TECHNICAL SPECIFICATIONS

CIVIL WORKS

1.0 **GENERAL** :-

1.01 The specifications and mode of measurements for Civil and Plumbing works shall be in accordance with C.P.W.D.specifications 1996 Volumes I to VI.

Unless otherwise specified in the nomenclature of individual item or in the specifications, the entire work shall be carried out as per the C.P.W.D. specifications with upto date correction slips upto the date of opening of tender.

1.02 For the item not covered under CPWD Specifications mentioned above, the work shall be executed as per latest relevant standards/codes published by B.I.S. (formerly ISI) inclusive of all amendments issued thereto or revision thereof, if any, upto the date of opening of tenders.

1.03 In case of B.I.S. (formerly I.S.I) codes/specifications are not available, the decision of the Engineer based on acceptable sound engineering practice and local usage shall be final and binding on the contractor.

1.04 However, in the event of any discrepancy in the description of any item as given in the schedule of quantities or specifications appended with the tender and the specifications relating to the relevant item as per CPWD specifications mentioned above, or in drawings the former shall prevail.

1.05 In general the building floor to floor height is 3.7m unless specified otherwise in the drawing. The rates for different items of work shall be for up to 4.0 m floor to floor height at all levels, lifts, leads and depths of the building except where otherwise specified explicitly in the item of work or in special conditions appended with the tender. All works above the top most terrace (main) shall be paid under the level existing below(ie machine room, mumty etc)

1.06 The work shall be carried out in accordance with the architectural, structural, plumbing and electrical drawings etc. The drawings shall have to be properly co-related before executing the work. In case of any difference noticed between the drawings, final decision, in writing of the Engineer shall be obtained by the contractor. For items, where so required, samples shall be prepared before starting the particular items of work for prior approval of the Engineer and nothing extra shall be payable on this account.

1.07 All materials to be used on works shall bear I.S. certification mark unless specifically permitted otherwise in writing. In case I.S. marked materials are not available(not produced) , the materials used shall conform to I.S. code or CPWD specifications as applicable in this contract.

In such cases the Engineer shall satisfy himself about the quality of such materials and give his approval in writing. Only articles classified as "First Quality" by the manufacturers shall be used unless otherwise specified. All materials shall be tested as per provisions of the Mandatory Tests in CPWD specifications and the relevant IS specifications. The Engineer may relax the condition regarding testing if the quantity of materials required for the work is small. Proper proof of procurement of materials from authentic manufacturers shall be provided by the contractor to the satisfaction of Engineer. Grade of cement used shall be 43 /53 unless otherwise specified explicitly. The contractor shall get the Design Mix for RCC done by the labs approved by HSCC only. Reinforcement Steel used shall be of FE-415 unless otherwise specified.

1.08 In respect of the work of the sub-agencies deployed for doing work of electrification, air-conditioning, external services, other building work, horticulture work, etc. for this project and any other agencies simultaneously executing other works, the contractor shall afford necessary coordination and facilities for the same. The contractor shall leave such necessary holes, openings, etc. for laying / burrying in the work pipes, cables, conduits, clamps, boxes and hooks for fan clamps, etc. as may be required for the electric, sanitary air-conditioning, fire fighting, PA system, telephone system, C.C.T.V. system, etc. and nothing extra over the agreement rates shall be paid for the same.

1.09 Unless otherwise specified in the bill of quantities, the rates for all items of work shall be considered as inclusive of pumping out or bailing out water if required for which no extra payment will be made. This will include water encountered from any source such as rains, floods, subsoil water table being high or due to any other cause whatsoever.

1.10 Any cement slurry added over base surface (or) for continuation of concreting for bond is added its cost is deemed to have in built in the item unless otherwise/explicitly stated and nothing extra shall be payable or extra cement considered with consumption on this account.

1.11 The rate for all items in which the use of cement is involved is inclusive of charges for curing.

1.12 The contractor shall clear the site thoroughly of all scaffolding materials and rubbish etc. left out of his work and dress the site around the building to the satisfaction of the Engineer before the work is considered as complete.

1.13 Rates for plastering work (excluding washed grit finish on external wall surfaces) shall include for making grooves, bands etc. wherever required and nothing extra shall be paid for the same.

1.14 The rates quoted for all brick/concrete work shall be deemed to include making openings and making good these with the same specifications as shown in drawings and/or as directed. No extra payment shall be made to the contractor on this account.

1.15 Rates for all concrete/plaster work shall include for making drip course moulding, grooves etc. wherever required and nothing extra shall be paid for the same.

1.16 Rates for flooring work shall include for laying the flooring in strips / simple designs wherever required and nothing extra shall be paid for the same.

1.17 The drawing(s) attached with the tender documents are for the purpose of tender only, giving the tenderer a general idea of the nature and the extent of works to be executed. The rates quoted by the tenderer shall be deemed to be for the execution of works taking into account the "Design Aspect" of the items and in accordance with the "Construction Drawings" to be supplied to the Contractor during execution of the works.

1.18 The quoted rate shall be for finished items and shall be complete in all respects including the cost of all materials, labour, tools & plants, machinery etc., all taxes, duties, levies, octroi, royalty charges, statutory levies etc. applicable from time to time and any other item required but not mentioned here involved in the operations described above. The client/HSCC/Employer shall not be supplying any material, labour, plant etc. unless explicitly mentioned so.

2.00 ALUMINIUM DOORS AND WINDOWS :

2.1 EXTENT AND INTENT:-

The work shall be carried out through an approved specialist contractor, who shall furnish all materials, labour, accessories, equipment, tools and plant and incidentals required for providing and installing anodized/powder coated aluminium doors, windows, claddings, louvers and other items as called for on the drawings. The drawings and specifications cover the major requirