge when considered necessary for obtaining better density and strength of concrete.

12.3 The grading test shall be taken in the beginning and at the change of source of materials. The necessary test indicated in

I.S. 383-1970 and I.S. 456-2000 shall have to be carried out to ensure the acceptability. The aggregates shall be stored separately and handled in such a manner as to prevent the intermixing of different aggregates, If the aggregates are covered with dust they shall be washed with water to make them clean.

M-13. Blak Trap or Equivalent Hard Stone Coares.

13.1. Aggregate for Design Mix Concrete: Course aggregate shall be of machine crushed stone of black trap or equivalent hard stone and be hard strong dense, durable clean and free from skin and coating likely to prevent proper adhesion of mortar.

13.2. The aggregates shall generally be cubical in shape. Unless special stones of particular quarries are mentioned, aggregate shall be machine crushed from the best, black trap or equivalent hard stones as approved. Aggregate shall have no deleterious reaction with cement.

13.3. The necessary tests indicated in I.S. 383-1970 and I.S. 456-2000 shall have to be carried out to. Ensure the acceptability of the material.

13.4. If aggregate is covered with dust it shall be washed with water to make it clean..

M-14. Brick Bats Aggregate

14.1. Brick bat aggregate shall be broken from well burnt or slightly over burnt and dense brick. It shall be homogeneous in texture roughly cubical in shape, clean and free from dirt of any other foreign material. The brick bats shall be of 40 mm. to 50 mm. size unless otherwise specified in the item. The under burnt or over burnt brick bats shall not be allowed.

14.2. The brick' bats shall be measured by volume by suitable boxes or as directed.

M-15. Brick

15.1. The bricks shall be hand or machine moulded and made from suitable soils and kiln-burnt. They shall be free from iron crack and nodules of free lime. They shall have smooth rectangular faces with sharp corners and shall be of uniform color.

The bricks shall be moulded with a frog of 100mm. x 40 mm. and 10mm. to 20 mm. deep on one of its flat sides. The bricks shall not break when thrown from a height of 600 mm.

15.2. The size of modular bricks shall be 190 mm. x 90 mm. x 90 mm.

15.3. The size of the conventional bricks shall be as under :

(9" x 4 3/8 "X2 3/4 ") 225 x 110 x 75 mm.

15.4. Only bricks of one standard size shall be used on one work. The following tolerances shall be permitted in the conventional size adopted in a particular work.

Length + 1/8 "(3.0 mm.) Width: $\pm 1/16$ " (1.50 mm.) Height. + 1/6" (1.50 mm.)

15.5. The crushing strength of the bricks shall not be less than 35 Kg./Sq.Cm. The average water absorption shall not be more than 20 percent by weight. Necessary tests for crushing strength and water absorption etc. shall be carried out as per I.S. 3495 (Part-I to IV) 1976.

M-16 Stone

16.1. The stone shall be of the specified variety such as Granite/Trap Stone/Quartzite or any other type of good hard stones.

The stones shall be obtained only from the approved quarry and shall be hard, sound, durable and free from defects like cavities, cracks, sand holes, flaws, injurious veins, patches of loose or soft materials etc. and weathered portions and other structural defects or

imperfections tending to affect their soundness and strength. The stone with round surface shall not be used. The percentage of water absorption shall not be more than 5% of dry weight, when tested in accordance, with I. S. 1134- 1974. The minimum crushing strength of the stone shall be 200 Kg. /Sq.Cm. unless otherwise specified.

16.2. The samples of the stone to be used shall be got approved before the work is started.

16.3. The Khanki facing stone shall be dressed by chisel as specified in the item for khanki facing in required shape and size. The face of stone shall be so dressed that the bushing on the exposed face shall not project by more than 40 mm. from the general wall surface and on face to be plastered it shall not project by more than 19 mm. nor shall it have depressions more than 10 mm. from the average wall surface.

M-17. Laterite stone

17.1 Laterite stone shall be obtained from the approved quarry. It shall be compacted in texture, sound, durable and free from soft patches. It shall have a minimum crushing strength of 100 Kg. /Sq.Cm. in its dry condition. It shall not absorb water more than 20% of its own weight, when immersed for 24 hours in water. After quarrying the stone shall be allowed to weather for sometime before using in work.

17.2. The stone shall be dressed into regular rectangular blocks so that all faces are free from waviness and unevenness, edges true and square.

17.3 Those types of stone in which white clay occurs, should not be used.

17.4 Special corner stones shall be provided where so directed.

M-18. Mild Steel Bars

18.1 Mild steel bars reinforcement for R.C.C. work shall conform to I.S. 432 (Part-II) 1966 and shall be of tested quality. It shall also comply with relevant part of I.S. 456- 1978.

18.2 All the reinforcement shall be clean and free from dirt, paint, grease, mill scale or loose or thick rust at the time of placing.

18.3 For the purpose of payment, the bar shall be measured correct upto 100 mm. length and weight payable worked out at the rate specified below :

1.	6 mm.	0.22 Kg./Rmt.	8	20 mm.	2.47 Kg./Rmt.
2.	8 mm.	0.39 Kg./Rmt.	9.	22. mm.	2.98 Kg./Rmt.
3.	10mm.	0.62 Kg./Rmt.	10.	25 mm.	3.85 Kg./Rmt.
4.	12 mm.	0.89 Kg./Rmt.	11.	28 mm.	4.83 Kg./Rmt.
5.	14 mm.	1.21 Kg./Rmt.	12.	32 mm.	6.31 Kg./Rmt.
6.	16mm.	1.58 Kg./Rmt,	13.	36 mm.	7.99 Kg./Rmt.
7.	18 mm.	2.00 Kg./Rmt.	14.	40 mm.	9.86 Kg/Rmt.

M-19. High Yield Strength Steel Deformed Bars

19.1. High yield strength steel deformed bars be either cold twisted or hot/rolled, shall conform to I.S. 1739-1966 and I.S.1139-1966 respectively.

19.2. Other provision and requirements shall conform to specification no. M-18. For Mild steel bars.

19.3.

M-20 High Tensile Steel Wires

20.1. The high tensile wires for the use in prestressed concrete work shall conform to I.S. 2090-1962.

20.2. The tensile strength of the high tensile steel bars shall be as specified in the item. In absence of the given strength, the minimum strength shall be taken as per para 6.1 of I.S. 1785-1962, Testing shall be done as per I.S. requirements.

20.3. The high tensile steel shall be free from loose mill scale, rust oil, grease, or any other harmful matter. Cleaning of steel bars may be carried out by immersion in solvent solution, wire brushing or passing through a pressure box containing carborundum.

20.4. The high tensile wire shall be obtained from manufactures in coil having diameter not less than 350 times the diameter of wire itself so that wire springs back straight on being uncoiled.

M-21 Mild Steel Binding Wire

21.1. The mild steel wire-shall be of 1.63 mm. or 1.22 mm. (16 or 18 gauge) diameter and shall conform to I.S. 280- S 972.

21.2. The use of black wire will be permitted for binding reinforcement bars, it shall be free from rust, oil paint, grease, loose mill scale or any other undesirable coating which may prevent adhesion of cement mortar.

M-22. Structural Steel

All structural steel shall conform to I.S. 226-1965. The steel shall be free from the defects mentioned in I.S. 226-1975 and shall have a smooth finish. The material shall be free from loose mill scale, rust pits or other defects affecting

The strength and durability. Rivet bars shall conform to I.S. 1148-1973.

22.1. When the steel is supplied by the Contractor test certificates of the manufacturers shall be obtained according to I.S. 226-1975 and other relevant Indian Standards.

M-23. Galvanized Iron Sheets

23.1 The galvanized iron sheets shall be plain or corrugated sheets of specified in item. The G.I. Sheets all conform to I.S 277-1977. The sheets shall be undamaged in carriage and handling either by rubbing off of zinc coating or otherwise they shall have clean and bright surface and shall be free from dents, holes, rust or white powdery deposit.

23.2. The length and width Of G.I. sheet shall be as directed as per site condition.

M-23-A; G.I. Valleys gutter ridges

23. A.1. The G.I. ridges and hips shall be of plain galvanized sheets class-3 of the thickness as specified item. These shall be 600 mm. in width and properly bent up to shape without damage to the sheets in process of bending.

23. A.2. Valleys gutters and flashings shall also be galvanized sheet of thickness as specific in item, Vallev's shall be 900 mm. wide overall and fishing shall be 380 mm. wide overall. They shall be bent (o the required shape without damage to the sheet in (the process of bending.

M-24. Asbestos Cement Sheets

24.1. Asbestos cement sheets plain, corrugated or semi corrugated shall conform to I.S. 459-1970. The thickness of fee sheets shall be as specified in the item. The shells shall be free front all defects such as cracks, holes deformities, chipped edges or otherwise damaged.

24.2. Ridged-& Hips

24.2.1. Ridges and hips shall be of same thickness at that of A.C. sheets. The types of ridges suitable for the type of sheets and location's.

24.2.2. Other accessories to be used in roof such as flashing pieces, caves filler pieces, valley gutters, north light and ventilator curves, barge boards etc. shall be standard manufacture and shall be suitable for the type of sheets and location.

M-25. Mangalore Pattern Roof Tiles

25.1. The Mangalore pattern tiles shall conform to I.S. 654-1972 for Class AA or Class 'A' type as specified in item. Samples of the tiles to be provided shall be got approved from the engineer in charge. Necessary tests shall be carried out as directed.

M-26. Shuttering

26.1. The shuttering shall be either of Wooden planking of 30 mm. minimum thickness with or without steel lining or of steel plates stiffened by steel angles. The shuttering shall be supported on battens and beams and props of vertical ballies properly cross braced together so as to make the centering rigid. In places of bullie props, brick pillar of adequate section built in mud mortar may 6e used.

26.2. The form work shall be sufficiently strong and shall have camber, so that it assumes correct shape after deposition of the concrete and shall be able to resist forces caused by vibration of live load of men working *over* it and other incidental loads associated with it. The shuttering snail have smooth and even surface and its joints shall not permit leakage of cement grout.

26.3. If at any stage of work during or after placing concrete in the structure, the form work sags or bulges out beyond the required shape of the structure, the concrete shall be removed and work redone with fresh concrete and adequately rigid form work. The complete form work shall be got inspected by and got approved from the Engineer-in-charge, before the reinforcement bars are placed in position.

26.4. The props shall consist of bullies having 100 mm. minimum diameter measured, at mix length and 80 mm, at thin end and shall be placed as per design requirement. These shall rest squarely on wooden sole plates 40 mm; thick and minimum bearing are if 0.10 sq. m. laid on sufficiently hard base.

26.5. Double wedges shall further be provided between the sole plate and the wooden props so as to facilitate tightening and easing of shuttering" without jerking they concrete.

26.6 The. Timber used in shuttering shall not be so dry as to absorb water from concrete and swell or bulge nor so green or wet *as* to shrink after erection. The timber shall be properly sawn and planed on the sides and surface coming in contact with concrete. Wooden form work with metal sheet lining or steel plates stiffened by steel angles shall be permitted.

26.7 As far as practicable, clamps shall be used to hold the forms together and use of nails and spikes avoided.

26.8 The surface of timber shuttering that would come in contact with concrete shall be well wetted and coated with soap solution before the concreting is done. Alternatively coat of raw linseed oil or oil of approved manufacturer may be applied in place of soap solution. In case of steel shuttering either soap solution or raw linseed oil shall be applied after thoroughly cleaning the surface. Under no circumstances black or burnt oil shall be permitted.

26.9 The shuttering for beams and slabs shall have camber of 4 mm. per meter (1 in 250) or as directed by the Engineer-in-charge so as to offset the subsequent deflection. For cantilevers, the camber at free end shall be 1/50 of the projected length or as directed by the Engineer-in-Charge.

M-27. Expansion joints- Premoulded filter:

27.1 The item provides for expansion joints in R.C.C. frame structures for internal joints, as well as exposed joints, with the use of premoulded bituminous joint filler.

27.2. Remoulded bituminous joint filler, i.e. performed strip of expansion joint filler shall not get deformed or broken by twisting, bending or other handling when exposed to atmospheric condition. Pieces of joint filler that have been damaged shall be rejected.

27.3 Thickness of the pro-moulded joint filler shall be 25 mm. unless otherwise specified.

27.4 Remoulded bituminous joint filler shall conform to I.S. 1838-1961.

M-28. Expansion joints-Copper strips & hold fasts:

28.1 The item provide for expansion joints in R.C.C. frame structure for internal joint as well as for exposed joints with the use of necessary copper strip and holdfasts.

28.2 Copper sheet shall be of 1.25 mm. thick and of 1.25 mm. width with the 'U' shape in the middle. Copper strip shall have holdfast of 3 mm. diameter copper rod fixed to the plate soldered on strip at intervals of about 30 cm. or as shown in the drawing or as directed. The width of each flange (horizontal side) of the copper plate to be embedded in the concrete work shall be 25 mm. Depth of 'U' to be provide in the expansion joint, in the copper plate shall be of 25 mm.

M-29. Teak wood:

29.1 The leak wood shall be of good quality as required for the item to be executed. When the kind of wood is not specifically mentioned, good Indian teak wood as approved shall be used.

29.2 Teak wood shall generally be free from large, loose, dead or cluster knots, flaws, shakes, warps, twists bends, or any other-defects. H shall generally be uniform in substance and of straight fibres as far as possible. It shall be free from rot, decay, harmful fungi and other defects of harmful nature which will affect the strength durability of its usefulness for the purpose for which it is required. The color shall be uniform as far as possible. Any effort like painting, using any adhesive or resins materials made to hide the defects shall render the pieces liable to rejection by the Engineer in-charge.

29.3. All scantlings; planks etc. shall be sawn in straight lines and planes in the direction of grains and of uniform thickness.

29.4. The tolerances in the dimensions shall be allowed at the rate of 1.5 mm. per face to be planed.

29.5. First class teak wood: 29.5.1. First class teak wood shall have no individual hard and sound knots, more than 6 sq. cm. size and the aggregate area of such knots shall not be more than 1% of area of piece. The timber shall be closed grained. 29.6 Second Class Teak wood:

29.6.1. No individual hard and sound knots shall be more than 15 sq. cms. In size and aggregate area of such knots shall not exceed 2% of the area of piece?

M-29. A. Non-teak wood:

The non-teak wood shall be chemically treated, seasoned as per IS Specifications and of good quality. The type of wood shall be got approved before collecting the same on site.

Fabrication of wooden members shall be started only after approval.

For this purpose wood of Bio, Kalali, Siras, Bchda, Jamun, Sisoo will be used for door frames whereas only Kalali, Siras, Halda, Kalam etc, will be permitted for shutters after proper seasoning and chemical treatment.

The non-teak wood shall be-free from large, loose, and dead of cluster knots, flows shakes, warps, bends or any other defect. It Pigtail-be uniform in substance and of straight fibres as far as possible. It shall be free from rots, decay harmful fungi and other defects of nature which effect the strength, durability or its usefulness for the purpose for which it is required. The color of wood shall be uniform as far as possible. The scantlings planks etc. shall be

sawn in straight lines and planes in the direction of grain and uniform thickness.

The department will use the Agency to produce certificate from Forest Department in event of Dispute and the decision of the Department shall be final and binding to me contractor.

The tolerance in the dimension shall be allowed as 1.5 mm. per face to be planed.

M-30. Wooden flush door shutters (solid core):

30.1. The solid core type flush door shutters shall be decorative or non-decorative type as specified in the drawing. The size and thickness of the shutter shall be as specified in drawings or as directed. The timber, species for core shall be used as per

1.5. 2202 - (Part-I) 1980. The timber shall be free from decay and insect attack. Knots and knot holes less than half the width of cross-section of the members in which they occur may be permitted. Pitch pockets, pitch streaks and harmless pin holes shall be permissible except in the exposed edges of the core members. The commercial plywood, cross-bands shall conform to I.S. 303-1275.

30.2. The face panel of the shutters shall be formed by gluing by the hot press process on both face of the core with either ply wood or cross-bands and face veneers. The hopping rebating opening of glazing Venetian etc. shall be provided if specified in the drawing.

30.3. All edges of the door shutters shall be square. The shutters shall be free from twist or warp in its plane. Both faces of the shutters shall be sand papered to smooth even texture.

30.4. The shutters shall be tested for

(1) End immersion test.: The test shall be carried out as per I.S. 2202 (part-I) 1980. There shall be no delamination at the end of the test.

(2) Knife Test: The face panel when tested in accordance with I.S. 1659-1979 shall pass the test.

(3) Glue adhesion test: The flush door shall be tested for glue adhesive test in accordance with KS...2202 (Pan 4) 1930, The shutters shall be considered to have passed the test if no delamination occurs in the glue lines in the plywood and if no single delamination more than 80 mm. in length and more than 3 mm. in depth has occurred in the assembly glue lines between them. Plywood face and the style and rail. Delamination at the corner shall be measured continuously around the corner. Delamination at the knots, knot holes and other permissible wood defects shall not be considered in assessing the sample.

30.5. The tolerance in size of solid core type flush door shall be as under.

In Normal thickness ± 1.2 mm. In Normal height ± 3 mm.

30.6. The thick of the shutters shall be uniform throughout with a permissible variation of not more than 0.8 mm. when measured at any two points.

M-31. Aluminum doors, windows, ventilators

31.1 Aluminium alloy used in the manufacture of extruded window sections shall conform to I.S. designation HEA-WP of

1.5. : 733-3975 and also to I.S. Designation WVG-WP of I.S. 1285-1975. The Section shall be as specified in the drawing and design. The fabrication shall be done as directed.

31.2. The hinges shall be cast or extruded aluminium hinge of same type as in window but of large size.

31.3. The hinges shall normally be of 50 mm. projecting type. Non-projecting type of hinges may also be used if directed.

The handles of door shall be of specified design. A suitable lock for the door opera table either from outside or inside shall be provided. In double shutter door, the first closing shutter shall have concealed aluminium alloy bolt at top and bottom.

M-32. Rolling Shutters:

32.1. The rolling shutters shall conform to I.S. 6248-1979. Rolling shutters shall be supplied of specified type with accessories. The size of the rolling shutters shall be specified in the drawings. The shutters shall be constructed with interlocking lath sections formed from cold rolled steel strips not less than 0.9 mm. thick and 80 mm: wide for shutters upto 3.5mm., width not less than L25 mm. thick and 80 mm; wide for shutters 3.5 mm in width and at above unless otherwise specified.

32.2. Guide channels shall be of mild steel deep channel section and of rolled pressed or built up (fabricated) joint construction. The thickness of sheet used shall not be less than 3.15mm.

32.3. Hood covers shall be made of M.S. Sheets not less than 0 92 mm. thickness. For shutters having width 3.5 Meter and above, the thickness of M.S. Sheet for the hood cover shall be not less than 1.25 mm.

32.4. The spring shall be of best quality and shall be manufactured from tested high tensile spring steel wire or strip of adequate strength to balance the shutters in all position. The spring pipe shaft etc. shall be supported on strong M.S. or malleable C.I. brackets. The brackets shall be fixed on or under the lintel as specified with raw plugs and screws bolts etc.

32.5. The roiling shutters shall be of self-rolling type up to 8 Sq. in. clear area without ball bearing and up to 12 sq. m. clear area with ball bearing. If the rolling shutters are larger, then gear operated type shutters shall be used.

32.6. The locking arrangement shall be provided at the bottom of shutter at both ends. The shutters shall be opened from outside.

32.7. The shutters shall be completed with door suspension shafts, locking arrangements, pulling hooks, handles and other accessories.

M-33. Collapsible. Steel-Gate:

33.1. The collapsible steel gate shall be in one or two leaves and size as per approved drawings or as specified. The gate shall be fabricated from best quality mild steel channels, flats etc. Either steel pulleys or ball bearings shall be provided in every double channel. Unless otherwise specified the particulars of collapsible gate shall be as under :

(a) Pickets: These shall be of 20 mm. M.S., channels of heavy sections unless otherwise shown on drawings. The distance centre to centre of pickets shall be 12 cms. With an opening of 10 cms.

(b) .Pivoted M.S. flats shall be 20 mm x 6 mm.

(c) Top and bottom guides shall be from tee or flat iron of approved size.

(d) The fittings like stoppers, fixing hold fasts, locking cleats, brass handles and cast iron rollers shall be of approved design and size.

M-34. Welded Steel Wire Fabric:

34.1. Welded steel wire fabric for general purpose shall be manufactured from cold drawn steel wire "as drawn" or galvanized steel conforming to I.S. 226-1975 with longitudinal and transverse wire securely connected at every intersection by a process of electrical resistance welding and conforming to I.S. 4948-1974. It shall be fabricated and finished in workmanlike manner and shall be free from injurious defects and shall be rustproof. The type of mesh shall be oblong or square as directed. The mesh sizes and size of wire for square as well as oblong welded steel wire fabric shall be as directed the steel wire fabric in panels shall be in one whole piece in each panel as far as stock size permit.

M-35. Expanded Metal Sheets:

35.1. The expanded metal sheets shall be free from flaws, joints, broken strands, laminations and other harmful surface. Expanded metal steel sheet shall conform to I.S. 412-1975, except that blank sheets need not be with guaranteed mechanical properties. The size of the diamond mesh of expended metal and dimensions of strands (width and thickness) shall be as specified. The tolerance in nominal weight of expanded metal sheets shall be of + 10 percent.

35.2 Expanded metal in pannels shall be in one whole piece panel each as far as stock size permit. The expanded metal sheets shall be coated with suitable protective coating to prevent corrosion.

M-36. Mild Steel Wire (Wire Gauze Jali):

36.1 Mild steel wire, may be galvanized, as indicated. All finished steel wire shall be well cleanly drawn to! He dimensions and-size of wire as specified in item. The wire shall be sound, free from splits, surface flaws, rough jagged and imperfect edges and other harmful surface defects and shall conform to I.S. 280-1978.

M-37. Plywood:

37.1. The plywood for general purpose shall conform I: S. 303- 1975.

Plywood is made by cementing together thin boards or sheets of wood into panels. There are always an odd number of layers 3, 5, 7, 9 ply etc. The plies are placed so that grain of each layer is right angle to the grain in the adjacent layer.

37.2. The chief advantages of plywood over a signal board of the same thickness is the more uniform strength of the plywood, along the length and width of the plywood and greater resistance to cracking and splitting with change in moisture content,

37.3. Usually synthetic resins are used for gluing, pherolic resins are usually cured in a hot press which compresses and simultaneously heats the plies between hot plates which maintain a temperature of 90 degree. C. to 140 degree C. and a pressure of 11 to 14 Kg/Sq. Cm. on the wood. The times of healing may be anything from 2 to 60 minutes depending upon thickness.

37.4. When water glue are used, the wood absorbs so much water that the finished plywood must be dried carefully. When synthetic resins are use as adhesive finished plywood must be exposed to an atmosphere of controlled humidity until the proper amount

of moisture, has been absorbed.

37.5. According to I.S. 303-1975 the plywood for general purpose shall be of three grades namely BWR, WWR and CWR, depending upon the adhesives used for bonding and veneers, and it will be farther classified into six types namely AA, AB, AC, BB, BC and C, C based on the quality of the two faces, each face being of three finds namely, A, B. and C. After pressing, the finished ply wood should be reconditioned to a moisture content not less than 8 percent and not more than 16 percent.

37.6. Thickness of ply wood Boards :

37.7. TABLE

Board	Thickness	Board,	Thickness	Board	Thickness	Board	Thickness
3 ply	3mm	5 ply	5mm	7 ply.	9mm	9 ply.	16mm.
	4 mm.		6mm.		13mm.		19 mm.
	5 mm:		8mm.		16mm.	11 Ply.	19 mm.
	6 mm.		9mm.	9 Ply.	13mm.		22mm.
							25 mm.

M.38. Glass:

38.1 All glass shall be of the best quality, free from specks, bubbles, smokes, veins, air holes blisters and other defects. The kind of glass to be used shall be mentioned in the item or specification or in the special provisions or as shown in detailed drawings. Thickness of glass panes shall be uniform. The specifications of different kinds of glass shall be as under:

38.2. Sheet Glass:

38.2.1. In absence of any specified thickness or weight in the item or detailed specifications of the item of work, sheet glass shall be weighing 73 Kg/Sq.m. for panes upto 600 mm x 600 mm.

38.2.2. For panes larger than 600 mm. x 600 mm. and upto 800 mm. x 800 mm. the glass weighing not less than 8.75 Kg/Sq m. shall be used. For bigger panes upto 900 mm. x 900 mm. glass weighing not less than 11.25 Kg/Sq. m. shall be used.

38.2.3. Sheet glass shall be patent, flattened glass of best quality and for glazing and framing purposes shall conform to I.S.: 1761 -1960. Sheet glass of the specified colours shall be used, if so shown on detailed drawings or so specified. For important buildings and for panes with any dimension over 900 mm. plate glass of specified thickness shall be used.

38.3. Plate Glass. 38.3.1. When plate glass is specified, it shall be 'Polished patent plate glass' of best quality. It shall have both the surface ground flat and parallel and polished to obtain clear undisturbed vision and reflection. The plate glass shall be of the thickness mentioned in the item or as shown in the detailed drawing or as specified. In absence of any specified thickness the thickness of plate glass to be supplied shall be 6mm and a tolerance of 0.20 mm. shall be admissible.

38.4. Obscured Glass: 38.4.1. This type of glass transmits light so that vision is partially or almost completely obscured. Glass shall be plain rolled, figured, ribbed or fluted or frosted glass as may be specified as required. The thickness and type of glass shall be as per details on drawings or as specified or as directed.

38.5. Wired Glass: 38.5.1. Glass shall be with wire netting embedded in a sheet of plate glass electrically welded 13 mm. Georgian square mesh may be used. Thickness of glass shall not be less than 6 mm. Wired glass shall be of type and thickness as specified.

M-39. Acrylic Sheets:

39.1. Acrylic sheet shall be of thickness as specified in the item and of a specified shape and size as the case may be. Panels may be flat or curved. It should be light in weight. It shall be colourless or coloured or opaque as specified in the item. Colourless sheet shall be as transparent as the finest optical glass, its light transmission rate shall be about 95%. Transparency shall not be affected for the sheets of larger thickness. It shall be extremely resistant to sunlight, weather and low temperatures. It shall not show any significant yellowing or change in physical properties or loss of light transmission over a longer period of use. The sheet shall be impact resistant also. Sheets should be available in complete range of standard transparent, translucent and opaque colours. Sheets shall be of such quality that they can be cut bent and jointed as desired. Solution for the joints shall be used as per the requirement of manufacturer.

M-40. Particle board:

40.1. The particle boards used for face panels shall be of best quality free from any defects. The particle boards shall be made with phenoimaldehyde adhesive. The particle boards shall conform to I.S.: 3087-1965. "Specification for wood particle board for general purpose". The size and the thickness shall be as indicated.

M-41. Expanded polystyrene of framed styroper slabs:

41.1. The expanded polystyrene ceiling boards and files shall be of approved make and shall be of size, thickness, finish and color as indicated. It shall be of high density and suitable for use as insulating material. The insulating material shall be like slab of Thermo Cole etc.

M-42. Resin bonded fiber glass:

42.1 The resin bonded fibre glass tiles, or rolls shall be of approved make and shall be of sizes, thickness and finish as indicated.

42.2. For test of Mineral wool thermal insulation Blanket I.S.: 3144/1965 shall be followed.

42.3. Insulation wool blanket shall be with following coverings on one or both sides as indicated.

- (1) Bituminised hessian Kraft paper suitable for use in position where moisture has to be excluded.
- (2) Hessian cloth or Kraft paper for keeping out dust.
- (3) G.I. wire netting, suitable for surfaces to be plastered over.

M-43. Fixtures and fastenings:

43.1. General:

43.1.1. The fixtures and fastenings, that is, butt, hinges, tee and strap hinges, sliding door bolts, tower bolts, door latch, bath room latch, handles, door stoppers, casement window fasteners, casement stays and ventilators catch shall be made of the metal as specified in the item or its specifications.

43.1.2. They shall be of iron, brags, aluminium, chromium plated iron, and chromium plated brass, copper oxidised iron, and copper oxidised brass or anodised aluminium as specified.

43.1.3. The fixtures shall be heavy, medium or light type. The fixtures and fastenings shall be smooth finished and shall be such as will ensure ease of operation.

43.1.4. The samples of fixtures and fastenings shall be got approved as regards quality and shape before providing them in position.

43.1.5. Brass and anodised aluminium fixtures and fastenings shall be bright finished.

43.2. Holdfasts: 43.2.1. Holdfasts shall be made from mild steel flat 30 cm. length and one of the holdfasts shall be bent at right angle and two nos. of 6 mm. diameter holes shall be made in it for fixing it to the Frame with screws. At the other end, the holdfast shall be forked and bent at right angles in opposite directions.

43.2. Butt hinges:

43.3.1. Railway standard heavy type butt hinges shall be used when so specified. 43.3.2. Tee and strap hinges shall be manufactured from M.S. Sheet.

43.4. Siding door bolts (AL drops): 43.4.1. The AL drops as specified in the item shall be used and shall be got approved.

43.5. Tower bolts (Barrel Type): 43.5.1. Tower bolts as specified in the item shall be used and shall be got approved.

43.6. Door latch: 43.6.1. The size of door latch shall be taken as the length of latch.

43.7. Bathroom Latch: 43.7.1. Bathroom latch shall be similar to tower bolt.

Handle: The size of the handles shall be determined by the inside grip length of the handles. Handles shall have a base plate of length 50 mm. more than the size of the handle.

43.8. Door Stoppers: 43.9.1. Door stoppers shall be either floor door stopper type or door catch type. Floor stopped shall be of overall size as specified and shall have a rubber cushion.

43.9. Door Catch: 43.10.1. Door catch shall be fixed at a height of about 900 mm. from the floor level so that one part of the catch is fitted on the inside of the shutter and the other part is fixed in the wall with necessary wooden plug arrangements for appropriate fixity. The catch shall be fixed 20 mm. inside the face of the door for easy operation of catch.

43.10. Wooden Door Stop with hinges: 43.11.1. Wooden door stop of size 100 mm x 60 mm x 40 mm shall be fixed on the door frame with a hinge of 75 mm size and at a height of 900 mm. from the floor level. The wooden door stop shall be provided with 3 coats of approved

oil paint.

43.11. Casement window Fastener: Casement window fastener for single leaf window shutter shall be left or right handled as directed.

43.12. Casement stays (Straight Peg Stay): 43.13.1. The stays shall be made from a channel section having three holes at appropriate position so that the window can be opened either fully or partially as directed. Size of the stay shall be 250 mm. to 300 mm. as directed.

43.13. Ventilator Catch: 43.14.1. The pattern and shape of the catch shall be as approved.

43.14. Pivot: 43.15.1. The base and socket plate shall be made from minimum 3 mm. thick plate and projected pivot shall not be less than 12 mm. diameter and 12 mm. length and shall be firmly riveted to the base plate in case of iron pivot and in single piece base plate in the case of brass pivot.

M-44. Paints: 44.1 (A) Oil paints:

44.1.1. Oil paints shall be of the specified color and shade, and as approved. The ready mixed paints shall only be used. However, if ready mixed paint or specific shade or tint is not available, white ready mixed paint with approved strainer will be allowed. In such a case, the contractor shall ensure that the shade of the paint so allowed shall be uniform.

44.1.2. All the paints shall meet with following general requirements :

(i) Paint shall not show excessive setting in a freshly opened full can and shall easily be re-dispersed with a paddle to a smooth homogeneous state. The paint shall show no curdling, leveraging, caking or color separation and shall be free from lumps and skins.

(ii) The paint as received shall brush easily, possess good leveraging properties and show no running or sagging tendencies.

(iii) The paint shall not skin within 48 hours in a three quarters filled closed container.

(iv) The paint shall dry to a smooth uniform finish free from roughness, grit, unevenness and other imperfections.

44.1.3. Ready mixed paint shall be used exactly as received from the manufacturers and generally according to their instructions and without any admixtures whatsoever.

44.2. (B) Enamel Paints:

44.2.1. The enamel paint shall satisfy in general requirements as mentioned in specification of oil paints. Enamel paint shall conform to I.S. 2933-1975.

M-45 French polish:

45.1. The French polish of required tint and shape shall be prepared with the below mentioned ingredients and other necessary materials:

(i) Denatured spirit of approved quality (ii) Chandras (iii) Shellac (IV) Pigment.

45.2. The French polish so prepared shall conform to I.S.: 348-1968.

M-46 Marble chips for marble mosaic terrazzo:

46.1. The marble chips shall be of approved quality and shades. It shall be hard, sound, dense and homogeneous in texture with crystalline and coarse grains. It shall be uniform in color and free from stains, cracks decay and weathering.

46.2. The size of various colours of marble chips ranging from the smallest upto 20 mm. shall be used where the thickness of top wearing layer is 6 mm. size. The marble chips of approved quality and colours only as per grading as decided by the Engineer-in-charge shall be used for marble mosaic tiles or works.

46.3 The marble chips shall be machine crushed. They shall be free from foreign matter, dust etc. Except as above, the chips shall conform to I. S.: 2114-1962.

M-47. Flooring Tiles:

47.1 (A) Plain Cement tiles :

47.1.1. The plain cement tiles shall be general purpose type. These are the tiles in the manufacturer of which no pigments are used. Cement used in the manufacture of tiles shall be as per Indian Standards.

47.1.2. The tiles shall be manufactured from a mixture of cement and natural aggregates by pressure process. During manufacture, the tiles shall be subjected to a pressure of not less than 140 Kg/Sq. Cm. The proportion of cement to aggregate in the backing of the tiles shall be not less than 1:3 by weight. The wearing face through the tiles are of plain cement, shall be provided with stone chips of 1 to 2 mm. Size. The proportions of cement to the marble chips aggregate in the wearing layer of the tiles shall be three parts of cement to one part chips by weight. The minimum thickness of wearing layer shall be 3 mm. The color and texture of

wearing layer shall be uniform throughout its face and thickness. On removal from mould, the tiles shall be kept in moist conditions continuously at least for seven days and subsequently, if necessary, for such long period as would ensure their conformity to requirements of I.S.: 1237-1980 regarding strength resistance to wear and water absorption.

47.1.3. The wearing face of the tiles shall be plain, free from projections, depressions and cracks and shall be reasonably parallel to the back face of the tile. All angles shall be right and all edges shall be sharp and true.

47.1.4. The size of tiles shall generally be square shape 24.85 Cm. x 24.85 Cm. or 25 Cm. x 25 Cm. The thickness of tiles shall be 20 mm.

47.1.5. Tolerance of length and breadth shall be plus or minus one millimetre. Tolerance on thickness shall be plus 5 mm.

47.1.6. The tiles shall satisfy the tests as regards transverse strength resistance to wear and water absorption as per I.S: 1237-1980.

47.2 (B) Plain Coloured Tiles :

47.2.1. These tiles shall have the same specification as per plain cement tiles as per (A) above except that they shall have a plain wearing surface wherein pigments are used. They shall conform to I.S. 1237-1980.

47.2.2. The pigment used for colouring cement shall not exceed 10 percent by weight of cement used in the mix. The pigments synthetic or otherwise, used for colouring tiles shall have permanent color and shall not contain materials detrimental to concrete.

47.2.3. The color of the tiles shall be specified in the item or as directed.

47.3 (C) Marble mosaic tiles :

47.3.1. These tiles have, the same specifications as per plain cement tiles except the requirements as stated below:

47.3.2. The marble mosaic tiles shall conform to I. S. 1237-1980. The wearing face of the tiles shall be mechanically ground and filled. The wearing face of tiles shall be free from projections, depressions and cracks and shall be reasonably parallel to the back face of the tiles. All angles shall be right angles and all edges shall be sharp and true.

47.3.3. Chips used in the tiles be from smallest upto 20 mm. size. The minimum thickness of wearing layer of tiles shall of 6 mm. For pattern of chips to be used on the wearing face, a few samples with or without their full size photographs as directed shall be presented to the Engineer-in-charge for approval.

47.3.4. Any particular samples, if found suitable shall be approved by the Engineer-in-charge, or he may ask for a few more samples to be prepared indicating roughly the particular sized chips to be more-or less in the samples presented. The samples have to be made by the contractor till a suitable sample is finally approved for use in the work.

The Contractor shall ensure that the tiles supplied for the work shall be in conformity with the approved sample only, in terms of its dimensions, thickness of backing layer and wearing surface, materials, ingredients, color shade, Chips, distribution etc. required.

47.3.5. The tiles shall be prepared from cement conforming to Indian Standards or coloured Portland cement generally depending upon the color of tiles to be used or as directed.

47.4 (D) Chequered Tiles :

47.4.1. Chequered tiles shall be plain cement tiles or marble mosaic tiles. The former shall have the same specification as per (A) above and the latter as per marble mosaic tiles as per (C) except as mentioned below :

47.4.2. The tiles shall be of nominal size of 250 mm. x 250 mm. or as specified. The centre to centre distance of chequer shall not be less than 25 mm. and not more than 50 mm. The overall thickness of the tile shall be 22 mm.

47.4.3. The grooves in the chequers shall be uniform and straight. The depth of the grooves shall not be less than 3 mm. The chequered shall be plain, coloured or mosaic as specified. The thickness of the upper layer measured from the top of the chequers shall not be less than 6 mm. The tiles shall be given the first grinding with machine before delivery to site.

47.4.4. Tiles shall conform to relevant I.S. 1237-1930.

47.5 (E) Chequered Tiles for Stair cases :

47.5.1. The requirements of these tiles shall be the same as chequered as per (D) above except in following respects;

- (1) The length of a tile including nose shall be 330 mm.
- (2) The minimum thickness shall be 28 mm.

- (3) The nosing shall have also the same wearing layer as at the top.
- (4) The nosing edge shall be rounded.
- (5) The front portion of the tile for a minimum length of 75 mm. from and including the nosing shall have grooves running parallel to nosing and at centre not exceeding 25 mm. Beyond that the tiles shall have normal chequer pattern.

M-48. Rough Kotah Stone:

48.1. The kotah. stones shall be hard, even, sound, and regular in shape and generally uniform in color. The color of the stone shall generally be green. Brown color stones shall not be allowed for use. They shall be without any softveins, cracks or flows.

48.2 The size of the stones to be used for flooring shall be of size 600 mm x 600 mm and/or size 600 mm x 450 mm, as directed. However smaller sizes will be allowed to be used to the extent of maintaining required pattern. Thickness shall be as specified.

48.3. Tolerance of minus 30 mm. on account of chisel dressing of edges shall be permitted for length as well as breadth. Tolerance in thickness shall be + 3 mm.

48.4. The edges of stones shall be truly chiselled and table rubbed with coarse sand before paving. All angles and edges of the stone shall be true, square and free from chipping and surface shall be true and plain.

48.5 When machine cut edges are specified, the exposed edges and the edges at joints shall be machine cut. The thickness of the exposed machine cut edges shall be uniform.

M-49. Polished Kotah Stones.

49.1. Polished kotah stone shall have the same specifications as per rough kotah stone except as mentioned below :

49.2. The stones shall have machine polished smooth surface. When brought on site, the stones shall be single polished or double polished depending upon its use. The stones for paving shall generally be single polished. The stones to be used for dado, .skirting, platforms, sink, veneering, sills, steps, etc. where machine polishing after the stones are fixed in situ is not possible, shall be double polished.

M-50. Dholpur Stone Slab:

50.1 Dholpur stone slab shall be of best quality as approved by the Engineer-in-charge the stone slab shall be even, sound and durable, regular in shape and of uniform color.

50.2. The size of the stone shall be specified in the item or detailed drawings or as approved by the Engineer-in-charge. The thickness of the stone shall be as specified in the item of work with the permissible tolerance of plus or minus 2 mm. The provisions in respect of polishing as for polished Kotah stone shall apply to polished Dholpur stone also. All angles and edges of the face of the stone slab shall be fine chiselled or polished as specified in the item of work and all the four edges shall be machine cut.

All angle and edges of the stone slab shall be true and plane.

50.3 The sample of stone shall be got approved from the Engineer-in-charge for shade and tint for a particular work. It shall be ensured that the stones to bemuse in a particular work shall not differ much in shade or tint from the approved sample.

M-51. Marble Slab:

51.1. Marble slab shall be white or of other color and of best quality as approved by the Engineer-in-charge.

51.2. Slabs shall be hard, uniform and homogeneous in texture. They shall have even crystalline grain and free from defects and cracks. The surface shall be machine polished to an even and perfectly plant surface and edges machine cut true and square. The rear face shall be rough to provide key for the mortar.

51.3. Marble slabs with natural veins, if selected shall have to be laid as per the pattern given by the Engineer-in-charge. Size of the slab shall be minimum 450 mm x 450 mm. and preferable- 600 mm x 600 mm. However, smaller sizes will be allowed to be used to the extent of maintaining required palter.

51.4. The slab shall not be thinner than the specified thickness at its thinnest part. A few specimen of finished slab to be used shall be deposited by the Contractor in the office for reference.

51.5. Except as above, the marble slabs shall, conform to I.S. 1130-1969.

M-52. Granite Stone Slab:

52.1. Granite shall be of approved color and quality. The stone shall be hard, even, sound regular in shape and generally uniform in color. It shall be without any soft veins, cracks of

flows.

52.2. The thickness of the stone shall be as specified in the items.

52.3. All exposed face shall be double polished to tender truly smooth and the even reflecting surface. The exposed edges and corners shall be rounded off as directed. The exposed edges shall be machine cut and shall have uniform thickness.

M-53 P.V.C Flooring:

53.1. P. V.C sheets for P.V.C. floor covering shall be of homogeneous flexible type, conforming to I.S. 3452-1966. The P.V.C. covering shall neither develop any toxic effect while put to use nor shall give off any disagreeable odour.

53.2 Thickness of flexible type covering tiles shall be as specified in the description of the item.

53.3. The flexible type shall be backed with hessain or other woven fabric. The following tolerances shall be applicable on the nominal dimension of the sheet rolls or tiles :

(a) Thickness 0.15 mm

(b) Length or Width :

1	300 mm. square tiles	± 0.20 mm.	39.00 mm. square tiles	± 0.30 mm.
2	600mm. “““	± 0.40 mm.	4. Sheets and rolls	+ 0.10 percent

53.4. Adhesive:

53.4.1. The adhesive for PVC flooring shall be of the type and make recommended by the manufacturers of PVC sheets/tiles.

M-54. Facing tiles:

54.1. The facing tiles (burnt clay facing bricks) shall be free from cracks, flaws and nodules of free lime. They shall be thoroughly burnt and shall have plane rectangular faces with parallel sides and sharp straight right edged faces. The texture of the finished surface that will be exposed when in place, shall conform to an approved sample consisting not less than four stretcher bricks each representing the texture desired. The facing tiles shall have a pleasing appearance, sufficient resistance to penetration by rain and greater durability than common bricks. The tiles shall conform to I.S. 2691-1972.

54.2. The standard size effacing brick tiles shall be 19 x 9 x 4 cms. The facing brick tiles shall be provided with frog which shall conform to I.S. 1077-1976.

54.0. The permissible tolerance in dimensions specified above shall be as follows :

Size Tolerance for

	1st class Brick	2nd class Brick
19 Cm.	± 6 mm.	± 10 mm.
9cm.	± 3 mm.	± 7 mm.
4cm.	± 1.5 mm	± 3 mm.

54.4. The tolerance for distortion or warpage of face or edges of individual brick from a plane surface and from a straight line respectively shall be as follows:

Facing dimensions

Permissible tolerance

Max. Below 19

cms. Max. 2.5mm.

-Do- above 19 cm. Max. 3.0 mm.

54.5. The average compressive strength obtained as a sample of five dies when tested in accordance with the procedure laid as per I.S. 1077-1976 shall be not less than 175 Kg/Sq. Cm. The average compressive strength of any individual bricks shall be not less than 160 Kg/Sq.Cm.

54.6. The average water absorption for five bricks files shall not exceed 12 percent of average weight of brick before testing.

The absorption for each individual bricks snail not exceed 25 percent.

54.7. The brick tiles when tested in accordance with I.S. 1077-1976, the rate of efflorescence shall not be more than ‘Slightly effloresced.’

M-55. White glazed tiles:

55.1. The tiles shall be of best quality as approved by the Engineer-in-charge. They shall be flat and true to shape. They shall be free from cracks, crazing, spots, chipped edges and corners. The glazing shall be of uniform shade.

55.2. The tiles shall be nominal size of 150 mm. x 150 mm. unless otherwise specified. The maximum variation from the stated sizes, other than the thickness of tile, shall be plus or minus 1.5 mm. The thickness of tile shall be 6 mm. except as above the tiles shall conform to I.S. 777 1970.

M-56. Galvanized iron pipes and fittings:

56.1. Galvanized iron pipe shall be of the medium type and of required diameter and shall comply with I.S. 239-1979. The specified diameter of the pipes shall refer to the inside diameter of the bore. Clamps, screw and all galvanized iron fittings shall be of the standard 'R' or equivalent make.

M-57. Bib cock and stop cock:

57.1. A bib cock is a draw off tap with a horizontal inlet and free outlet. A stop cock is a valve with a suitable means of connection for insertion in a pipe line for controlling or stopping the flow.

57.2. They shall be of screw down type and of brass chromium plated and of diameter as specified in the description of the item. They shall conform to I.S. 781-1977 and they shall be of best Indian make. They shall be polished bright.

57.3. The minimum finished weight of bib cock and stop cock shall be as given below :

Diameter	Bib cock	Stop cock	Diameter	Bib cock	Stop cock
8 mm	0.25 Kg.	0.25 Kg.	15 mm.	0.40 Kg.	0.40 Kg.
10 mm.	0.30 Kg.	0.35 Kg.	20 mm.	0.75 Kg.	0.75 Kg.

M-58. Gun metal wheel valve:

58.1. The gun metal wheel valve be of approved quality. These shall be gun metal fitted with wheel and shall be of gate valve opening full way and of the size as specified. These shall conform to I.S. 778-1971.

M-59. White glazed porcelain wash basin:

59.1. Wash basin shall be of white porcelain first quality best Indian make and it shall conform to I.S. 2556 (Part-IV) 1972 and I.S. 771-1979.

The size of the wash basin shall be as specified in the item, Wash basin shall be of one piece construction with continued over-flow arrangements. All internal angles shall be designed so as to facilitate cleaning. Wash basin shall have single tap hole or two holes as specified. Each basin shall have a circular waste hole which is either rabbled or beveled internally with 65 mm. diameter at top and 10 mm. depth to suit the waste fitting. The necessary stud slot to receive the bracket on the underside of the basin shall be provided. Basin shall have an internal soap holder recess which shall fully drain into the bowl.

59.2. White glazed pedestal of the quality and color as that of the basin shall be provided where specified in the item. It shall be completely recessed at the back for reception of supply and wash pipe. It shall be capable of supporting the basin rigidly and adequately and shall be so designed as to make the height from floor to top of the rim of basin 750 mm. to 800 mm. as directed.

M-60. European type water closet/with low level flushing:

60.1. The European type water closet shall be white glazed porcelain first quality and shall be of wash down type conforming to I.S. 2556-1973 and I.S. 771-1979.

60.2. 'S' trap shall be provided as required with water seal not less than 50 mm. The solid plastic seat and cover shall be of the best Indian make conforming to I.S. 2548-1980. They shall be made of moulded syntactic materials which shall be tough and hard with high resistance to solvents and shall be free from blisters and other surface defects and shall have chromium plated brass hinges and rubber buffer of suitable size.

M-61. Orissa type water closet:

61.1. The specification of Orissa type white glazed water closet of first quality shall conform to I.S. 2556 (Part-III) 1981 and relevant specification of Indian type water closet except that pan will be with the integral squatting pan of size 580 mm. x 440 mm. with raised footrest.

M-62. Indian type water closet:

62.1. The Indian type white glazed water closet of first quality shall be of size as specified in the item and conforming to I.S. 771-1979 and I.S. 2556 (Part-II) 1981. Each pan shall have

integral flushing ring of suitable type with adequate number of holes around as directed to have satisfactory flushing. It shall also have an inlet at back or front for connecting flush pipe as directed. The inside of the bottom of the pan shall have sufficient slope from the front towards the outlet and surface shall be uniform and smooth.

Pan shall be provided with 100 mm. diameter 'P' OR's' trap with approximately 50 mm. water seal and 50 mm. diameter vent horn.

M-62.A Foot Rests: 62-A-1. A pair of white glazed-earthen ware rectangular foot rests of minimum size 250 mm. x 130 mm. 20 mm. shall be provided with water closet.

M-63. Glazed Earthen Ware Sink:

63.1. The glazed earthen-ware sink shall be specified size, color and quality. The sink shall conform to I.S. 771 Part-II-1979. The brackets for sinks shall conform to I.S. 775-1970.

63.2. The pipes shall conform to I.S. 1239-Part-11973 and I.S. 404-1962 for steel and lead pipes respectively 32 mm. brass waste coupling of standard pattern with brass chain and rubber plug shall be provided with sink.

M-64. Glazed earthen ware Lipped type flat back urinal/corner type urinal:

64.1 The lipped type urinal shall be flat back or corner type as specified in the item and shall conform to I.S. 771-1979. It shall be of best Indian make and size as specified and approved by the Engineer-in-charge. The flat back or corner type urinal must be of 1st quality free from any defects, cracks, etc.

M-65. Low level enamel flushing tank:

65.1. The low level enamel flushing tank shall be of 15 litres capacity. It shall conform to I.S. 774-1971. The flushing cistern shall be of best quality and free from any defects. The flushing tank shall have outlet 32 mm. diameter. The outlet shall be connected with W.C. Pan by lead pipe or P.V.C. pipe as specified. The flushing tank shall be provided with inlet and outlet for fixing G.I. inlet pipes and over-flow pipes. The flushing cistern shall be provided with chromium plated handle for flushing. The flushing tank shall be provided with bracket of cast iron so that it can be fixed on wall at specified height. The brackets shall conform to I.S. 775-1970.

M-66. Cast iron flushing cistern:

66.1. The cast iron flushing cistern shall be of 15 litres capacity. It shall conform to I.S. 774-1971. The flushing cistern shall be of best quality free from any defects. The flushing cistern shall have outlet of 32 mm. diameter. The outlet shall be connected to lead pipe of 32 mm. diameter. The lead pipe shall conform to I.S. 404 (Part-I) 1962. For fixing G.I. inlet pipes and overflow pipe 20 mm. dia. inlet and outlet shall be provided. The flushing cistern shall be provided with galvanized iron chain and pull of sufficient length and shall be got approved from the Engineer-in-charge. The cast iron flushing cistern shall be painted with one coat of anticorrosive paint and two coats of paints. The flushing cistern shall be fixed on two C.I. brackets. The C.I. brackets shall conform to I.S. 775-1970.

M-67. Flush cock:

67.1. Half turn flush cusec (Heavy weight) shall be of gun metal chromium plated of diameter as specified in the description of the item. The flush cock shall conform to relevant Indian Standard.

M-68. Cast iron pipes and fittings:

68.1 All soil, water, vent and anti-syphon age pipes and fittings shall conform to I.S. 1729-1964. The pipe shall have spigot and socket ends with head on spigot end. The pipes and fittings shall be true to shape, smooth, cylindrical, their inner and outlet surfaces being as nearly as practicable concentric. They shall be sound and nicely cast and shall be free from cracks, laps, pinholes or other imperfection and shall be neatly dressed and carefully fettled.

68.2. The end of pipes and fittings shall be reasonable square to their axis.

68.3. The sand cast iron pipes shall be of the diameter as specified in the description and shall be in lengths of 1.5 M. 1.8 M. and 2 M. including socket ends of the pipe unless shorter lengths are either specified or required at junctions etc. The pipes and fittings shall be supplied without ears unless specified or directed otherwise.

Tolerances:

68.4.1. The Standard weights and thickness of pipes shall be as shown in the following table: A tolerance upto minus 10 per cent may however be allowed against these standard weights.

Sr.	Nominal dia. of	Thickness	1.5 m.long	Overall Weight of Pipe excluding ears 2 m. long	
No.	bore			1.8m. long.	2m. long
1	75 mm	5.0 mm	12.83 Kg.	16.52 Kg.	18.37 Kg.
2	100 mm	5.0 mm	18.14 Kg.	21.67 Kg.	24.15 Kg.

68.4.2. A tolerance upto minus 15 percent in thickness and 20 mm. in length will be allowed. For fittings tolerance in lengths shall be plus 15 mm. and minus 10 mm.

68.4.3. The thickness of fittings and their socket and spigot dimensions shall conform to the thickness and dimensions specified for the corresponding sizes of straight pipes. The tolerances in weights and thickness shall be the same as for straight pipes.

M-69. Nahni Trap:

69.1. Nahni trap shall be of cast iron and shall be sound and free from porosity or other defects which affect serviceability. The thickness of the base metal shall not be less than 6.5 mm. The surface shall be smooth and free from craze, ships and other flaws or any other kind of defects which affect serviceability. The size of nahni trap shall be as specified and shall be of self-cleansing design.

69.2. The nahni trap shall be of quality approved by the Engineer-in-charge and shall generally conform to the relevant Indian Standards.

69.3. The Nahni trap provided shall be with deep seal, minimum 50 mm, except at places where trap with deep seal cannot be accommodated. The cover shall be cast iron. Perforated cover shall be provided *on* the trap of appropriate size.

M-70. Gully Trap:

70.1 Gully trap shall conform to I.S. 651-1980. It shall be sound, free from defects such as fire cracks. The glaze of the traps shall be free from crazing. They shall give a short clear note when struck with light hammer. There shall be no broken blisters.

70.2. The size of the gully trap shall be as specified in the item.

70.3. Each gully trap shall have one C.I. grating of square size corresponding to the dimensions of inlet of gully trap. It will also have a water tight C.I. cover with frame inside dimensions 300 mm; x 300 mm., the cover with frame inside dimension, 300 mm. x 300 mm., the cover weighing not less than 4.53 Kg. and the frame not less than 2.72 Kg. The grating cover and frame shall be of sound and good casting and shall have truly square machined seating faces.

M-71. Glaze Stone Ware Pipe And Fitting:

71.1. The pipes and fittings shall be of best quality as approved by the Engineer-in-charge. The pipe shall be of best quality manufactured from stone-ware of fire clay, salt glazed thoroughly burnt through the whole thickness, of a close even texture, free from air blows, fire blisters, crack and other imperfections, which effect the serviceability. The inner and outer surfaces shall be smooth and perfectly glazed. The pipe shall be capable to-withstand pressure of 1.5 m. lead without showing sign of leakage. The thickness of the wall shall not be less than 1/12th of the internal dia. The depth of socket shall not be less than 38 mm. The socket shall be sufficiently large to allow a joint of 1 mm. around the pipe.

71.2. The pipes shall generally conform to relevant I.S. 651 -1980.

M-72. Wall Peg Rail:

72.1. The aluminium wall peg rail shall have three aluminium pegs of approved quality and size. It shall be fixed on leak wood plank of size 450 mm. x 75 mm. x 20 mm. The teakwood shall be French polished or oil painted as specified.

M-73. G.I. Water Spot:

73.1. The G.I. pipes of 40 mm. dia shall be of medium quality and specials shall be of 'R' brand or equivalent brand of best approved quality.

73.2. The pipe shall have length as required for the thickness of wall in which it is fixed, and at the outside end tee and bend cut at half the length shall be provided and at other end coupling shall be provided to have better fixing. The water spout shall be provided as per detailed drawing or as directed.

M-74. Asbestos Cement Pipe (A.C. Pipe):

74.1. The asbestos cement pipe of diameter as specified in the description of the item shall conform to I.S. 1626-1980. Specials like bends, shoes cowls, etc. shall conform to relevant

Indian Standards. The interior of pipe shall have a smooth finish, regular surface and regular, internal diameter. The tolerance in all dimensions shall be as per I.S. 1626-Part-11980.

M-75. Corydon Ball Valve:

75.1. Ball valve of screwed type including polthylene float and necessary lever etc. shall be of the size as mentioned in the description of item and shall conform to I.S. 1703-1977.

M-76. Bitumen Felt For Water Proofing And Damp Proofing:

76.1 Bitumen felt shall be on the fibre bases and shall be type 2, self-finished grade-2 and shall conform to I.S. 1322-1970.

M-77 Select Earth:

77.1. The selected earth shall be that obtained from excavated material or shall have to brought from outside as indicated in the item. If item does not indicate anything, the selected earth shall have to be brought from outside.

77.2 The selected earth shall be good yellow soil and shall be got approved from the Engineer-in-charge. La no case black cotton soil or similar expansive and shrinkable soil shall be used. It shall be clean and free from all rubbish and perishable materials, stones or brick bats. The clods shall be broken to a size of 50. Mm or less, Contractor shall make his own arrangement at his own cost for land for borrowing selected earth. The stacking of material shall be done as directed by the Engineer-in-charge in such a way as not to interfere with any constructional activities and in proper stacks.

77.3 When excavated material is to be used, only selected stuff got approved from the Engineer-in-charge shall be used. It shall be stacked separately and shall comply with all the requirements of selected earth mentioned above :

M-78. Barbed Wire:

78.1 The barbed wire shall be of galvanized steel and it shall generally conform to I.S. 278-1978. The barbed wire shall be of type-I whose nominal diameter for line wire shall be 2.5 mm. and point wire 2.24 mm. The nominal distance between two bars shall be 75 mm. unless otherwise specified in the item. The barbed wire shall be formed by twisting together two line wires, one containing the barbs. The size of the line and point wires and barb spacing's shall be as specified above. The permissible deviation from the nominal diameter of the line wire and point wire shall not exceed ± 0.08 mm.

78.2 The barbs shall carry four points shall be formed by twisting two point wires, each two turns, lightly round one line wire, making altogether four complete turns. The barbs shall be so finished that the four points are -set and looked at right angles to each other. The barbs shall have a length of not less than 13 mm. and not more than 18 mm. The point, shall be sharp and cut at an angle not greater than 35 degree of the axis of the wire forming the barbs.

78.3 The line and point wire shall be circular section free from scale and other defects and shall be uniformly galvanized. The line wire shall be in continuous length and shall not contain any weld other than those in the rod before it is drawn. The distance between two successive splices shall not be less than 15 meters.

78.4 The lengths per 100 Kg. of barbed wire
I.S. type I shall be as under Nominal 1000 meter
Minimum 834 Meter Maximum 1066 Meter.

M-79 Water Bound Distemper

79.1 It shall be from Asian, Berger or Asian or equivalent as approved by Architect. It shall conform to relevant IS codes.

79.2 It can be in powder form or liquid form as per the manufacture's specification. If it is in powder form it can be prepared by adding warm water in the proportion recommended by the manufacture.

79.3 It shall be applied by the conventional distemper brush to all plastered surface. It shall be applied by the conventional distemper brush to all plastered walls, ceilings and woodwork. Priming coat shall be applied before applying the paint.

M-80 Plastic Emulsion Paint

80.1 Plastic emulsion paint shall conform to IS: 5411 of approved brand and manufacture and of the required shade shall be used.

80.2 The plastic emulsion paint is not suitable for application on external, wood and iron surface and surfaces which are liable to heavy condensation. These paints are to be used on internal surfaces except wooden and steel.

M-81 Cement Paint

81.1 The cement paint shall be (conforming to IS: 5410) of approved brand and manufacture.

81.2 The cement paint shall be brought to the site of work by the contractor in its original container in sealed condition. The material shall be brought by the contractor at a time in adequate to suffice for the whole work or at least for a fortnight's work. The material shall be

kept in joint custody of Architect and engineer-in-charge. Empty tins shall not be removed from the site of work, till this item of work has been completed and passed by the engineer-in-charge.

81.3 It shall be manufactured from selected range of raw materials and a special cement, so that it shall be suitable for both indoors and outdoors. It shall be suitably used on concrete renderings, cement/sand renderings, cement/lime/sand renderings, asbestos sheets, fiber boards, brickwork, etc. It shall offer matt finish. It shall require no primer and shall be water washable. It shall offer a covering capacity as per manufacturer's specification, depending on the surface and shade used. It shall preferably not be applied under direct sunlight to avoid patchy effect.

M-82 Textured wall finish

82.1 It shall be from Bakelite Hilum Ltd or equivalent as approved by Architect or engineer-in-charge. It shall conform to relevant IS codes. It shall be granules, flakes, granite flakes and granules and flakes mix. 82.2 It shall be of two component or one component as specified by the Architect or engineer-in-charge. It shall be easily applicable by trained applicators. The single coat shall be 1.5 mm thick as specified in the item description. It shall be weather and fade resistant, water and damp resistant, durable and highly washable. It shall be acid and alkali resistant, high abrasion resistant, non-toxic and shall be capable of taking any shape. It can be applied on wide variety of surface like cement mortar, plywood, plaster board, AC sheet, Asbestos board, gypsum plaster or any other materials, to get homogenous layer.

82.3 It shall be water washable to avoid water contamination, incombustible and flexible. It shall be good fire-resistant, anti-fungal, good impact resistant having adhesion strength more than 8 kg./cm². There shall not be any development of hair line cracks and no peeling off shall occur, after the maximum drying time of 4 hours and curing period of 2 days.

M-83 Silicone paint

83.1 It shall be of the best quality, like Wacker, GE Silicone, Pixilate, Dow Corning or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS Codes.

83.2 It shall be prepared by mixing Silicone and Epoxy. It shall be applied on dry as well as damp surfaces. It shall be non-toxic and odorless, so shall be suitable for drinking water structures also. It shall render the surface impervious to water and shall prevent water penetration. It itself shall penetrate into the structure and shall form a strong film on the pores of the structure surface, making the surface watertight, non-toxic and erosion free.

83.3 It shall be water washable. Before use, the hardener of the Silicone Epoxy shall be mixed with resin and thinned with water, in the proportions described by the manufacturer. It shall be applied with a suitable spray gun with a fine nozzle. An overlap of 25 to 30 cm. shall be preferred. It shall be semitransparent but on drying it shall become transparent.

M-84 Synthetic Enamel Paint

84.1 Synthetic Enamel paint shall conform to IS: 2933. It shall be from Nerolac, Berger, Asian Paints or equivalent. It shall offer variety of finishes like Glossy, Semi-glossy, Pearl luster and Matt finish.

84.2 It shall be applied either by brush, roll or spray. It shall have a covering capacity of as specified by the manufacturer, depending on the surface to be painted. It shall be used both on metal and wood surfaces.

84.3 It shall have a viscosity of application of 30 to 40 seconds, if brush or rollers are used and 20 to 25 seconds, if spraying is done. The drying time shall however vary with the ambient temperature and humidity.

M-85 Acrylic Paint

85.1 It shall be from Asian Paints, ICI, and Berger, Nerolac or equivalent as approved by the Architect. It shall conform to the relevant IS Codes.

85.2 It shall be used on both interiors and exteriors on all different types of plaster, wooden surfaces, stone, brickwork, asbestos cement sheets, hard and soft boards, etc. as specified in the drawing. It shall render rich smooth finish and shall provide a tough film that forms a suitable protection against all elements.

85.3 It shall be water thin able. On interior surface it shall be applied after one coat of cement primer and in case of exterior surface it shall be applied on waterproof cement coating. On a

new but highly absorbent surface, a thin coat of the paint shall be applied by adding two parts of water by volume to two parts of Acrylic Emulsion by volume. On previously painted surfaces, one coat of the acrylic paint shall be applied by thinning four parts of the emulsion with one or two parts of water. It shall be applied by brush, roller or spray. It shall have a covering capacity as per manufacture's specification, depending on the surface and shade used. It can be washed to remove the day-to-day dirt, after the surface has been painted, minimum for a month. It should be non-flammable. For the best performance of paint proper washing and cleaning of all algal and fungal growth at regular intervals at six months is required.

M-86 French polish

86.1 Pure Shellac conforming to IS: 16 varying from pale orange to lemon yellow color free from resin or dirt shall be dissolved in methylated spirit at the rate of 140 gm. of Shellac to 1 liter of spirit. Suitable pigment shall be added to get the required shade.

86.2 Readymade polish conforming to IS: 348 can also be used. The French polish so prepared shall Conform to IS: 348.

M-87 Aluminum Sheets

87.1 It shall be of the best quality and from reputed manufacturer like Hidalgo or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to IS: 1254, in all respects. The aluminum alloys used in the manufacture of the sheets shall conform to IS: 737.

87.2 The sheets shall be extremely light with high-strength-to weight ratio. Having a density of about 2.70 gms/cm³. It is corrosion resistant in almost any kind of environment. Even in highly-corrosive industrial environments, it should be resistant to fumes and vapors of organic compounds and to chemicals like ammonia, carbon-dioxide and acids like hydrochloric acid, nitric acid and sulphuric acid. This corrosion resistant property gives the metal a long life and keeps it looking good throughout its life the sheets shall be non-fragile and shall be exceptionally durable. As aluminum reflects a high proportion of the radiant heat, the sheets provide excellent insulation when used for cladding/roofing. The sheets shall be non-combustible, non-flammable and non-sparking. As aluminum is elastic, the sheets shall offer high resistance to denting and shall be shatter-proof. Co-efficient of linear expansion of aluminum is 0.000024 per co. and therefore the lateral expansion of the sheets shall be readily accommodated in the corrugations. The sheets shall offer no health hazard and shall be totally hygienic. Aluminum is a good conductor of heat, its high reflectivity of radiant heat and light (75 to 80 per cent when new, 60 per cent after several years) keeps the interiors of an aluminum building from five to eight degree Celsius cooler in summer while its low emission rate cuts heat loss during winter.

87.3 It shall be available in trapezoidal and rounded corrugations and shall be extensively used for various Industrial buildings, Warehouses, Aircraft hangers, Power plants, Storage sheds, Bunk houses etc. It shall be innovatively used as interior partitions, wall panels, false ceiling etc.

M-88 PVC Sheet

88.1 PVC sheet should be of Finolex or equivalent as sample approved by Architect and engineer-in-charge. PVC sheet should be corrosion resistant and chemical resistant. It should resist actions against chemicals like mineral acids, alkalis, plating solutions, pickling solutions, paper making chemicals, most inorganic compounds, alcohols, aliphatic hydrocarbons, glycols, amines and phenols in both liquid and vapor form.

88.2 It should be hygienic, virtually maintenance free, UV resistant, highly flexible so that it can be bent perpendicular or parallel to corrugation. It should be light weight than it can be easily handled and transported.

80.3 It should possess excellent thermal insulation and rust proof to make it ideal for coastal region.

80.4 It should be fire retardant it should be as per the sample approved by engineer-in-charge. It should be such type that it can be used in heavy industries, factories and warehouses, agricultural and food processing industries and for coastal construction

M-89 PVC Water stops

89.1 The PVC water stop shall be of approved make, as approved by the Architect and Engineer-in-charge.

89.2 It shall have optimum resilience, high elasticity & stretch strength, immune to corrosion, excellent weather resistance. They shall be manufactured to safeguard against hydrostatic pressure, water seepage, expansion or contraction of joints and to take care of any deflection or displacement arising due to change in temperature or settlement of foundation to eliminate danger of cracks.

89.3 They shall be effective in tropical climate having high mechanical strength, good ageing, longer life, shall be unaffected by acids, alkalis, metal salts and other chemicals. It shall not be hazardous and shall have fire retardant properties. It shall absorb less water than rubber, shall work as water tight seal but shall allow safe passage of seepage water and shall withstand high hydrostatic pressure. It shall be easily welded and can be installed easily, having high tensile strength and shall be capable of bearing heavy shocks arising due to turbines, earthquakes, floods etc.

89.4 It shall withstand a minimum hydrostatic pressure of 30 m. high column of water.

89.5 The selection criteria of water stop depends upon the hydrostatic pressure, however the following points should be kept in mind:

- 1) Where substantial expansion/contraction of joints takes place, Dumb Bell type shall be used.
- 2) Where a firm grip in concrete is desired, serrated types should be used.
- 3) The overall width of the water stop should not be greater than the thickness of concrete.
- 4) The distance from the face of the concrete to the water stop must not be less than half the width of the water stop.
- 5) The width of the water stop must be at least 6 times the largest aggregate used for satisfactory compaction.

89.6 The prior approval of selected size and type of water stop shall be taken from the Architect and Engineering-charge, before use.

M-90 Admixtures for Mass Concrete and Mortar

M-90A Joint Sealant:

90A.1 the sealant shall be of best quality and from manufacturer like CICO, MC-BAUCHEMIE, PIDILITE, HMP or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

90A.2 it shall be a two component poly sulphied rubber joint sealant, based on a low molecular weight polymer. It should not contain chlorides or other corrosive substances.

90A.3 It shall be used for sealing joints in water retaining structures, roofs, external walls, cladding, floors, partitions, ceilings etc. It shall have excellent property to adhere most of building materials like Aluminum, Stainless Steel, Glass, Concrete, Marble, Stone, Brick, Masonry block, Plaster, Ceramic and quarry tiles, Timber etc. The modulus of elasticity of the sealant shall be less than 0.16 MPa, +10% at 100% elongation. The shore "A" hardness of the sealant shall be 22+3 @ 25OC. The operating temperature range for the sealant shall be -25OC to 80OC. The permanent dynamic movement capability of the sealant shall be +25%. The tensile strength of the sealant shall not be less than 0.4 MPa. The optimum width/depth ratio shall be 2:1. The Sp.gr. of the sealant shall be 1.6 kg/lit. The sealant should be capable to resist attack of water, sunlight, oxidation, corrosive fumes, oils, petrol, diluted acids and alkalis, salt spray, aliphatic and aromatic solvents and shall not contain tar or bituminous ingredients. 89A.4 it shall possess the properties like 550% elongation at break, non-toxicity when fully cured, no staining and shrinkage less than 1%. The trafficable strength shall be achieved within 24 hours and full at 7 days (at 25OC & 250% RH). It shall possess excellent coverage capacity and more strength at low dry temperatures.

M-90B Abrasion Resistant Industrial Flooring Aggregate:

90B.1 the flooring aggregate, shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

90B.2 the flooring aggregate shall be a factory processed and specially graded non-oxidizing, non-magnetic and chemically inert metallic flooring aggregate, free from oil and grease.

90B.3 it shall be used as a surface hardener to concrete floors. It is recommended for Factory floors, Warehouses, Hangers, Car parks and such other areas, subjected to heavy vehicular

traffic. It shall also be used on open and continuously wet surfaces. The flooring aggregate shall build in wear resistance and shall produce high abrasion resistant floor surface. It shall impart extreme surface density and shall offer resistance to oil and water penetration. It shall provide a non-rusting floor surface which is easy to maintain.

90B.4 It shall be used with cement in the ratio, as per the manufacturer's instructions and spread evenly on the surface to be treated, at the rate depending on the type of floor. The flooring aggregate shall be spread when the surface of the concrete floor is still fresh, i.e. as soon as the surface water has evaporated and then trawled, in stages, to bring about a uniform and smooth finish.

M-90C Concrete Hardener and Dustproofed:

90C.1 The Concrete hardener and dustproofed, shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code. 90C.2 It shall have a specific gravity of 1.18 and shall be applied on concrete floors, at the rate of at least 25 let's per 100 m². Per coat. A total of three coats shall be applied for permanently hardened concrete floor, with increased abrasion resistance, increased surface density, and increased resistance to chemical attack and to eliminate dust accumulation. Drying time of 4-6 hours for each coat shall be allowed before the floor is put to use or is applied with another coat of the product. Precautions shall be taken while using the product, to avoid contact with eyes and open wounds and to work in good ventilation. After application, the affected parts shall be washed copiously. It shall not be stored for a period of more than 2 months before use.

M-90D Water Repellent Coating:

90D.1 The Water repellent coating, shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

90D.2 Water repellent coatings for exterior exposed surfaces shall be acrylic resin based, having a Flash point of approx. 400C and specific gravity of 0.95.

90D.3 it shall be suitably used for concrete, brick, stone and plastered surfaces preventing moisture penetration and thus any damage to the interiors. It shall be quick acting, long lasting, invisible i.e. colorless so as to maintain the original color of the surface treated. It shall impart sealing characteristics so that the treated surface becomes stain and dust free. The coating itself shall not darken or turn yellow with age.

M-90E Accelerating, Water Reducing Admixture and Plasticizer:

90E.1 The Accelerating, Water reducing admixture and plasticizer, shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

90E.2 It shall be in liquid state with a specific gravity of 1.30 and complying with ASTM C-494 Type E, IS : 9103 & IS : 2645. It shall accelerate the setting and hardening of the concrete mix, thereby achieving higher early age strength. It shall reduce the water content of the concrete without affecting its workability. It is useful for pre-cast/pre-stressed works, structural concrete works, floors, roads, runways, paving etc. It shall be used at the rate instructed by the manufacturer, with cement, depending on the amount of acceleration of hardening required. It should be compatible to all types of cement.

M-90F Retarding, Water Reducing Admixture and Plasticizer:


90F.1 The Retarding, water reducing admixture and plasticizer, shall be of best quality and from manufacturer like CICO, Feb Rife or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

90F.2 It shall be in liquid state with a specific gravity of 1.22 and complying with ASTM C-494 Type B & D, IS : 9103, CRD-C87 Type B & D, BS 5075 Part 1. It shall be added to the concrete mix during the mixing process, at the same time as the water or the aggregates. No extension of normal mixing time is necessary. It shall extend the period of time as to placing the concrete and compacting, i.e. delay the initial and final setting time. It shall help to spread the heat of hydration over a longer period of time. It shall give a highly workable concrete

with a low W/C ratio. It shall be used at the rate instructed by the manufacturer, with cement, depending on the amount of acceleration of hardening required. It should be compatible to all types of cement.

M-91 Corrugated GI Sheet

91.1 CPWD specification clause no. 12.1.1, 12.1.2 shall be followed.



TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM.

1. SCOPE OF WORK

The scope of work covers the supply, installation, erection testing, commissioning of followings :

- a) Internal hydrant system.
- b) External hydrant system.
- c) Related piping with all accessories.
- d) All type of valves, connections, headers.
- e) Hydrant valves, hose reel, hose pipes, Fire hose cabinets etc.
- f) Electrical and diesel operated Firefighting pumps with all accessories.
- g) Electrical works, Panels, cables and earthing.
- h) Fire extinguishers.
- i) All other allied and necessary equipment and accessories to complete the system up to the satisfaction of engineer-in- charge and for proper functioning of the entire system.

It will be the responsibility of the contractor to get all **approval and completion certificate** from the Local Fire Authorities without which the work will not be considered complete and will not be taken over. The contractor shall bear all the expenses required to obtain these certificates. Nothing extra will be paid for the work done and follow up by him in this regard. However, any statutory fees paid by the contractor shall be reimbursed by the client on depositing the proper receipt.

In the interpretation of agreement the order of descending importance for any ambiguity or discrepancy shall be as follows -

- a) Schedule of quantities.
- b) Specials conditions, specification of contract and drawings.
- c) General conditions of contract.

The complete installation of Fire Fighting System shall strictly confirm to the minimum specifications and guidelines given in NBC – 2005 (part IV), IS : 15105 for sprinkler system, IS : 13030 for external hydrant system, other relevant IS code of practice.

The codes of National fire protection association (NFPA) of USA shall be used as a general guide for good engineering practice, design and workmanship. However, certificate of compliance to NFPA codes will not be required.

2. FEE AND PERMITS

It will be the responsibility of the contractor to get all approval and completion certificate from the Local Fire Authorities without which the work will not be considered complete and will not be taken over. The contractor shall bear all the expenses required to obtain these certificates. Nothing extra will be paid for the work done and follow up by him in this regard. However, any statutory fees paid by the contractor shall be reimbursed by the client on depositing the proper receipt.

3. GUARANTEES / DEFECT LIABILITY PERIOD

- a) The contractor shall provide guarantee against manufacturing defects for months from the date of actual completion or complete and satisfactory handing over to the Client whichever is later.
- b) In the event of failure of any particular part of any equipment more than three times during the guarantee period. It shall not be repaired but the complete part shall be replaced by the contractor and the guarantee for this particular part shall be extended by one year from the date of last replacement.
- c) In case it is found that the above mentioned failure is due to some connected part of the equipment, that part shall also be rectified or replaced by the contractor to avoid such failure. The guarantee for such replaced part shall be extended by one year from the date of replacement.
In the event of failure of any particular equipment which fails more than three times during the guarantee period as mentioned in clause-b above, the contractor shall replace at his own cost that equipment with another equivalent make as approved by the consultant/engineer-in-charge.
Manufacturer's/Contractor's guarantee as mentioned in clause-b above for such Replaced equipment shall be kept valid at least for one year from the date of last replacement.
- d) For electrical motors during the guarantee periods in case some important part of motor like starter winding shaft bearing squirrel cage, motor etc. become defective the guarantee shall cover their complete replacement and no repairs shall be allowed.

4. SITE CONDITIONS

It is assumed that before tendering the Contractor would have visited the site and familiarized himself with all the local conditions and means of transportation and communications. No claim of whatsoever nature would be entertained at a later date on account of the Contractor's ignorance of the local conditions.

5. WORKMANSHIP

The workmanship shall be best of its kind and shall conform to the specifications, as below or Indian Standard Specifications in every respect or latest trade practices and shall be subject to approval of the Architects/consultants. All materials and/or Workmanship which in the opinion of the Engineer is defective or unsuitable shall be removed immediately from the site and shall be substituted with proper materials and / or workmanship forthwith.

All electrical works shall be carried out only by those Contractors who are licensed by the concerned local authorities to execute this type of work.

6. RATES

The rates mentioned in the schedule of quantities / to be quoted for any particular item by the tenderer are / shall be inclusive of the cost of material, erection, connection, testing, labour, supervision, tools, plant, transportation, storage, insurance, excise duty, local taxes, contingencies, breakage, wastage and all other sundries for execution at any level, depths, leads and height. Nothing extra shall be payable to him on these account.

The rate shall also be inclusive of cutting holes, making chases in RCC or brick, making good the same, providing sleeves for crossing of pipes, hangers for supports etc. No claim for extra would be entertained on this account.

7. DISCREPANCIES IN THE DRAWINGS

If there is any discrepancy due to in-complete description, ambiguity or omission in the drawings and other documents relating to this Contract found by the Contractor either before starting the work or during execution or after completion, the same shall be Immediately brought to the attention of the Architect/Consultant and his decision would be final and binding on the Contractor.

8. MATERIALS

All materials to be supplied by the Contractor shall be new, best of their kind and shall confirm to the latest Indian standards. All packed items shall arrive at site in original packing only. Any items found defective or damaged shall be replaced by the Contractor at his own expenses.

9. INSTRUMENTS FOR MEASUREMENT AND TESTING

The Contractor shall provide, free of cost, all equipment, instruments, labour and all other allied assistance required by the Architect/Consultant or their representatives for measurement and testing of the works.

10. UP-KEEP OF THE SITE

It shall be the responsibility of the Contractor to clear away, from time to time all debris and excess material generated by the activities of his workers.

11. PROTECTION

All work shall be adequately protected, to the satisfaction of the Architect, so that the whole work is free from the damage throughout the period of construction up to the time of handing over.

Before handing over the work, the Contractor shall clean all elements of the complete installation, remove plasters, stickers, rust stains and all other foreign matter and leave every part in acceptable condition and ready for use to the satisfaction of the Architect/Consultant.

12. SAFETY CODES AND LABOUR REGULATIONS

- (i) In respect of all labour employed directly or indirectly on the work for the performance of the firefighting contractor's part of work, the contractor at his own expense, will arrange for the safety provisions as per the statutory provisions, B.I.S recommendations, BOCOW (building & other construction workers) act, workman's compensation act, and instructions issued from time to time. Failure to provide such safety requirements would make the tenderer liable for penalty for Rs. 200/- for each violation. In addition the Engineer-in-charge, shall be at liberty to make arrangements and provide facilities as aforesaid and recover the cost incurred thereon from the contractor.
- (ii) The contractor shall provide necessary barriers, warning signals and other safety measures while laying pipelines, cables etc. or wherever necessary so as to avoid accident. He shall also indemnify client against claims for compensation arising out of negligence in this respect. Contractor shall be liable, in accordance with the Indian Law and Regulations for any accident occurring due to any cause. The client shall not be responsible for any accident occurred or damage incurred or claims arising there from during the execution of work. The contractor shall also provide all insurance including third party insurance as may be necessary to cover the risk. No extra payment would be made to the contractor due to the above provisions thereof

13. WORKS TO BE ARRANGED BY THE CLIENT

Unless otherwise specified in the tender documents, the following works shall be arranged by the Client:

- (i) Space for accommodating all the equipments and components involved in the work
- (ii) One point metered Power supply and Water supply.

14. WORK TO BE DONE BY THE CONTRACTOR

Unless otherwise mentioned in the tender documents, the following works shall be done by the contractor and therefore, their cost shall be deemed to be included in their tendered cost- whether specifically indicated in the schedule of work or not :-

- I. Foundations for equipments including foundation bolts and vibration isolation spring/pads,
- II. Suspenders, brackets and floor/ wall supports for suspending/supporting pipes.
- III. Suspenders and/or cable trays for laying the cables.
- IV. Excavation and refilling of trenches in soil wherever the pipes are to be laid directly in ground, including necessary base treatment and supports.
- V. Sealing of all floor slab/wall openings to be provided by the Client for pipes and cables, from fire safety point of view, after laying of the same. (Client's scope)
- VI. Painting of all exposed metal surfaces of equipments and components with

Appropriate colour.

- VII. Making openings in the walls/ floors/ slabs or modification in the existing openings wherever provided for carrying pipe line, cables etc.
- VIII. All electrical works including cable/wires, earthing etc. beyond power supply made Available by the contractor.
- IX. Making good all damages caused to the structure during installation, and restoring Same to their original finish.

- X. Approval from local fire authorities as may be required as per local bye-laws. (The contractor's responsibility shall be limited to the work executed by him.)

15. COMPLETENESS OF THE TENDER, SUBMISSION OF PROGRAMME, APPROVAL OF DRAWINGS AND COMMENCEMENT OF WORK

Completeness of the tender:-

All sundry equipments, fittings, assemblies, accessories, hardware items, foundation bolts, supports, termination lugs for electrical connections, cable glands, junction boxes and all other items which are useful and necessary for proper assembly and efficient working of the various equipments and components of the work shall be deemed to have been included in the tender, irrespective of the fact whether such items are specifically mentioned in the tender or not.

Submission of programme:-

Within fifteen days from the date of receipt of the letter of award, the successful tenderer shall submit his programme for submission of drawings, supply of equipment, installation, testing, commissioning and handing over of the installation to the Engineer-in-Charge. This programme shall be framed keeping in view the building progress and the priority fixed by Engineer in-charge. Items like piping etc. that directly affect the building progress shall be given priority. Hose pipes, branch pipes, first aid hose reel pipes shall be supplied just before commissioning the system.

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Commencement of Work:-

The contractor shall commence work as soon as the drawings submitted by him are approved either in full or in part as the case may be.

16 DISPATCH OF MATERIALS TO SITE AND THEIR SAFE CUSTODY

The contractor shall dispatch materials to site in consultation with the Engineer-in-charge. Suitable lockable storage accommodation shall be made available free of charge temporarily. Watch and ward however, shall be the responsibility of contractor. Programme of dispatch of material shall be framed keeping in view the building progress. Safe custody of all machinery and equipment supplied by the contractor shall be the responsibility of the contractor till final taking over by the client.

All material samples should be approved from the client before dispatch to the site.

17 CO-ORDINATION WITH OTHER AGENCIES

The contractor shall co-ordinate with all other agencies involved at the site of work so that the work of other agencies is not hampered due to delay in his work. Piping, cabling or any other work, which directly affect the progress of work of other agencies, shall be given priority.

18 CARE OF THE BUILDING

Care shall be taken by the contractor during execution of the work to avoid damage to the building. He shall be responsible for repairing all such damages and restoring the same to the original finish at his cost. He shall also remove all unwanted and waste materials arising out of the installation from the site of work from time to time.

19 COLOUR SCHEME FOR THE EQUIPMENT AND COMPONENTS.

The entire metal work related to fire fighting above ground level shall be painted with red colour shade No. 536 of IS: 5.

20 INSPECTION AND TESTING

Initial Inspection and testing

- (i) Initial inspection of materials and equipments at manufacturer's works shall be done by the Engineer-in-Charge or his representative. For item/ equipment requiring initial inspection at manufacturer's works, the contractor will intimate the date of testing of equipments at the manufacturer's works before dispatch. The contractor shall give sufficient advance notice regarding the dates proposed for such tests to the client's representative(s) to facilitate his presence during testing. The Engineer-in-charge at his discretion may witness such testing. Material / Equipments will be inspected at the manufacturer/ authorized dealer's premises, before dispatch to the site by the contractor.
- (ii) The client also reserves the right to inspect the fabrication job at factory and the successful tenderer has, to make arrangements for the same.
- (iii) The materials duly inspected by Engineer-in-Charge or his authorized representative shall be dispatched to site by the contractor.
- (iv) No additional payment shall be made to the contractor for initial inspection/testing at the manufacturer's works by the representative of the Engineer-in-Charge. However, the client will bear the expenses of its representative deputed for carrying out initial inspection/testing.

Final Inspection and testing

Final Inspection and testing will be done by the Engineer-in-Charge or his representative. The necessary test certificates shall be submitted before dispatch of material.

The installation will be offered for inspection by local bodies fire authority. The contractor or his representative shall attend such inspection from fire authority, extend all test facilities as are considered necessary, rectify and comply with all observations of the fire authority which are part of the agreement and arrange for obtaining necessary clearance certificate in favour of the client. In case the contractor fails to attend the inspection and make desired facilities available during inspection, the client reserves the right to provide the same at the risk and cost of the contractor and impose penalty for the same. The installation will be accepted by the client only after receiving clearance from Fire authority for the work executed by the contractor under the agreement.

21 SAFETY MEASURES

All equipments shall incorporate suitable safety provisions to ensure safety of the operating personnel at all times. The initial and final inspection reports shall bring out explicitly the safety provisions incorporated in each equipment.

22 TENDER DRAWINGS, DRAWINGS FOR APPROVAL AND AS BUILT DRAWINGS

Tender Drawings

The drawings appended with the tender documents are intended to show the areas for various equipments, tentative pipe routes. The equipments offered shall be suitable for installation in the spaces shown in these drawings.

Drawings for approval on award of the work / shop drawings

The contractor shall prepare and submit following drawings and get them approved from the Engineer-in-charge before the start of the work. The approval of drawings however does not absolve the contractor of his responsibility to supply the equipments/materials as per agreement. In case of any contradiction between the approved drawings and agreement the decision of the Engineer –in-Charge shall be final and binding on the contractor.

- (a) Lay out drawings of the equipments to be installed in pump room and terrace.
- (b) Drawings showing the detail of erection of entire equipments including their foundations.
- (c) Fire drawings showings the layout of entire piping, dia. and length of pipes, hydrant, air vessel, valves and isometric drawings showing connections to various equipment.
- (d) Sprinkler drawing indicating layout and sizes of pipe, location of valves, sprinklers etc.
- (e) Electrical wiring diagrams for all electrical equipments and controls including the sizes and capacities of the various cables and equipments

- (f) Dimensioned drawings of all electrical and control panels,
- (g) Drawings showing details of supports for pipes, cable trays etc.
- (h) Any other drawings relevant to the work.

As built Drawings

Three sets of the following laminated drawings shall be submitted by the contractor while handing over the installation to the Client. Out of this one of the sets shall be laminated on a hard base for display in the fire control room. In addition one set soft copy will be given on compact disc.

- (a) Installation drawings giving complete details of all the equipments, including their foundations.
- (b) Fire drawings giving sizes and lengths of all the pipes and the sizes and locations of all types of valves, and including isometric drawings for the entire piping including the pipe connections to the various equipments.
- (c) Line diagram and layout of all electrical control panels giving switchgear ratings and their arrangement, cable feeder sizes and their layout.
- (d) Control wiring drawings with all control components and sequence of operations to explain the operation of control circuits.
- (e) Schematic diagrams.

23 DOCUMENTS TO BE FURNISHED ON COMPLETION OF INSTALLATION

There sets of the following documents shall be furnished to the client by the contractor on completion of work :-

- (a) As built drawings as mentioned above
- (b) 3 sets of manufacturer's technical catalogues of all equipments and accessories.
- (c) Operation and maintenance manual of all major equipments, detailing all adjustments, operation and maintenance procedure.
- (d) Approval of drawing/scheme by District fire officer.

24 INSTRUCTION MANUAL / TRAINING

The contractor shall furnish in 3 copies details instruction and operation manual to the consultant/engineer-in-charge. The contractor shall guide owner's / client's staff for operation and maintenance of the entire installation for at least fifteen days.

The manual shall contain detailed technical data and drawings for each equipment installed, the erection, testing, operation and maintenance procedures, spare parts manual and recommended spares for 3 years period of maintenance of each equipment.

(A) TECHNICAL SPECIFICATION FOR FIRE PUMPS**1. SCOPE**

This covers the general requirements of water pumps for main fire pump and jockey pump

2. TYPE

The pumps shall be centrifugal type direct driven with a 3 phase, 415 V \pm 10%, 50 Hz., A.C. motor. The standby fire pump shall be driven by diesel engine. The pumps may be either of horizontal split casing (HSC) type with operating speed 1500 / 2900 rpm, or end suction type / solid casing or multi stage with operating speed not exceeding 3000 rpm as specified in the BOQ.

3. RATING

The main fire pumps shall be suitable for continuous operation in the system. The jockey pumps shall be suitable for intermittent operation to built up pressure in the system on account of leakage. The head and discharge requirements shall be as specified in the tender documents. The head shall be suitable for the system and shall take into consideration the pressure drops across the various components in the water circuit as well as the frictional losses.

Pump shall be capable of discharging not less than 150 percent of the rated discharge at a head of not less than 65 percent with the rated head. The shut off head shall not exceed 120 percent of the rated head.

4. MATERIAL AND CONSTRUCTION

- (i) The centrifugal pumps shall conform to IS 1520.
- (ii) The pump casing shall be of heavy section close grained cast iron and designed to withstand 1.5 time the working pressure. The casing shall be provided with shaft seal arrangement as well as flanges for suction and delivery pipe connections as required.
- (iii) The impeller shall be of bronze. This shall be shrouded type with machined collars. Wear rings, where fitted to the impeller, shall be of the same material as the impeller. The impeller surface shall be smooth finished for minimum frictional loss. The impeller shall be secured to the shaft by a key.

- (iv) The shaft shall be of stainless steel and shall be accurately machined. The shaft shall be balanced to avoid vibrations at any speed within the operating range of the pump.
- (v) The shaft sleeve shall be of bronze or gunmetal.
- (vi) The bearings shall be ball or roller type suitable for the duty involved. These shall be grease lubricated and shall be provided with grease nipples/cups. The bearings shall be effectively sealed against leakage of lubricant or entry of dust or water.
- (vii) The shaft seal shall be mechanical type, so as to allow minimum leakage. A drip well shall be provided beneath the seal.
- (viii) The pumps shall be directly coupled to the motor/diesel engine shaft through a flexible coupling protected by a coupling guard.
- (ix) The pump and motor / diesel engine shall be mounted on a common base plate fabricated from mild steel section. The base plate shall have rigid, flat and true surfaces to receive the pump and motor/diesel engine mounting feet. The pump will be perfectly aligned with the motor/engine so as to avoid any vibration during operation.

5. ACCESSORIES

Each pump shall be provided with the following accessories: -

- (a) Butterfly valves on suction and discharge (If positive suction is not provided butterfly valve at suction is not to be provided)
- (b) Reducers, as may be required to match the sizes of the connected pipe work.
- (c) Non-return valve at the discharge.
- (d) Pressure gauge at discharge side between pump and the non-return valve.

6. INSTALLATION

- (i) The pump and motor assembly shall be mounted and arranged for ease of maintenance and to prevent transmission of vibration and noise to the building structure or to the pipe work.
- (ii) The pump and motor assembly shall be installed on suitable RCC foundation. The length and width of the foundation shall be such that 100 mm. space is left all around the base frame. The height of foundation shall be so decided that the total weight of foundation block is 1.5 times the operating weigh of the pump assembly. The foundation shall be isolated from the floor by vibration isolating pads. Angle iron frame of size 35 mm x 35 mm x 3 mm shall be provided on the top edges of the foundation.
- (iii) More than one pump and motor assembly shall not be installed on a single base or cement concrete block.

- (iv) the suction/discharge pipe shall be independently supported and their weight shall not be transferred to the pump. It should be possible to disconnect any pump for repairs without disturbing the connecting pipe line.
- (v) The suitable clearance have to be provided around the fire pumps as per drawings.
- (vi) Sufficient space is to be left in front for the radiator of diesel engine for free discharge of hot air. Arrangement for discharge hot air to out side the pump house shall be provided so that hot air does not stagnate in the pump house.

7. OPERATING CONDITIONS

Fire pumps shall operate on drop of pressure in the mains header as given below. The pump operating sequence shall be arranged in such a manner to start the pump automatically but should be capable of being stopped manually by stop push buttons only.

Operating conditions for fire hydrant and sprinkler pumps

	<u>Operating Pressure “a”</u>	<u>Cut in</u>	<u>Cut out</u>
<u>a.</u>	<u>Jockey pump (Sprinkler system)</u>	<u>“a” – 1.0 Kg/Sqcm</u>	<u>“a” Kg/Sqcm</u>
<u>b.</u>	<u>Jockey pump (Hydrant system)</u>	<u>“a” – 1.5 Kg/Sqcm</u>	<u>“a” Kg/Sqcm</u>
<u>c.</u>	<u>Sprinkler pump - duty (Electric)</u>	<u>“a” – 2.0 Kg/Sqcm</u>	<u>Manual</u>
<u>d.</u>	<u>Hydrant pump - duty (Electric)</u>	<u>“a” – 2.5 Kg/Sqcm</u>	<u>Manual</u>
<u>e.</u>	<u>Hydrant / Sprinkler - Standby (Diesel)</u>	<u>“a” – 3.0 Kg/Sqcm</u>	<u>Manual</u>

Notes On Starting System

- Jockey pumps shall start and stop through pressure switch automatically.
- Jockey pump shall stop when the main pump starts.
- Main Fire pump shall start automatically on fall of pressure but stopping shall be manual.
- Diesel Fire pump shall start automatically on further fall of pressure but stopping shall be manual.

The 'Cut in' and 'Cut out' pressures shall be reconfirmed at detailed design stage.

(B) DIESEL ENGINE FOR FIRE PUMP

1. SCOPE

This covers the details of requirements of a diesel engine for main fire pump to act as standby.

2. GENERAL

The diesel engine shall be suitable for automatic operation complete with necessary automatic starting gear, battery system and shall be complete with all accessories. Both engine and pump shall be assembled on a common bed place, fabricated from mild steel channel.

3. DRIVE

The pump shall be only direct driven by means of a flexible coupling. Coupling guard shall be provided. The speed shall be as per mentioned in Respective BOQ item.

4. DIESEL ENGINE

a) Environment conditions- The engine shall be suitable to operate under the conditions of environment at site

b) Engine Rating- The engine shall be multi cylinder/vertical 4 stroke cycle, watercooled, developing suitable HP at the operating speed specified to drive the fire pump. Continuous capacity available for the load shall be exclusive of the power requirement of auxiliaries of the diesel engine, and after correction for altitude, ambient temperature and humidity for specified environment conditions. The engine rating shall be suitable to drive the pump at 150 percent of its rated discharge with at least 65 percent of rated head. The engine shall have 10% overload capacity for one hour in any period of 12 hours continuous run.

The engine shall be suitable for cold starting for which suitable heaters shall be provided in lubricating oil.

The engine shall develop full load within 15 seconds from the receipt of signal to start. The diesel engine shall conform to BS 649/IS 1601/IS 10002, amended upto date.

c) Engine Accessories- The engine shall be complete with following accessories.

- (i) Fly wheel dynamically balanced.
- (ii) Direct coupling for pump and coupling guard.
- (iii) Radiator with hoses, fan, water pump, drive arrangement and guard.
- (iv) Air cleaner dry type.
- (v) Fuel service tank with necessary pipe work.

- (vi) Pump for lubricating oil and Lub.oil filter.
- (vii) Elect. starting battery 12 V /24 V with 2 Nos. battery.
- (viii) Exhaust silencer with necessary pipe work.
- (ix) Speed Governor.
- (x) Instrument panel housing all the gauges, including Tachometer, hour meter and starting switch with key (for manual starting).
- (xi) Necessary safety controls.

d) Cooling System- The engine shall be radiator water cooled. The radiator assembly shall be mounted on the engine. The radiator fan shall be driven by the engine as its auxiliary with multiple fan belts. When half the belts are broken, the remaining belts shall be capable of driving the fan. Cooling water shall be circulated by means of an auxiliary pump of suitable capacity driven by the engine in a closed circuit.

e) Fuel System- The fuel, system shall be gravity fed from the fuel tank to the engine driven fuel pump. The engine fuel tank shall be mounted either adjacent to the engine or suitably wall mounted on brackets. The fuel filter shall be suitably located to permit easy servicing.

All fuel piping to the engine shall be with M.S. 'C' class pipe with flexible hose connections where required. Plastic tubing shall not be permitted.

The fuel tank shall be of welded steel construction (2 mm. thick) and of capacity sufficient to allow the engine to run on full load for at least 2 hours. The tank shall be complete with necessary floor mounted supports, level indicator (protected against - mechanical injury) inlet, outlet, overflow connections and drain plug and piping to the engine fuel tank. The outlet should be so located as to avoid entry of any sediments in to the fuel line to the engine.

f) Lubricating Oil System- Forced feed Lubricating Oil system shall be employed for positive lubrication. Necessary Lub. oil filters shall be provided, located suitably for convenient servicing.

g) Starting System- The starting system shall comprise necessary batteries 12 Volts /24 Volts, starter motor of adequate capacity and axle type gear to match with the toothed ring on the fly wheel. Suitable protection to protect starting motor from excessively long cranking runs shall be suitably integrated with engine protection system.

The capacity of the battery shall be suitable for meeting the needs of the starting system.

The battery capacity shall be adequate for 10 consecutive starts without recharging with cold engine under full compression.

Three attempt starting facility shall be provided. If the engine fails to start after third attempt, the engine shall be locked out and suitable audio-visual alarm shall be given to indicate engine failure.

The scope shall cover all cabling, terminals, initial charging etc

- h) Exhaust System-** The exhaust system shall be complete with residential silencersuitable for outdoor installation and silencer piping shall be extended up to 1 m above the nearest boundary wall, outside pump house duly insulated with 50 mm. thick glass wool and 1.0 mm. thick aluminum sheet cladding.
- i) Engine shut down mechanism-** This shall be manually operated and shall return automatically to the starting position after use.
- j) Governing System-** The engine shall be provided with an adjustable governor to control the engine speed within 5% of its rated speed under all conditions of load up to full load. The governor shall be set to maintain rated pump speed at maximum pump load.
- k) Engine instrumentation -** Engine instrumentation shall include the following:-
- (i) Lub. oil pressure gauge.
 - (ii) Lub. oil temperature gauge.
 - (iii) Water temperature gauge.
 - (iv) Tachometer.
 - (v) Hour meter.
- The instrumentation panel shall be suitably mounted on the engine.
- l) Engine protection devices -** Following engine protection and automatic shut downfacilities shall be provided:
- (i) Low lub. oil pressure.
 - (ii) High cooling water temperature.
 - (iii) High lub. oil temperature.
 - (iv) Over speed shut down.
- m) Pipe work-** All pipe lines with fittings and accessories required shall be provided forfuel oil, lub.oil and exhaust systems.
- n) Anti vibration mounting-** Suitable vibration mounting duly approved by engineer-in-charge shall be employed for mounting the unit so as to minimize transmission of vibration to the structure.
- o) Battery Charger-** Necessary float and boost charger shall be incorporated in thecontrol section of power and control panel, to keep the battery under trim condition. Voltmeter to indicate the state of charge of the batteries shall be provided.
- p) The engine installation shall be approved by the representative of engine manufacturer (who shall carry out after sales service under AMC).**

(C) PIPE NETWORK FOR FIRE FIGHTING SYSTEM

1. SCOPE

This covers the requirements of pipe work in firefighting installations.

2. PIPE MATERIALS

(i) Pipes shall be of the following materials.

(a) G. I. pipes of heavy duty class (B-class) conforming to IS: 1239 for sizes up to 150mm size shall be used.

(b) Welded black steel pipe, conforming to IS: 3589, for sizes greater than 150 mm. These pipes shall be factory rolled and fabricated from minimum 6mm thick M.S. Sheet for pipes upto 250 mm dia

(ii) Cadmium plated steel nuts/bolts/washers shall be used.

3. PIPE JOINTS

i) For 50 mm dia and above pipe size, Electric welding joints with V groove shall be provided in the G.I pipe work. For up to 40 mm dia, threaded joints by Teflon tape shall be provided in the G.I pipe work. Flanged joints to be provided for connections to valves, pumps, vessels etc. and also on straight lengths at suitable points to facilitate erection and subsequent maintenance.

ii) G.I..pipe laid at such locations shall be provided anti-corrosive treatment.

iii) Mild steel flanges shall be in accordance with Table - 17 of IS : 6392 i.e. "Plate Flanges for Welding" and flange thickness shall be as under. Gasket thickness shall not be less than 3 mm.

<u>Pipe dia</u>	<u>Flange Thickness</u>	<u>No. of holes</u>
<u>200 mm.</u>	<u>24 mm.</u>	<u>12</u>
<u>150 mm and 125 mm.</u>	<u>22 mm.</u>	<u>8</u>
<u>100 mm and 80 mm.</u>	<u>20 mm.</u>	<u>8</u>
<u>65 mm.</u>	<u>18 mm.</u>	<u>4</u>
<u>40 mm and below.</u>	<u>16 mm.</u>	<u>4</u>

All hardware items such as Nuts, Bolts, Washers shall be of appropriate size. Washers shall be used on both sides of the bolt.

4. SLUICE AND BUTTERFLY VALVES

Sluice valve conforming to IS:14846 or butterfly valve conforming to IS: 13095 shall be provided. All valves shall be suitable to with-stand the pressure in the system and rating shall be as per BOQ; All valves shall be right handed (i.e. handle or key shall be rotated clock wise to close the valve), the direction of opening and closing shall be marked and an open/shunt indicator fitted.

(ii) The material of valves shall be as under :

Body - Cast iron / cast steel

Disc - Stainless Steel

Seat - EPDM

(iii) Non return valves shall be swing check type in horizontal run and lift check type in vertical run of pipe or dual plate type as per BOQ.

5. STRAINERS

Stainless steel strainers shall have 1.6 mm thick screen with 3 mm perforations

6. ORIFICE PLATE

Orifice plate shall be made of 6 mm. thick stainless steel and shall have an identification tag projecting beyond any flange between which it is clamped. The orifice shall be plain central hole without burs and diameter not less than one-half of the internal diameter of the pipe to which it is fitted.

INSTRUMENTS

(i) Pressure gauge of appropriate range and 150 mm. dia size shall be provided.

(ii) The pressure gauge shall be duly calibrated before installation and shall complete with shut off valve.

7. AIR CUSHION TANK

Air cushion shall be provided on top of each riser, and shall be fabricated out of 8 mm thick M. S. Sheet. The ends shall be dished. This shall be of 250 mm. dia, 1.2 m. high and installed vertically on suitable legs. The legs shall be provided with M. S. Plate of size 75 mm x 75 mm x 5 mm at the bottom so that the legs do not puncture the roof. The legs shall be grouted in CC foundation. Flange connection shall be provided for connection with pipe. Air release valve and pressure gauge with shut off valve shall be provided. The air cushion tank shall be tested at 25 kg/cm² pressure before installation.

8. PRESSURE VESSEL TANK

Pressure vessel shall be provided inside fire pump house connected to main header of fire pumps and shall be fabricated out of 10 mm thick M. S. Sheet. The ends shall be dished. This shall be of 450 mm. dia, 2 m. high and installed vertically on suitable legs. The legs shall be provided with M. S. Plate of size 75 mm x 75 mm x 5 mm at the bottom. The legs shall be grouted in CC foundation. Flange connection shall be provided for connection with header pipe. Air release valve and pressure gauge with shut off valve shall be provided.

The pressure vessel tank shall be tested at 25 kg/cm² pressure before installation. Suitable pressure switches shall be installed for automatic operation of fire pumps.

9. INSTALLATION

- (i) The installation work shall be carried out in accordance with the detailed drawings prepared by the contractor and approved by the Engineer-in-charge.
- (ii) In pipe above ground level, expansion loops or joints shall be provided to take care of expansion or contraction of pipes due to temperature changes.
- (iii) Tee-off connections shall be through equal or reducing tees, otherwise ferrules welded to the main pipe shall be used. Drilling and tapping of the walls of the main pipe shall not be resorted to.
- (iv) Open ends of piping shall be blocked as soon as the pipe is installed to avoid entrance of foreign matter.
- (v) Piping installation shall be supported on or suspended from structure adequately. The contractor shall provide, clamps, hangers etc. in accordance with Para under pipe support
Proper lines and levels shall be maintained while installing exposed pipes.
- (vi) The Spacing of fire pipe supports for sprinkler / clevis hanger shall not be more than that specified below: -

<u>Nominal Pipes Diameter (mm)</u>	<u>Spacing between supports (meter)</u>	<u>Hanger rod diameter (mm)</u>
<u>Up to 25</u>	<u>2.00</u>	<u>8</u>
<u>32 to 50</u>	<u>2.50</u>	<u>8</u>
<u>65 to 80</u>	<u>2.50</u>	<u>10</u>
<u>100</u>	<u>2.50</u>	<u>12</u>
<u>150</u>	<u>3.00</u>	<u>16</u>
<u>200 & above</u>	<u>3.00</u>	<u>16</u>

Extra supports shall be provided at the bends and at heavy fittings like valves to avoid undue stress on the pipes.

- (vii) Anti vibration pads, springs or liners of resilient and non-deteriorating material shall be provided at each support, so as to prevent transmission of vibration through the supports.
- (viii) Pipe sleeves of diameter larger than the pipe by least 50 mm shall be provided wherever pipes pass through walls and the annular spaces shall be filled with felt and finished with retaining rings.
- (ix) (a) Vertical risers shall be parallel to walls and column lines and shall be straight and in plumb. Risers passing from floor to floor shall be supported at each floor by MS angle with clamp as per specification of pipe support
- (b) The space in the floor cut outs around the pipes work shall be closed using cement concrete (1:2:4 mix) or steel sheet, from the fire safety considerations.

taking care to see that a small annular space is left around the pipes to prevent transmission of vibration to the structure.

(c) Riser shall have suitable supports at the lowest point.

(x) Where mild steel pipes are to be buried under ground the same shall be treated in accordance with Para under anti corrosive treatment before laying. The top of the pipes shall be not less than 100 cms. below the ground level. Where this is not practicable, permission of the Engineer-in-charge shall be obtained for burying the pipes at lesser depth. Masonry or C.C. blocks shall be provided for supporting the pipes at interval in accordance with Para (vi) above. After the pipes have been laid, the trench shall be refilled with the excavated soil in layers of 20 cm. and rammed and any extra soil shall be removed from the site of work by the contractor.

(xi) Underground pipe shall be laid at least 2 m. away from the face of the building preferably along the roads and foot paths. As far as possible laying of pipes under road, pavement and large open spaces shall be avoided. Pipes shall not be laid under building and where unavoidable, these shall be laid in masonry trenches with removable covers.

(xii) To facilitate detection of leak and isolation of defective portion of pipe, valves shall be provided in under ground pipe at suitable locations. As far as possible such valves shall be provided over ground. If the valves are to be provided below ground, suitable masonry chamber with cover plate shall be provided. Locations where vehicles can pass shall be avoided for provision of valve below ground.

(xiii) Pipe over ground shall be painted in red colour shade No 536 of IS : 5 Suitable identification shall be provided to indicate the run of under ground pipe where the route of underground pipe cannot be ascertained from the location of yard hydrant/isolating valves.

(xiv) It shall be made sure that proper noiseless circulation is achieved in the system If proper circulation is not achieved due to air-bound connections, the contractor shall rectify the defective connections. He shall bear all the expenses for carry out the above rectification, including the tearing up and refinishing of floors, walls etc. as required.

(XV) Thrust blocks shall be installed for under ground pipe line wherever there is a change in the direction / size of the pipe line or the pressure line diagram, or when the pipe line ends at a dead end and at locations determined by the engg-in-charge. If necessary, thrust blocks may be constructed at valves also. Thrust blocks (1:2:4 cement concrete) shall be constructed taking into account the pipe size, water pressure, type of fitting, gravity component shell when laid on slopes and the type of soil.

10. PRESSURE TESTING

i All piping shall be tested to hydrostatic test pressure of at least the 1.5 times of operating pressure, but not less than 15 kg./sq.cm. for a period not less than 24 hours. All leaks and defects in joints revealed during the testing shall be rectified to the satisfaction of the Engineer-in-Charge.

ii Piping repaired subsequent to the above pressure test shall be re-tested in the same manner.

- (c) System may be tested in sections and such sections shall be securely capped.
- (d) pressure gauges may be capped off during pressure testing of the installation.

11. ANTI-CORROSIVE PROTECTION ON UNDER GROUND PIPE

Corrosion protection tape shall be wrapped on M. S. Pipes to be buried in ground. This corrosion protection tape shall comprise of coal tar/asphalt component supported on fabric of organic or inorganic fiber and minimum 4 mm. thick and conform to requirement of IS : 10221-Code of practice for coating and wrapping of under ground mild steel pipe line. Before application of corrosion protection tape all foreign matter on pipe shall be removed with the help of wire brush and suitable primer shall be applied over the pipe thereafter. The primer shall be allowed to dry until the solvent evaporates and the surface becomes tacky. Both primer and tape shall be furnished by the same manufacturer. Corrosion protection tape shall then be wound around the pipe in spiral fashion and bounded completely to the pipe. There shall be no air pocket or bubble beneath the tape. The overlaps shall be 15 mm. and 250 mm. shall be left uncoated on either end of pipe to permit installation and welding. This area shall be coated in situ after the pipe line is installed. The tapes shall be wrapped in accordance with the manufacturer's recommendations. If application is done in cold weather, the surface of the pipe shall be pre- heated until it is warm to touch and traces of moisture are removed and then primer shall be applied and allowed to dry.

12. PIPE SUPPORTS

For installing pipes vertically or horizontally inside the building standard pipe supports of reputed make shall be used. Following supports shall be used.

- (i) Split pipe support clamps with rubber lining for vertical, horizontal and roof hanging.
- (ii) Clevis Hangers for horizontal supports to adjust varying heights.
- (iii) Sprinkler Hangers for horizontal supports for pipes from 15 mm dia to 150 mm dia.

Fasteners and fully threaded rods shall be used for installing the pipe supports. The sizes of pipe supports and installation shall be in accordance with manufacturers recommendations.

For pipes of size 100 mm and above, with the prior approval of Engineer-in-Charge, 50x50x6 mm MS angle iron with 'U' clamp with dash fastener may be used for supporting horizontal pipe from ceiling.

13. MEASUREMENT

Measurements of plumbing work shall be on following basis:-

- (a) Piping shall be measured along the centre line of installed pipes including all pipe fittings and accessories but excluding valves and other items for which quantities are specifically indicated in the schedule of work. No separate payment shall be made for fittings and accessories.

- (b) The rates for piping work shall include all wastage allowances, flanges pipe supports, hangers, excavation, refilling, testing, nuts and check nuts, vibration isolators, suspension where specified or required, and any other item required to complete the piping installation. None of these items will be separately measured and paid.

(D) TECHNICAL SPECIFICATION FOR FIRE FIGHTING ACCESSORIES

1. SCOPE

This chapter covers landing valves, first aid hose reels, hose pipes, branch pipes etc, which are vital tools for fire fighting.

2. LANDING VALVE

Landing valves are provided in the system for connection of hose pipes for discharging water for fighting fire by brigade or trained personnel.

a) The landing valves shall be as per I.S.: 5290

The landing valves are of single and double head outlet types as per BOQ.

c) Material of construction.

- | | | |
|------|--------------------------------|---|
| (i) | <u>Body outlet and cap etc</u> | <u>stainless steel (as per BOQ)</u> |
| (ii) | <u>Spindle</u> | <u>stainless steel for stainless steel body</u> |
| (ii) | <u>Hand wheel</u> | <u>Mild steel or cast iron.</u> |

Installation

- i) The landing valve shall be fitted to a T connection of the riser at the landing in such a way that the valve is in the centre of the internal hydrant opening and at a height of 1 M. from floor level.
- ii) The valve base shall be vertical and the valve facing out side. There should be no hindrance in operation of the handle.

3. FIRST AID HOSE REEL

First Aid Hose Reel is meant for delivering small quantity of water in early stage of fire and can be operated even by untrained personnel, and thus provides a most effective firefighting facility. It consists of a length of 20 mm (nominal internal) diameter hose tubing wrapped around a reel with water inlet pipe, stop valve and shut off nozzle. The entire assembly is mounted on a MS wall bracket and can swing 180 degree. The water inlet is connected to the riser pipe by means of 40 mm socket and 20 mm dia valve. The hose tube can be pulled out easily for the purpose of discharge of water on fire.

First aid hose reel shall be as per IS – 884. The coupling, branch pipe and nozzle shall be as per IS:8090

b) Material of Construction:-

- | | | | |
|------|------------------------------|---|---|
| (i) | <u>Hub and sides sheets.</u> | : | <u>Aluminium Alloy / Mild steel / Aluminium</u> |
| (ii) | <u>Wall Bracket</u> | : | <u>Cast iron / Mild steel.</u> |

- (iii) Hose tube (20 mm) : high pressure rubber braided hose pipe as per IS:444
- (iv) Nozzle with branch Pipe : SS (as per BOQ)

Normally M S construction is used. Other material may be used in areas having corrosive atmosphere.

- c) The water flow rate shall not be less than 24 lpm and the range of jet shall be not less than 6 meter.

d) Installation

First aid hose reel are installed in suitable size MS cabinet as per BOQ and shall be painted red as per colour shade No. 536 of IS:5. The size & location of the cabinet shall be such that it does not form an obstruction in passage/escape route.

The length of hose tube shall be 30 meter.

There shall be no obstruction in swinging the hose reel and should be installed above landing valve where provided.

The inlet valve shall be at 900 mm above floor level.

Hose reel bracket should be firmly grouted on the wall with the help of rawl bolts / fastener.

4. FIRE HOSE DELIVERY COUPLING, BRANCH PIPE AND NOZZLES

- a) These are important accessories used for fire fighting operations.

Material of Construction - Stainless Steel (as per BOQ).

c) **Delivery Hose Coupling's**

The delivery hose coupling consist of male half coupling and female half coupling. Groves are provided on outer side on both coupling for binding hose pipes with wires. In female coupling spring loaded cam tooth is provided for holding male half coupling in position. Male half coupling and female half coupling are provided on both sides (i.e. on one side male and on other side female) of hose pipes. Two or more pipes can be joined together with the help of these couplings instantaneously.

- ii) Sizes:- 63 mm nominal

- d) **Branch Pipe and Nozzle:-** Branch pipes with nozzle are mounted at the end of hose pipe. Branch pipe is properly finished and free from sharp edges. During operation, a fireman has to hold the branch pipe. One end of branch pipe is fixed with hose coupling and the other end is threaded to fit the nozzle.

Nozzle is tapered pipe with one end threaded internally which is fixed on branch pipe. The size of other end i.e. nozzle shall be 15 mm. (nominal internal diameter).

5. FIRE SERVICES INLET AND FIRE SERVICE CONNECTION

- a) These are provided for connection of fire service hose pipes for either directly pressurizing the system with their pumps or filling water in the tank from a distance. In the first case non return valve with butterfly valve shall be provided for holding water pressure. Fire service inlet shall be provided with each wet riser/down comer and the ring main. These are fixed to 150mm dia. pipe and located in MS box made of 2 mm thick mild steel with openable glass cover.
- b) These shall be as per IS: 904.

Material of Construction - Cast iron body

6. HOSE PIPES

Hose pipes shall be rubber lined woven jacketed and 63 mm in diameter. They shall conform to Type A (Re-inforced rubber lined) of IS:636. They shall be flexible and capable of being rolled. Length of hose pipe will be 15 m.

The hose pipe shall be complete with male and female coupling at the ends.

Besides keeping hose pipe with internal and yard hydrant, spare hose pipes along with branch pipes shall be kept in fire control room/pump room.

(E) TECHNICAL SPECIFICATION FOR ELECTRICAL WORK REQUIRED FOR FIRE FIGHTING SYSTEM

1. SCOPE

This covers the requirements for the electrical works associated with fighting installations, namely, motors, switch boards, power cabling, control earthing and remote control-cum-indicating panels.

2. GENERAL

- a) Unless otherwise specified in the tender specifications, all equipment and materials for electrical works shall be suitable for operations on 415 V / 240 V \pm 10%(3 phase/single phase), 50 Hz. AC system.
- b) All electrical works shall be carried out complying with the Indian Electricity Rules, 1956 as amended to date.
- c) All parts of electrical works shall be carried out as per appropriate General Specifications for Electrical works published by CPWD all amended up to date.
- d) All materials and components used shall conform to the relevant IS specifications amended to date.

3. POWER SUPPLY

Following 3 phases, 415 Volts, 50 Hz., supplies shall be made available for fire fighting installations directly from sub-station.

- (i) Normal supply for fire pumps near under ground tank.
- (ii) Essential supply for terrace pump

In buildings where power failures are likely to be for long duration, in order to facilitate operation of Jockey Pump and maintain pressure in the system, essential supply for Jockey Pump and control for diesel engine shall be made available in the pump house.

- a) Power cable of adequate size shall be laid from the sub-station directly to the switch board of above pumps. Independent supply shall be provided for water supply pumps if installed in the same pump house. The power supply for fire fighting is not used for any other purpose.
- b) If the fire pump house, is away from the sub-station building, the route of the cable shall not pass under the building or permanent structure. Cable shall be laid along the route which is safe from fire.
- c) Sufficient spare power shall always be available to drive pumping sets at all times throughout the year. Suitable capacity ACB/MCCB/Fuse Switches/Switch Fuses shall be provided in the electrical panel for extending supplies to fire pumps. Such switches shall be suitably marked with "FIRE SWITCH" and shall not be switched off without permission/intimation to appropriate authority. In case any maintenance work is to be carried out on the electrical panel where from supplies to fire pumps have been extended, alternative arrangement shall be made to ensure that power supply to fire pumps continue to be available for operation any time.

4. MOTORS

The motors shall be squirrel cage AC induction type. The motors shall be suitable for continuous duty and rating necessary to drive the pumps at 150 percent of its rated discharge with at least 65 percent rated head. The motor shall be totally enclosed fan cooled type confirming to protection clause IP 21 of IS: 4691. The class of insulation shall be 'F' having IP 55 protection. The synchronous speed shall be 1500/3000 rpm as per requirement of the pumps. The motor shall conform to IS: 325.

5. MOTOR STARTER

- a) The motor starter shall conform to IS: 1822 "Motor starters of voltage not exceeding 1000 volts" and shall be air insulated and suitable for 415 V, \pm 10% HZ, 3 phase AC supply and shall be integrated in the panel.
- b) Starter for the motor shall be direct on line (D.O.L) for motors up to and including 7.5 H.P. rating and automatic star-delta type for motors of higher rating unless otherwise specified in the tender specifications.
- c) Each starter shall be provided with the following protections :-
 - i) Thermal overload on all the three phases with adjustable settings.
 - ii) Independent single phase preventer. (current sensing type)
- d) Adequate number of extra NO / NC contacts for interlocks, indicating lamps, remote operation etc. shall be provided on the starter / contactor.
- e) Under voltage/No volt trip shall not be provided.

6. SWITCH BOARDS

- a) The main panel shall be floor mounted, free standing or wall mounted cubical type and shall be factory built fabricated by one of the approved switch board manufacturer. The board shall be fabricated from 2 mm. thick CRCA sheet and powder coated after 9 tank treatment process. The board shall be fabricated with IP

52 degree of protection. It shall be suitable for termination of the incoming cable (s) from bottom.

- b) The capacity of switch gear shall be suitable for the requirements of motor fed controlled. Starting currents shall be duly considered.
- c) MCCB's shall be used upto and including 630 amp. and ACB shall be used for 800 amp. and above ratings.
- d) All switch fuses/SDFU shall be of AC 23 duty as per IS: 4064-1978 as amend upto date. They shall be complete with suitable HRC cartridge type fuses.
- e) Switch boards shall house starters for motors with independent current sensing type single phase preventer for each starter.
- f) Volt meter with selector switch, a set of indicating lamps and fuses for voltmeter and lamps shall be provided. Ammeter with CTs, and selector switch shall provided with each motor starter. Instruments shall be flush mounted with the panel and have a class index not higher than 1.0. The instruments and accessories shall be provided whether or not specifically indicated in the tender specifications.
- g) The fabrication of switchboard shall be taken up only after the drawings for the fabrication of the same are approved by the Engineer-in-charge.
- h) Switchboards shall be fabricated as per specifications indicated in sub-para above.
- i) The layout shall be designed for convenient connections and inter-connections with the various switchgear. Connections from individual compartments to cable alleys shall be such as not to shut down healthy circuits in the event of maintenance work becoming necessary on a defective circuit.
- j) Care shall be taken to provide adequate clearances between phase bus bars as well as between phase bus bars, neutral and earth.
- k) Where terminations are done on the bus bars by drilling holes therein, extra cross section shall be provided for the bus bars. Alternatively, terminations may be made by clamping.
- l) Provision shall be made for proper termination of cables at the switchboards such that there is no strain either on the cables, or on the terminators. Cable connected to the upper tiers shall be duly clamped within the switchboard.
- m) Identification labels shall be provided against each switchgear and starter compartment, using Plastic/Aluminium engraved labels.
- n) Metallic danger board conforming to relevant IS shall be fixed on each electrical switchboard.

7. SYSTEM ANNUNCIATION

For controlling operation of pumps and indicating fault, system annunciation shall be provided. The system shall consist of relays timer, contactors etc and shall be designed to operate the fire pumps with interlocking and fault indication Annunciation window shall be provided to indicate following faults.

Low water level in UG tank. Main pump failed to start.

Main pump failed during operation.

Diesel pump failed to start.

Diesel pump failed during operation.

Supply to Main Pump failed.

Supply to Pressurization Pump failed.

Suitable sensors, differential pressure switches, monitors shall be provided at respective location, the control system shall be operational on 12 / 24 volt DC batteries of engine

starting. Battery chargers shall be provided to ensure that batteries remain charged. Batteries shall be sealed maintenance free type.

8. REMOTE INDICATING PANEL

- a) Remote indicating panel shall be provided in the fire control room. This panel shall have necessary status indication of all electrical motors.
- b) Back indication to show the status of operation of all the motors and also pressure in the system, water level in under ground and over head tank etc. shall be provided.
- c) Panel shall be fabricated from not less than 1.6 mm thick CRA sheet and powder coated after 7 tank treatment process. The panel shall be dust, damp and vermin proof. This shall be of wall mounting type. This shall be complete with necessary termination arrangements, multicore cables, tag blocks, control transformer, designation plastic labels, double earth studs etc. as required.

9. POWER CABLING

- a) Unless otherwise specified, the power cables shall be XLPE insulated, PVC outer sheathed aluminium conductor, armoured cables 1100 V grade.
- b) Power cables shall be sizes to meet the starting and running current of motors fed and shall be as approved by the Engineer-in-Charge, after taking into consideration the load, the length of cabling.
- c) Cables shall be laid in suitable metallic trays suspended from ceiling, or mounted on walls. Cable ducts shall not be provided in pump rooms. Cable trays shall be of perforated steel sheet with adequate structural strength and rigidity. Necessary supports and suspenders for cable trays shall be provided by the contractor as repaired.

10. CONTROL WIRING

- a) Control wiring shall be done using ISI marked FRLS, PVC insulated and PVC sheathed, 2.5 sq. mm, 250 V grade, armoured multi-core copper conductor cable. The control cable shall also be laid in the same manner as power cable.
- b) The number and size of the control cables shall be such as to suit the control system design adopted by the contractor.
- c) Runs of control wires within the. Switchboard shall be neatly bunched and suitably supported / clamped. Means shall be provided for easy identification of the control wires.

- d) Control wiring shall correspond to the circuitry/sequence of operations and interlocks approved by Engineer-in-Charge.

11. EARTHING

- a) Provision of earth electrodes and the type of earthing shall be as specified in Schedule of quantities.
- b) The earth work shall be carried out in conformity with CPWD Specifications for Electrical works.
- c) Metallic body of all motors, medium voltage equipments and switch boards shall be connected by two separate and distinct earth conductors to the earth stations of the installations. Looping of such body earth conductors is acceptable from one equipment, or switch board to another.
- d) The size of earth conductors for body earthing of equipments shall be 2 Nos. 25 x 3 mm G.I. strip. / 2 Nos. 32 x 6 mm G.I. strip as required & as specified in BOQ.
- e) Armouring of cables shall be connected to the body of the equipments/switch board at both the ends. Compression type glands shall be used for all such terminations in the case of PVC cables.

12. PAINTING

All panels shall be supplied with the manufacturer's standard finish painting or as indicated in the Schedule of Work.

(F) INSTALLATION, TESTING AND COMMISSIONING

1. SCOPE

This covers the requirement of Installation, testing and commissioning fire fighting system.

2. PREPARATION AND APPROVAL OF DRAWING

On award of the work, the contractor has to prepare shop drawings as per special conditions of contract and submit to the Engineer-in-charge for approval. The work is to be executed as per approved drawing. The stage of approval of drawings is therefore very important. All drawings should be carefully and critically examined before approval. The requirements of various components of fire fighting system have been described with the components of fire fighting system. However generally following points are to be taken care while examining and approving the drawings.

- a) Site survey should be carried out in detail.
- b) In addition to building plans, layout plan along with landscape plan/horticulture plan and other services plans should be consulted while deciding route of under ground pipes from pumps house and around the building.

- c) As far as possible, under ground pipe are not to be laid under road, pavement, building and along open spaces. The locations along road, foot path in earth may be preferred.
- d) The location of yard hydrants, fire services inlet and fire service connection are to be decided based on National Building code. However necessary adjustments are to be made so that these components do not become hindrance in vehicular movement and entrance to the building. Requirement of other building services are also to be given due consideration. Symmetry should be maintained for aesthetic considerations.
- e) Pipe sizes are to be decided in accordance with provision of NBC.
- f) **Pump House:-** The layout of equipment in pump house is very important from operation and maintenance considerations. The requirement of pumps and engine have been described in earlier chapters. In case other equipment 's i.e. water supply pumps etc are to be installed in the same pump house, sufficient space shall be left for them as well. The dimensioned foundation drawing of pumps should be available for marking in the pump room layout. The layout is to be prepared in such a way that it should be possible to maintain any equipment without disturbing the adjoining equipment. Electrical panels are to be installed at a location which is easily accessible near the entrance to the pump house and there should be no possibility of water dripping over or near the electrical panel.
- g) **Electrical Panel:-** Complete wiring drawing, layout etc. are to be examined to ensure that provisions of agreement are incorporated in the drawing. Sizes of various panel and mounting arrangement may be decided keeping in view ease of operation and aesthetic consideration as well.

3. INSTALLATION

The requirements of installation of various components have been described with different equipments. However following precautions are to be taken during execution of the work.

- a) The pump and motor/engine are to be perfectly aligned on the base plate so that there is no vibration during operation. All nuts, bolts, washers shall be of adequate size and galvanized.
- b) The pipe supports should be decided in a way that the weight of pipes and valves are not transferred to the pumps and supports do not cause hindrance in movement inside the pump house. As far as possible, floor supports may be provided in pump house.
- c) All valves shall be installed at a height and in a position that their operation by right hand is conveniently possible.
- d) All pressure gauges should be installed so that the dial is vertical and is visible while entering the pump house.
- e) Electrical panels should not be installed at floor level. The panels shall be sufficiently raised above ground level. If panels are to be mounted on wall, an angle iron frame shall be provided so that at least 75 mm space is left behind the panels. The panels shall be easily approachable.
- f) Cable trays are to be used for laying of power and control cable inside pump house. No cable is to be laid at floor level/in trench. Cable tray layout should give neat appearance. All cable tray shall be adequately supported from the ceiling /floor.

- g) Drain pump of suitable size as per drawings shall be installed in the sump provided in pump house. The pump shall operate automatically for which water level sensor shall be provided.
- h) In no case any structural member i.e. RCC wall, column, beam and floor are to be damaged during installation. Mechanical fasteners are to be used for grouting support. U.G. tank wall is not to be used for any support. No pipe/cable is to cross the pump house below ground level. Openings above ground level are only to be used for this purpose.
- i) The engine installation work shall be carried out in accordance with the requirement of engine manufacturer and be got approved by the manufacturer or their authorised service centre. The exhaust pipe should be suitably extended out side the pump house so that smoke does not effect nearby structure. Fuel tank shall be properly supported and located in way that the same does not cause hindrance in movement in the pump house.
- j) While excavating for laying of external pipes, suitable sign board/ barricading shall be provided to ensure that no person falls in the trench.
- k) The width and depth of trench shall be adequate for laying the pipe 1 m below ground level.
- l) No earth or any other matter is to be allowed to enter the pipes. The ends shall be kept closed always.
- m) The anticorrosive treatment is to be applied on the entire length laid under ground in accordance with specifications. The treatment is not to be damaged.
- n) Pressure testing is to be carried out in sections before filling the earth back in the trench.
- o) The earth filling is to be done in layers of 20 cm each and properly rammed so as to avoid possibility of settlement. Surplus earth / malba shall be removed from the site by the contractor.
- p) where pipes crossing road likely to have heavy traffic, additional protection over pipe shall be provided to ensure that pipe is not damaged.
- q) External hydrants and fire service connection/ inlet shall be located parallel to the nearby road/foot path so as to give proper appearance. Foundation shall be raised from below ground level and shall be properly plastered in plumb. The hydrants shall be facing the road/ approach. There shall be no obstruction in approaching the hydrants for operation.
- r) Risers shall be parallel to the wall and in plumb. Adequate supports shall be provided from the wall. Opening around the pipe in slab shall be filled with CC and finished with plaster.
- s) Internal hydrant shall be provided in the centre and facing out side for ease of operation. Sufficient space shall be provided around the handle for operation. There shall be no hindrance in moving the first aid hose reel.
- t) Terrace pipe shall be supported on CC pedestals of adequate height. The pipe route shall be such as no hindrance is created in movement at the terrace. Pipes shall be sufficiently raised above terrace. It is to be ensured that water proofing is not damaged during laying of pipes.

4. TESTING

a) Initial Testing

- i) During laying of pipes, the same shall be subjected to 15 kg./cm² hydraulic pressure for a period of 24 hours, in sections.
- ii) After completion of the work, all valves/ fittings shall be installed in position And entire system shall be tested for 24 hours at a pressure of 15 kg/ cm². The drop of pressure up to 0.5 kg/cm² shall be accepted.

b) Final Testing

- i) After completion, all operation checks shall be carried out for automatic operation of the systems. For this purpose, landing valves may be opens at different locations. The exercise shall be repeated couple of times to ensure trouble free operation of the system.
- ii) **Flow Test:-** The design flow of pumps shall be checked. The pump shall beoperated after opening a number of landing valves at different locations. Design pressure is be maintained in the pump house. Water discharge is to be measured by drop in level in UG tank for a certain period. All pumps shall be

Tested one by one. The flow rate shall be not less than as specified while maintaining the design pressure in pump house.

5. INSPECTION BY LOCAL FIRE OFFICER AND SAFETY DIRECTOR

After completion of the work and testing to the entire satisfaction of Engineer-in Charge the installation shall be offered for inspection by Chief Fire Officer or his representative. Testing as desired by the Fire Officer shall be carried out. The contractor will extend all help including manpower during testing. The observation of Chief Fire Officer which are a part of agreement shall by attended by the contractor. Nothing extra is to be paid for testing as above. If required installation are to be inspected and approved by Director Safety or his authorized representative.

6. COMMISSIONING

- a) **Flushing the System:** - Before commissioning, the entire system shall be flushed to ensure that any earth/ foreign matters which might have entered during Installation are taken out. For this, pump may be operated and valves opened at different location.
- b) As soon as the work is complete, the system shall be commissioned and made available for use. Requirement of fire fighting installations is equally important during occupation of the building. If the building is to be occupied in part, fire fighting system of building completed shall be commissioned by isolating the system of under construction portion of the building.
- c) The fire fighting system shall be maintained and manned from the very first day of its commissioning.
- d) Any defects noticed during the warranty period shall be promptly attended by the contractor and availability of the system at all time is to be ensured.

ANNEXURE – A

<u>LIST OF APPROVED MANUFACTURERS FOR FIRE FIGHTING SYSTEM</u>		
<u>S.No</u>	<u>DESCRIPTION</u>	<u>MANUFACTURER'S NAME</u>
<u>1</u>	<u>Hydrant Valves / Fire Brigade Inlet / Draw out</u>	<u>Newage / Safeguard / Padmini / Getech</u>
<u>2</u>	<u>Sluice Valves / Butterfly valves / Non Return Valves</u>	<u>IVC / Venus / Audco / Advance / SKS / CRI / AIP</u>
<u>3</u>	<u>Ball Valves</u>	<u>CIM / Leader / Audco / Advance</u>
<u>4</u>	<u>Air Release Valves</u>	<u>Newage / CIM / Leader / Sant</u>
<u>5</u>	<u>Strainers</u>	<u>Advance / Audco / SKS / AIP</u>
<u>6</u>	<u>Fire Extinguishers</u>	<u>Minimax / Cease Fire / Safex / Safeguard / UFS</u>
<u>7</u>	<u>Fire Mans Axe</u>	<u>Newage / Safeguard / Padmini / Getech</u>
<u>8</u>	<u>Air Release Valve</u>	<u>CIM / Newage / Leader / Sant</u>
<u>9</u>	<u>Pressure Reducing Valve</u>	<u>WILKINS (Newage) / AIP / SKS</u>
<u>10</u>	<u>Branch Pipe and Nozzle</u>	<u>Newage / Safeguard / Padmini / Getech</u>
<u>11</u>	<u>Galvanized Iron Pipe / MS Pipe - IS : 1239</u>	<u>Jindal (Hissar) / Prakash surya</u>
<u>12</u>	<u>G.I./ MS / M.I. Fittings</u>	<u>Unik / Jainsons</u>
<u>13</u>	<u>Ductile Iron Fittings</u>	<u>Jainsons Industries</u>
<u>14</u>	<u>MS Forged Fittings</u>	<u>VS / B M / True forge</u>
<u>15</u>	<u>Fire Hose Pipe</u>	<u>Newage / Jayshree / Padmini / Safeguard / Getech / Mitras</u>
<u>16</u>	<u>Hose Reel</u>	<u>Newage / Safeguard / Padmini / Getech / Mitras</u>
<u>17</u>	<u>XLPE / PVC Insulated Aluminium Conductor Armoured Cables.</u>	<u>Universal (Satna) / CCI / Nicco / Finolex / Polycab / Skytone / RR</u>

<u>18.</u>	<u>Copper Conductor Armoured Control Cables.</u>	<u>Universal (Satna) / CCI / Nicco / Finolex / Polycab / Skytone / RR</u>
<u>19.</u>	<u>Cable Tray</u>	<u>Indiana / Bharti / Slotco / Steelways / Skaber / Profab / Rico / Dynamic</u>
<u>20.</u>	<u>MCCB</u>	<u>ABB / L & T / Schneider / Siemens / Legrand</u>
<u>21.</u>	<u>Relays / Contactors</u>	<u>L & T / ABB / Siemens / Schneider / Automatic Electric</u>
<u>22.</u>	<u>Current Transformer</u>	<u>Kappa / Pragati / AE / Gilbert & Maxwell / Vishal</u>
<u>23.</u>	<u>Voltage Transformer</u>	<u>Kappa / AE / Gilbert & Maxwell / Vishal</u>
<u>24.</u>	<u>Ammeter /Voltmeter/ Metering Equipment's</u>	<u>L & T / Siemens / Neptune / Enercon / Automatic Electric</u>
<u>25.</u>	<u>Selector Switches</u>	<u>Kaycee / Salzer / L&T</u>
<u>26.</u>	<u>LED Lamps</u>	<u>L&T / Vaishno / Siemens</u>
<u>27.</u>	<u>Pump Control Panel</u>	<u>Tricolite / Advance (Delhi) / Ambit / Adlec / Milestone / ASES (Agni Suraksha) / Vidyut control / RST / Dynamic</u>
<u>28.</u>	<u>Fire Fighting Pumps</u>	<u>Kirlosker / Mather+Platt / Grundfos</u>
<u>29.</u>	<u>Diesel Engine</u>	<u>Kirlosker / Cummins</u>
<u>30.</u>	<u>Electric Motors</u>	<u>Kirlosker / Crompton / Siemens</u>
<u>31.</u>	<u>Pressure Switches</u>	<u>Danfoss / Indfoss</u>
<u>32.</u>	<u>Pressure Gauge</u>	<u>H Guru / FIBIG</u>
<u>33.</u>	<u>Flow Switches</u>	<u>System sensor</u>
<u>34.</u>	<u>Sprinkler Annunciation Panel</u>	<u>Safeway / Agni Suraksha (ASES) / Daksh Morley / Agni devices</u>
<u>35.</u>	<u>Sprinklers</u>	<u>Tyco / Globe / Viking / Reliable</u>

<u>36.</u>	<u>Sprinklers Flexible Hose</u>	<u>Tyco / Globe / Viking / Padmini / Newage</u>
<u>37.</u>	<u>Installation Control valve</u>	<u>Tyco / Globe / Viking</u>
<u>38.</u>	<u>Anchor Fastner / U clamp / Celvis sprinkler hangers</u>	<u>/Hilti / Intello tech / Hightech / Fisher / Easyflex</u>
<u>39.</u>	<u>Anti Vibration Mounting / Expansion Joint</u>	<u>Easyflex / Resistoflex / Kanwal / Precise</u>
<u>40.</u>	<u>Exit Sign</u>	<u>Glow light / Legrand / Autoglow / Pierlite / Agni Suraksha (ASES) / Agni Devices</u>
<u>41.</u>	<u>Paint</u>	<u>Asian / Berger / Nerolac / ICI</u>
<u>42.</u>	<u>Any Other Items</u>	<u>On Approval of Consultant or Engineer-In- Charge</u>
<u>NOTE :</u> <u>The choice of the Final makes shall be made by the owner / consultant.</u>		

ANNEXURE – B**LIST OF RELEVANT INDIAN STANDARDS**

<u>S.No</u>	<u>I.S. No.</u>	<u>Title</u>
<u>1.</u>	<u>IS-8757</u>	<u>Glossary of terms associated with fire safety</u>
<u>2.</u>	<u>IS-884.</u>	<u>Specification for first-aid hose reel for fire fighting</u>
<u>3.</u>	<u>IS-901.</u>	<u>Specification for couplings, double male and double Female instantaneous pattern for fire fighting.</u>
<u>4.</u>	<u>IS-902.</u>	<u>Specification for fire hose delivery couplings, branch Pipe, nozzles and nozzle spanner.</u>
<u>5.</u>	<u>IS-903.</u>	<u>Specification for fire hose delivery couplings, branch Pipe, nozzles and nozzle spanner.</u>
<u>6.</u>	<u>IS-904.</u>	<u>Specification for two way and three – way suction Collecting heads for fire fighting purposes.</u>
<u>7.</u>	<u>IS-907.</u>	<u>Specification for suction strainers, cylindrical type for Fire fighting purpose.</u>
<u>8.</u>	<u>IS-908.</u>	<u>Specification for fire hydrant, stand post type.</u>
<u>9.</u>	<u>IS-909.</u>	<u>Specification for under ground fire hydrant.</u>
<u>10.</u>	<u>IS-636.</u>	<u>Non percolating flexible fire fighting delivery hose.</u>
<u>11.</u>	<u>IS-7637.</u>	<u>Glossary of terms for fire fighting equipment.</u>
<u>12.</u>	<u>IS-937.</u>	<u>Specification for washers for water fittings for fire Fighting purposes.</u>
<u>13.</u>	<u>IS-1641.</u>	<u>Code of practice for fire safety of buildings (general): General principles.</u>
<u>14.</u>	<u>IS-1642.</u>	<u>Code of practice for fire safety of buildings (general): Details of Construction.</u>
<u>15.</u>	<u>IS-1643.</u>	<u>Code of practice for fire safety of buildings (General):Exposure hazard.</u>
<u>16.</u>	<u>IS-1644.</u>	<u>Code of practice for fire safety of buildings (general): Exit requirements and personal hazard.</u>

<u>17.</u>	<u>IS-1646.</u>	<u>Code of practice for fire safety of buildings (general): Electrical installations</u>
<u>18.</u>	<u>IS-2871.</u>	<u>Specification for branch pipe, universal for fire fighting Purposes.</u>
<u>19.</u>	<u>IS-2930.</u>	<u>Functional requirements for hose laying tender for fire Brigade use.</u>
<u>20.</u>	<u>IS-5290.</u>	<u>Specification for landing valves.</u>
<u>21.</u>	<u>IS-8090.</u>	<u>Specification for couplings, branch pipe, nozzle, used in Hose reel tubing for fire fighting.</u>
<u>22.</u>	<u>IS-8442.</u>	<u>Specification for stand post type water monitor for fire Fighting.</u>
<u>23.</u>	<u>IS-9972.</u>	<u>Specification for automatic sprinkler heads.</u>
<u>24.</u>	<u>IS-11101.</u>	<u>Specification for extended branch pipe for fire brigade Use.</u>
<u>25.</u>	<u>IS-12349.</u>	<u>Fire protection-Safety sign.</u>
<u>26.</u>	<u>IS-12407.</u>	<u>Graphic symbols for fire protection plan.</u>
<u>27.</u>	<u>IS-9668.</u>	<u>Code of practice for provision and maintenance of water Supplies and fire fighting.</u>
<u>28.</u>	<u>IS-3844.</u>	<u>Code of practice for installation and maintenance of Internal fire hydrants and hose reel on premises.</u>
<u>29.</u>	<u>IS-12585.</u>	<u>Specification for thermoplastic hose (Textile Reinforced)</u>
<u>30.</u>	<u>IS-10221.</u>	<u>Code of practice coating and wrapping of under ground Mild steel pipe lines.</u>
<u>31.</u>	<u>IS-15105.</u>	<u>Design and installation of fixed automatic sprinkler fire Extinguisher system-code of Practice.</u>
<u>32.</u>	<u>IS-325.</u>	<u>Three phase induction motors.</u>
<u>33.</u>	<u>IS-1822.</u>	<u>Motor starter for voltage not exceeding 1000 volts.</u>
<u>34.</u>	<u>IS-3624.</u>	<u>Bourdon tube pressure and vacuum gauges.</u>
<u>35.</u>	<u>IS-1520.</u>	<u>Horizontal centrifugal pumps for clear, cold, fresh water.</u>
<u>36.</u>	<u>IS-1239.</u>	<u>Mild steel tubes, tubular and other wrought steel fittings.</u>
<u>37.</u>	<u>IS-3589.</u>	<u>Electrically welded steel pipes for water, gas and sewage.</u>

<u>38.</u>	<u>IS-6392.</u>	<u>Steel pipe flanges.</u>
<u>39.</u>	<u>IS-778.</u>	<u>Gun metal gate, globe and check valves for general Purpose.</u>
<u>40.</u>	<u>IS-2592.</u>	<u>Recommendation for methods of measurement or fluid Flow <u>be means of orifice plates and nozzles.</u></u>
<u>41.</u>	<u>IS-732.</u>	<u>Code practice for electrical wiring and fittings of Building.</u>
<u>42.</u>	<u>IS-900.</u>	<u>Code of practice for installation and maintenance of Induction <u>motor.</u></u>
<u>43.</u>	<u>IS-1248.</u>	<u>Direct acting electrical indicating instruments.</u>
<u>44.</u>	<u>IS-2516.</u>	<u>A.C.circuit breakers for voltages not exceeding 1000 Volts.</u>
<u>45.</u>	<u>IS-4047.</u>	<u>Heavy duty air break switches and composite units of air break switches and fuses for voltage not exceeding 1000 volts.</u>
<u>46.</u>	<u>IS-2208.</u>	<u>HRC cartridge fuse links upto 650 volts.</u>
<u>47.</u>	<u>IS-1554.</u> <u>(Part - I).</u>	<u>PVC insulated (heavy duty) electric cables for working Voltage <u>upto and including 1100 volts.</u></u>
<u>48.</u>	<u>IS-780.</u>	<u>Sluice valve for water works purposes (50 to 300 mm. Size).</u>
<u>49.</u>	<u>IS-13095.</u>	<u>Butterfly valves.</u>
<u>50.</u>	<u>IS-1992.</u>	<u>Selection of Fire Extinguisher</u>
<u>51.</u>	<u>IS-694 - 1990</u>	<u>PVC insulated wires / cables for working voltage up to And <u>including 1100V.</u></u>

EQUIVALENT PLAIN AREAS OF UNEVEN SURFACES
(Vide specifications for items relating to : Painting & Polishing)

Sr. No.	Description of work	How measured	Multiplying Factor
1.	Paneled or framed and braced on ledged and battened or ledged and braced joinery.	Measured flat (not girthed) including chowkhat or frame edges, chocks clients etc. shall be deemed to be included in item.	1.30 (For each said)
2.	Flush joinery	Measured flat (not girthed) including chowkhat or frame. Edges, Chocks, cleats, etc. shall be deemed to be included in the item.	1.20 (For each side)
3.	Fully glazed or gauzed joinery	Measured flat (not girthed) including chowkhat or frame. Edges, Chocks, cleats, etc. shall be deemed to be included in the item.	0.80 (For each side)
4.	Partly paneled and partly glazed or gauzed joinery	Measured flat (not girthed) including chowkhat or frame. Edges, Chocks, cleats, etc. shall be deemed to be included in the item.	1.00 (For each side)
5.	Fully venetioned or louvered joinery.	Measured flat (not girthed) including chowkhat or frame. Edges, Chocks, cleats, etc. shall be deemed to be included in the item.	1.80 (For each side)
6.	Weather boarding	Measured flat (not girthed) supporting frame work shall not be measured separately.	1.20.(For each side)
7.	Wood single roofing	Measured flat (not girthed)	1.10(For each side)
8.	Boarding with cover fillets at match boarding	Measured flat (not girthed)	1.05 (For each side)
9.	Tile and Slate battening	Measured flat, overall, no deduction shall be made for open space over	0.80 (For painting all over)
10.	Trellis (or Jafri) work one way or two way	Measured flat, over all, no deduction shall be made for the open spaces supporting members shall not be measured separately)	1.00 (For painting all over)

11.	Guard, bars, balustrades, gates, graying, grills, expanded metal and railings.	Measured flat over all, No deduction shall be made for the open spaces, over) supporting members shall not be measured separately.	1.00 (For painting all over)
12.	Gates and open palisade fencing including standards	Measured flat over all No. deduction shall be made of open spaces : supporting members shall not be measured separately, (see note).	1.00 painting all over
13.	Curved or enriched work	Measured flat	2.0 (For each side)
14.	Steel roller shutter	Measured flat (size of opening) over all jamb, guides bottom rails and locking arrangement etc., shall be included in the item (top cover shall be measured separately).	1.10 (For each side)
15.	Plain sheet door and windows	Measured flat (not including) frame	1.10 (For each side)
16.	Full glazed or gauze steel door and windows	Measured flat (not girthed) including Frame edges etc.	0.50 (For each side)
17.	Partly paneled and partly glazed or gauzed steel doors	Measured flat (not girthed) including frame edges etc.	0.08 (For each side)
18.	Collapsible gate	Measured flat (size of opening) no separate measurements shall be taken for the top and bottom guide rails, rollers, fittings, etc.	1.50 (For painting all over)

Note : The height shall be taken from the bottom of the lowest of rail if the palisades do not go below it (or from the lower end of palisades, if they protect below the lower rail) up to the top of palisades, but not upto the top of standards if they are higher then the palisades.

NOTE : PLEASE READ CAREFULLY :

- (1) Where detailed specification of an item provides for specific size of any fixture or fastening that shall prevail over the provisions in this schedule.
- (2) Fixtures and fastenings (except hold fasts which shall be of M.S. plate only) shall be of Brass, copper, oxidised brass, chromium plated brass, Iron, copper oxidised iron, or chromium plated iron as specified in the item of the work or detailed specifications.
- (3) External door and door failing in staircase excepting the door in balcony shall have sliding door bolt of size 300 mm. x 18 mm. in place of 250 mm. x 16 mm- as shown in this schedule.
- (4) The length of tower lock shown is for a door having shutter height up to 2100 mm. only. For door having shutter height more than 2100 mm. the length of tower bolts to be increased to the extent of increase of door shutter height beyond 2100 mm.
- (5) 150 mm. x 150 mm. size glass vision panel shall be provided in the doors of Officers chamber in addition to the scheduled provision if so directed by the Engineering in charge.
- (6) Diamond shape chromium plated brass peeping plate of approved quality shall be provided in one entrance door in residential building in addition to the scheduled provisions.
- (7) Drawer up a wardrobe shall be provided with one furniture handle and one drawer lock (4 levers) in addition to its scheduled provision.
- (8) For door and window with steel frame, 75 mm. size screws, shall be provided both in top bottom frame for fixity as shown below:
 - (a) For width up to 1200 mm.....2 Nos.
 - (b) For width above 1200 mm. and up to 1800 mm.....3 Nos.
 - (c) For every additional width of 500 mm. over and above 1800 mm.....1 No.
- (9) When the mortise lock (6 levers) and latch is specified to be provided to a door either in the item of work itself or by a separate item, the requirement of providing sliding door bolt, door latch and handles as per this schedule shall be dispensed with.
- (10) For door/window with ventilator at top, fixtures and fastenings of door/window plus those of ventilator (excluding hold fasts) shall be used.
- (11) Where the item of the work, or its specification provides for anodised aluminum fixtures, all the fixtures except hinges and screws will be of anodised aluminum and chromium plated iron hinges and screws shall be used.
- (12) For door, window, or cupboard frame abutting concrete section, instead of hold fasts as shown in the schedule-, coach screws of size mentioned below shall be used:
 - (a) Teak wood frame..... 125 mm.
 - (b) Steel frame.....75 mm.
- (13) The locking etc. in the door latch shall be so positioned that the can be properly rocked even if part of the latch, when fully slid, remains in the frame or masonry.
- (14) Showcase cupboards having single shutter shall be provided with all catcher instead of tower bolt (barrel type) as per schedule.
- (15) The size of the handle shown in the schedule indicates grip length.
- (16) Door stopper shall be shown in the schedule indicates grip length.
- (17) Piano hinges shall be for the full height of the shutter.
- (18) Shutter with pivot arrangements shall be pivot arrangement shall be provided with two pivots of approved size instead of hinges as per the schedule.
- (19) For butt hinges, only lengths are indicated in the schedule. The width of each flap being 5 mm. less than the thickness of the shutter to which they are to be fixed and the thickness of the flap shall be as specified in the relevant I.S. for heavy, medium or light as specified in the detailed specifications of the item of work.

TENDER FOR CONSTRUCTION SHOPPING COMPLEX & PARKING, KEVADIA.	
Title – Applicable Standards for Civil & Plumbing Works	Sheet 1 OF 5
1 Conversion factors	IS:786
2 Method of measurement of building works	IS:1200
3 Code of practice for measurement of civil engineering works	IS:3385
4 Materials and workmanship for earthwork and excavation	IS:1200 (PART I)
5 Safety code for blasting and related drilling operations	IS:4081
6 Safety code for excavation work	IS:3764
7 Moisture content in sand for filling	IS:2720
8 Determination of moisture content	IS:2720 (PART II)
9 Determination of moisture content & dry density relation using light compaction	IS: 2720 (PART VIII)
10 Determination of dry density of soils in-place by the sand replacement method	IS:2720(PART XXVIII)
11 Determination of dry density of soils in-place by the core cutter method	IS:2720 (PART XXIX)
12 Anti termite treatment	IS:6313(PART I TO III)
13 Construction water	IS:456
14 Methods of sampling and test (physical and chemical water used in industry)	IS:3025
15 Ordinary (33 grade)/low heat Portland cement	IS:269
16 Ordinary Portland cement (43 grade)	IS:8112
17 Ordinary Portland cement (53 grade)	IS:12269
18 White Portland cement	IS:8042-E
19 Portland pozzolana cement	IS:1489
20 Rapid hardening Portland cement	IS:8041, IS:269
21 Portland(blast furnace) slag cement	IS:455
22 Hydrophobic cement	IS:8043
23 High alumina cement	IS:6452
24 Super sulphated cement	IS:6909
25 Oil well cement	IS:8229E
26 Standard for testing of cement	IS:650
27 Methods of physical tests for hydraulic cement	IS:4031
28 Specification for standard sand for testing of cement	IS:650
29 Coarse and fine aggregates for concrete	IS:383, IS:515
30 Gradation of coarse aggregates	IS:383(TABLE II)
31 Gradation of fine aggregates	IS:383 (TABLE III)
32 All-in-aggregates	IS:383 (TABLE IV)
33 Method of tests for aggregates for concrete	IS:2386 (PART I TO VIII)
34 Methods of determination the maximum qty. of deleterious materials in aggregate	IS:2386 (PART II)
35 Limiting values of the maximum quantities of deleterious materials in aggregate	IS:383 (TABLE I)
36 Flakiness index of aggregates	IS:2396 (PART I), IS:5640
37 Moisture content test for aggregates	IS:2386 (PART III)
38 Specification for mild steel and medium tensile steel bars and hard drawn steel wire for conc rete reinforcement.	IS:432 (PART I & II)
39 Specification for plain hard drawn steel wire fabric for cement concrete	IS:1566
40 Specification for cold twisted steel bars for concrete reinforcement	IS:1786
41 Specifications for hot rolled mild steel and medium tensile steel deformed bars	IS:1139, IS:1739
42 Code of practice for bending and fixing of bars for concrete reinforcement	IS:2502
43 Mild steel binding wire	IS:280
44 Code of practice for welding of mild steel bars used for RCC	IS:2751
45 Code of practice for plain and reinforced concrete	IS:456
46 Code of practice for general construction of plain and RCC for dams	IS:457
47 Testing of reinforced cement concrete	IS:516
48 Method of tests for strength of concrete	IS:516
49 Methods of sampling & analysis of concrete	IS:1199
50 Code of practice for concrete structures for storage of liquids	IS:3370 (PART I TO IV)
51 Code of practice for composite construction	IS:3935
52 Code of practice for construction of reinforced concrete shell roof	IS:2204
53 Criteria for the design of RCC shell structures and folded plates	IS:2210
54 Specification for batch type concrete mixers	IS:1791

TENDER FOR CONSTRUCTION SHOPPING COMPLEX & PARKING, KEVADIA.	
Title – Applicable Standards for Civil & Plumbing Works	Sheet 2 OF 5
55	Specification for portable swing weigh batchers for concrete IS:2722
56	Specification for roller pan mixer IS:2438
57	Specification for concrete vibrators immersion type IS:2505
58	Specification for screed board concrete vibrators IS:2506
59	Specification for concrete vibrating tables IS:2514
60	Specification for pan vibrators IS:3366
61	Specification for form vibrators for concrete IS:4656
62	Code of practice for use of immersion vibrators for consolidated concrete IS:3558
63	Air entraining agent ASTM:6260
64	Criteria for design and construction of precast concrete trusses IS:3201
65	Prestressed concrete IS:1343
66	Specification for high tensile steel bars used in code of practice for pre-stressed concrete IS:2090
67	Specification for plain hard drawn steel wire for pre-stressed concrete IS:1785 (PART I)
68	Specification for plywood for concrete
69	Shuttering work IS:4990
70	Code of practice for steel tubular scaffolding IS:4014 (PART I & II)
71	Specification for steel scaffolding IS:2750
72	Safety code for scaffolds and ladders IS:3696
73	Common burnt clay building bricks IS:1077
74	Classification of burnt clay bricks IS:3102
75	Burnt clay building bricks, heavy duty IS:2180
76	Burnt clay facing bricks IS:2691, IS:1077
77	Method of sampling and testing clay building bricks IS:3495 (PART I - IV)
78	Mortar for brick work IS:2250
79	Code of practice for brick work IS:2221
80	Masonry works IS:3466
81	Structural safety etc. Of building masonry walls IS:1905
82	Load bearing hollow concrete blocks IS:2185
83	Lime - cement - cinder hollow concrete blocks IS:5498
84	Lime - cement - cinder solid blocks IS:3115
85	Code of practice for construction of stone masonry IS:1597 (PART I)
86	Stone tests IS:1124
87	Code of practice for design and installation of joints in buildings IS:3414
88	Joint sealing compound IS:834
89	Pre-molded bituminous joint filler IS:1838
90	Timber door, window and ventilator frames IS:4021
91	Material & workmanship for wood work IS:883, IS:4021
92	Wooden flush door shutters (solid core type) IS:2202 (PART I)
93	Timber paneled and glazed shutters IS:1003 (PART I & II)
94	Method of tests for wooden flush doors, type tests IS:4020
95	Plywood & tests IS:303
96	General tests for wood work IS:1659
97	Red lead for wood knot IS:103
98	Oil type wood preservative IS:218
99	Particle board IS:3087
100	Transparent sheet glass for glazing & framing purposes IS:1761
101	Resin bonded fiber glass IS:3144
102	Putty for glazing IS:420
103	Steel door frames IS:4351
104	Steel window IS:1361
105	Steel doors IS:1038
106	Steel ventilators IS:1081
107	Rolling shutters IS:6248
108	Primer for steel doors, windows & ventilators IS:102

TENDER FOR CONSTRUCTION SHOPPING COMPLEX & PARKING, KEVADIA.	
Title – Applicable Standards for Civil & Plumbing Works	Sheet 3 OF 5
109 Aluminum alloy for door/window frames	IS DSGN. HEA-WP OF IS:733
110 Sections	IS:1948
111 Anodizing	BS:1616
112 Hydraulic lime & storage	IS:712
113 General tests for lime	IS:6932 (PART I TO X)
114 Field tests for lime	IS:1624
115 Lime mortar preparation	IS:1625
116 Slacked lime	IS:1639
117 Surkhi	IS:1344
118 Code of practice for application of lime plaster finish	IS:2394
119 Rough cast plaster	IS:1661(CLAUSE-165)
120 Specification for integral cement water proofing compounds	IS:2645
121 Water proofing asphalt/maxphalt	IS:702
122 Bitumen saturated layer	IS:1322
123 Bitumen felt	IS:1322
124 Bitumen	IS:702
125 Code of practice for laying and finishing of cement concrete flooring tiles	IS:1443
126 Material & workmanship for flooring	IS:1197, IS:1344
127 Code of practice for laying in situ terrazzo floor finish	IS:2114
128 Code of practice for laying in-situ cement concrete flooring	IS:2571
129 Mosaic tiles	IS:1237
130 Glazed earthenware tiles	IS:777
131 Marble chips & marble mosaic terrazzo	IS:2114
132 Plain cement tiles & tests	IS:1237
133 Marble mosaic tiles	IS:1237
134 Marble slab	IS:1130
135 PVC flooring tiles & sheets	IS:3461, IS:3462
136 Broken marble mosaic tiles	IS:1257
137 Oxy-chloride	IS:658
138 Magnesium chloride	IS:657
139 C.I. grid tiles	IS:210
140 Pigment for terrazzo flooring	IS:459
141 Rivets	IS:1148
142 Electrodes for welding	IS:814
143 Code of practice for use of electric arc welding for general construction in steel	IS:813
144 Tests for welding works	IS:1181
145 Welding works	IS:816
146 Bolts and nuts	IS:1367
147 Tests for bolts and nuts	IS:1608
148 Structural steel sections & tests	IS:226
149 Structural steel plates	IS:2062
150 Defects in structural steel	IS:229
151 Dimension & properties of steel section	IS:808
152 Structural steel work	IS:226, IS:4948
154 Expanded metal steel sheet	IS:412
155 Mild steel wire gauze jali	IS:280
156 Welding procedure & edge preparation	IS:823
157 Washers	IS:2016
158 Storage of welding wire & electrodes	IS:816
159 Primer to structural surface for bolts	IS:2074
160 Checkered plates	IS:3502
161 Code of practice for painting of ferrous metal in building and allied finishes	IS:1477 (PART I & II)
162 Distemper and dry color	IS:427
163 Code of practice for painting concrete, masonry and plaster surfaces	IS:2395
164 Distemper and oil emulsion	IS:428

TENDER FOR CONSTRUCTION SHOPPING COMPLEX & PARKING, KEVADIA.	
Title – Applicable Standards for Civil & Plumbing Works	Sheet 4 OF 5
165 Enamel paints	IS:2933
170 Coat of zinc chromate	IS:104
171 French spirit polish	IS:348
172 GI sheets	IS:227
173 Ac sheets	IS:459
174 Ac sheet fixing	IS:730
175 Mangalore pattern tiles	IS:654
176 Fiber glass reinforced polyester	IS:4154
177 Galvanized steel for barbed wire	IS:278
178 Insulation of hot water pipes, tanks & heat exchanger	BS:476
179 GI pipes & MS tubes	IS:1239 (PART I)
180 Screw down bib cocks & stop cocks	IS:781
181 Vitreous sanitary fixtures(general)	IS:2556 (PART I)
182 Gun metal wheel, globe, check, gate & non return valves	IS:778
183 Wash basin	IS:2556 (PART IV), IS:771
184 European W.C.	IS:2556, IS:771
185 Solid plastic seat & cover	IS:2548
186 Orissa pan W.C.	IS:2556 (PART III)
187 Squatting pans & traps	IS:2556 (PART III)
188 Indian W.C. (wash down W.C.)	IS:2556 (PART II), IS:771
189 Urinals	IS:2556 (PART VI)
190 Half round channels	IS:2556 (PART VII)
191 Specific requirements of siphonic wash down W.C.	IS:2556 (PART VIII)
192 Ss sink/C.I./flushing tank brackets	IS:775
193 C.I. siphonic flushing cistern	IS:774
194 Lead pipes	IS:404 (PART I)
195 Sand cast pipes & fittings	IS:1729
196 C.I. spun soil pipes & fittings	IS:3939
197 Gully trap	IS:651
198 Glazed stone ware pipes & fittings	IS:651
199 Ac pipe	IS:1626, IS:1626 (PART I)
200 High pressure/crydon ball valve	IS:1703
201 C.I. sluice valve	IS:780
202 Capstan head	IS:1795
203 Malleable iron fittings	IS:1879 (PART I TO X)
204 C.I. pipes	IS:1536, IS:1537
205 Molten (pig)lead	IS:782
206 C.I. manhole frames & covers	IS:1726
207 Concrete pipes	IS:458
208 Threads for screwed pipes	IS:554
209 Lead jointing	IS:718
210 Carbon steel for pipes	IS:9161
211 Low level ceramic cistern	IS:774
212 Bowl pattern flat back urinals	IS:2556 (PART IV)
213 Showers	IS:2064
214 Heavy C.I. pipes	IS:1729
215 Concrete mix design	IS:10262
216 Code of practice for construction of floor and roof with joists and filler blocks	IS:6061 (PART I)
217 Code of practice for construction of light weight concrete block masonry	IS:6042
218 Specification for load bearing light weight concrete blocks	IS:3590
219 Code of practice for construction of hollow concrete block masonry	IS:2572
220 Specification for concrete masonry units (hollow and solid concrete blocks)	IS:2185 (PART I)
221 Chemical composition of ordinary Portland cement	IS:4032
222 Sulphate resistant cement	BS:4027 & ASTM C-150 TYPE II
223 Specifications for circular hollow sections	IS:1161

TENDER FOR CONSTRUCTION SHOPPING COMPLEX & PARKING, KEVADIA.	
Title – Applicable Standards for Civil & Plumbing Works	Sheet 5 OF 5
224 Properties of rectangular & square hollow sections	IS:4923
225 Cold formed welded & seamless carbon steel structural tubing	ASTMA 500
226 Cold but not formed welded & seamless carbon steel structural tubing	ASTMA 501
227 Hot formed welded & seamless high strength low alloy tubing	ASTMA 618
228 Hot rolled structural steel hollow section	BS:4848/
229 (Part 1) Code of Practice for design and construction of pile foundation concrete piles cast-in-situ bored piles.	IS : 2911
230 Recommendation for detailing of Reinforcement in Reinforced Concrete Works.	IS : 5525
<p>Note: For the reference of all Codes and Standards, the latest version of the above specified Standards shall be followed, Wherever, such Standards are not specified for the construction materials, equipment and method, the relevant Indian Standard Codes of Practice shall be followed, in the absence of Indian Standards corresponding British Standard Codes of Practice or relevant American Standards shall be followed.</p>	

Sr No	Description	Make
1	Cement	M/S Narmada Cement Limited, Magdalla (Gujarat)
		Gujarat Ambuja Cement Co. Ltd. Kodinar (Gujarat)
		Suarashtra Cement and Chemical Co. Ltd. Ranavav, (Gujarat)
		Shree Digvijay Cement Co. Ltd. Sikka, (Gujarat)
		Cement Corporation of Gujarat Limited (Sidhee), Chorwad. (Gujarat)
		J.K. Cement Works Ltd. Nimbhera, (Rajasthan)
		Gujarat Cement Works (L & T), Amreli (Gujarat)
		Aditya Vikram Cement, Shambhalpura, (Rajasthan)
		Lakshmi Cement Jaykaypuram, (Rajasthan)
		Vikram Super Cement Khor, (MP)
		Indorama Cement Ltd. Khakaravi, Dist, Raigad (MP)
		Andhra Cement Ltd. Visakhapatnam (A.P)
		Grasim Industries Ltd. Rawan, (CG)
		Sanghi Cement Limited, (Kachchh, Gujarat)
		Binani Cement Limited, (Binanigram - Rajasthan)
		Wonder Cement
		Shree Cement
		JSW Cement
		J.K. Laxmi Cement, Kalol, (Gujarat)
		M/S Sautashtra Cement Limited (Hathi), Porbandar, Gujarat
		M/S Sanghi Industries Ltd. Kutch.
		M/S. Birla Corporation Limited (CCW, Rajasthan)
2	Steel	Steel Authority of India Limited (SAIL)
		Tata Steel
		Rashtriya Ispat Nigam Ltd., (RINL)
		M/S JSW Steel Limited
		"JINDAL PANTHER", M/S. Jindal Steel & Power Limited

Flooring		
Sr.no	Description	Make
3	24" x 24" vitrified 8 mm thick tile	AGL, Rak, Somany, Vermora, Johnson,Kajaria,Varmora,Nitco
4	Ceramic tiles	Kajaria, Varmora, Nitco
5	colour glazed tiles	Kajaria, Varmora, Nitco

38mm thick water proof flush door solid core double shutter		
6	1mm thick laminated sheet on both side of the shutter having teakwood lipping edge patti of 38 mm x 25.4 mm on all edges with Melamine Polish matching shade of laminate with Magnetic catcher triple strip vertical type(1 No),S.S. 304 tower bolt (barrel type) 300x10 mm (1 No)	Define, Kich : TBF312S
7	Main door set 19mm dia mortise handle	DEFINE: Mortise handle (DF ESRH 01),kich:Morties Handle-PRLH 193S
8	60mm X 85mm lock body with strike plate	DEFINE - Lock Body: DF-ML 100) (Kich : Lock body: PRMLB 9S)
9	thumb turn cylinders 70mm	Kich : thumb turn cylinder: PRPCKN S70, Define : DF-OSK-70
10	SS matt Hinges of 100mm X 65mm X 3.2mm	Kich Item No.PRBHT2B34 and Define Make - Item No. DF-BBH-04

38mm thick water proof flush door solid core single shutter		
11	1mm thick laminated sheet on both side of the shutter with teak wood frame of size 100mm X 65mm for door frame, Magnetic catcher triple strip vertical type(1 No),S.S. 304 tower bolt (barrel type) 300x10 mm (1 No)	Define, Kich : TBF312S
12	Main door set 19mm dia mortise handle	DEFINE: Mortise handle (DF ESRH 01),kich: Morties Handle-PRLH 193S
13	60mm X 85mm lock body with strike plate	DEFINE - Lock Body: DF-ML 100) (Kich : Lock body: PRMLB 9S)
14	thumb turn cylinders 70mm	Kich : thumb turn cylinder: PRPCKN S70, Define : DF-OSK-70
15	SS matt Hinges of 100mm X 65mm X 3.2mm	Kich Item No.PRBHT2B34 and Define Make - Item No. DF-BBH-04

38mm thick water proof flush door solid core single shutter		
16	Godrej Locking Solutions and Systems Classic Keyless Cylindrical Lock 5805	Godrej, Yale, Europa
17	SS matt Hinges of 100mm X 65mm X 3.2mm	Kich Item No.PRBHT2B34 and Define Make - Item No. DF-BBH-04
18	baby latch	Kich - Item Code : ABLRC14S, DEFINE
19	600 mm dia Coil	Tata Make

Plumbing		
Sr.no	Description	Make
20	50mm dia. U.P.V.C. Pipe (SCH- 80)	PRINCE / SUPREME / ASTRAL / FINOLEX
21	50mm dia. U.P.V.C. Pipe (SCH- 40)	PRINCE / SUPREME / ASTRAL / FINOLEX
22	32mm dia. U.P.V.C. Pipe (SCH- 40)	PRINCE / SUPREME / ASTRAL / FINOLEX or equivalent
23	25mm dia. U.P.V.C. Pipe (SCH- 40)	PRINCE / SUPREME / ASTRAL / FINOLEX or equivalent
24	15mm dia. U.P.V.C. Pipe (SCH- 40)	PRINCE / SUPREME / ASTRAL / FINOLEX or equivalent
25	wash down water closet wall hung (European type, W.C. Pan) with integral P or S trap including jointing the trap with soil pipe in Cement Mortar 1:1 (1-Cement : 1-fine sand) (A) vitreous China Pattern :(i) in white colour, including plastic seat and cover for wash down water closer with C.P. brass hinges and rubber buffers, Providing and fixing G.I. inlet connection for flush pipe with W.C. Pan, Providing and fixing 32mm dual flow metropole valve including concealed body with exposed shutoff provision and round flange of approved quality including fixing in pipe line etc. complete and providing and fixing Health Faucet Heavy duty having pipe length of 1 rmt with hook with fitting etc.	Cera, Hindware, Plumber make
26	Urinal with trap and with integral longitudinal flush pipe.(A) Squating plate pattern white earthenware 550mm x 300mm.	Hindware, Vermora, Johnson make
27	water closet squatting Pan (Indian type W.C. Pan) size 580mm (Earthwork, bed concrete, foot rest and trap to be measured and paid for separately) (A) Vitreous China.(I) Long pattern = White colour	Cera, Hindware, Plumber make
28	table top Wash Basin single hole for pillar tap and making good the same but including fitting (A) Vitreous china : (II) Flat back wash basin 550mm x 400mm size in white colour including providing and fixing C.P. brass waste coupling of 32mm dia., chromium plated bottle trap with necessary couplings of approved quality, M. I. fisher union of 32mm dia., C.P. brass pillar tap of 15mm dia., PVC connection pipe from stop cock to pillar tap etc. complete.	Cera, Vermora, Johnson make
29	CP Brass 32mm size Bottle Trap	Cera, Johnson, Vermora
30	Single Lever Faucets quarter turn concealed diverter	Johnson, Varmora OR Hindware

	40mm + exposed body part, with spout with flange etc.	
31	C.P. Single Flow Shower Rose of 70mm Dia. having 100mm shower Arm with 15 to 20mm Dia. Connected With Hot and Cold 2 in 1 Wall Mixer with bend pipe.	Cera, Varmora, Johnson make
32	C.P. brass towel rail complete with C.P. brass brackets fixed to wooden plugs with C.P. brass screws (B) 600mm x 20mm size.	Cera, Hindware, Johnson make
33	SS towel ring complete with fittings having 200 mm diameter etc.	Cera, Jaguar, Johnson make
34	SS towel rod complete with fittings having 600 mm length etc.	Cera, Jaguar, Johnson Make
35	1.50 m long, 5 Pipe cloth hanging system with pulley to adjust height of the kit as required by the user.	Esy Dry make
36	25mm Concealed Stop Cock body plus exposed part etc.	Cera, Johnson, Vermora
37	I.S.I. mark 7 levers three keys brass pad lock	Navtal (Godrej)

કામોના સ્પેસીફિકેશનમાં એકસૂતતા જાળવવા અને
કામોની ગુણવત્તા સુધારવા અંગે મીક્ષ ડીઝાઇનીનું
સ્ટાન્ડર્ડાઇઝેશન કરવા બાબત

ગુજરાત સરકાર
નર્મદા જળસંપત્તિ, પાણી પુરવઠા અને કલ્પસર વિભાગ
સચિવાલય, ગાંધીનગર
ક્રમાંક: એમઆઈએસ૧૦૨૦૧૦/૧૭/ક-૧
તા: ૩૦/૦૭/૨૦૧૮

વંચાણો લીધો:-નર્મદા જળસંપત્તિ પાણી પુરવઠા અને કલ્પસર વિભાગના પરિપત્ર નં. પરચ-
૨૦૧૦/૬૭-ગુ.નિ. તા: ૧૫/૦૩/૨૦૧૧

પ્રસ્તાવના:

સંદર્ભ હેઠળના નર્મદા જળસંપત્તિ પાણી પુરવઠા અને કલ્પસર વિભાગના પરિપત્રથી કામોના સ્પેસીફિકેશનમાં
એકસૂતતા જાળવવા અંગે અને કામોની ગુણવત્તા સુધારવા નીચે દર્શાવેલ ગ્રેડની કોકીટ મીક્ષ ડીઝાઇનીનું
સ્ટાન્ડર્ડાઇઝેશન કરવાનું નક્કી કરવામાં આવેલ હતું.

1. 300 kg for M-15/20 (msa)
2. 280 kg for M-15/40 msa
3. 360 kg for M-20/20 msa
4. 330 kg for M-20/40 msa
5. 400 kg for M-25/20 msa
6. 370 kg for M-25/40 msa

(msa= maximum size aggregate)

પરિપત્ર:

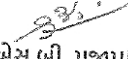
સંદર્ભ હેઠળના નર્મદા, જળ સંપત્તિ, પાણી પુરવઠા અને કલ્પસર વિભાગના પરિપત્રમાં સૂચવવામાં આવેલ સીમેન્ટ
લેવલમાં જળ સંપત્તિ વિભાગ દ્વારા હાથ ધરાતાં વિવિધ પ્રકારના કામોની જરૂરીયાત મુજબ સુધારા કરવાનું તેમજ
અન્ય વધારાના કોકીટ ગ્રેડ માટે સ્ટાન્ડર્ડ સીમેન્ટ લેવલ નક્કી કરવાની બાબત વિચારણા હેઠળ હતી. જે અન્વયે
નીચે મુજબના જુદા જુદા કોકીટ ગ્રેડના સ્ટાન્ડર્ડ સીમેન્ટ લેવલ નક્કી કરવામાં આવેલ છે.

1. 300 kg for M-15/20 msa
2. 280 kg for M-15/40 msa
3. 360 kg for M-20/20 msa
4. 330 kg for M-20/40 msa
5. 380 kg for M-25/20 msa
6. 360 kg for M-25/40 msa
7. 410 kg for M-30/20 msa
8. 425 kg for M-35/20 msa
9. 440 kg for M-40/20 msa
10. 450 kg for M-45/20 msa

(પાછળ)

ઉક્ત સ્ટાન્ડર્ડ સીમેન્ટ લેવલ કોફીટના કામોના અંદાજપત્રો તૈયાર કરવામાં ધ્યાને લેવાના રહેશે તેમજ સ્પેસીફિકેશનમાં ઉપર દર્શાવ્યા મુજબ નિર્દેશ કરવાનો રહેશે અને સાથોસાથ એ મુજબ શરત રાખવાની રહેશે કે આ સીમેન્ટ લેવલથી જો મીક્ષ ડીઝાઇનમાં વધુ સીમેન્ટ લેવલ જણાશે તો તે અંગે ચુકવણી કરવાનું રહેશે નહીં, પરંતુ જો નિયત સીમેન્ટ લેવલથી ઓછું સીમેન્ટ લેવલ મીક્ષ ડીઝાઇનમાં આવે તો તે અંગે કપાત નિયત ધારાધોરણ અનુસાર કરવાની રહેશે. IS-456:2000ની જોગવાઈ મુજબ જે તે ગ્રેડના કોફીટ માટે Minimum Cement Level કરતા ઓછો સીમેન્ટ વાપરી શકાશે નહિ.

ગુજરાત રાજ્યપાલશ્રીના હુકમથી અને તેમના નામે.


(એસ.બી. પ્રજાપતિ)

ખાસ ફરજ પરના અધિકારી (સિ.યો.)
નર્મદા જળસંપત્તિ પાણી પુરવઠા અને કલ્પસર વિભાગ
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- (૫) તકેદારી આયુક્તશ્રી, ગુજરાત તકેદારી આયોગ, સેક્ટર-૧૦ બી, ગાંધીનગર
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- (૭) નાયબ સચિવશ્રી(તપાસ), સચિવાલય, ગાંધીનગર
- (૮) સર્વે ઉપસચિવશ્રીઓ (તાંત્રિક), , સચિવાલય, ગાંધીનગર
- (૯) સર્વે અધિક્ષક ઇજનેરશ્રીઓ ન.જ.સં.પા.પુ. અને ક. વિભાગ
- (૧૦) સર્વે પ્રોજેક્ટ શાખા(ક-૧, ક-૨, ક-૩, જ), , સચિવાલય, ગાંધીનગર
- (૧૧) સીલેક્ટ ફાઈલ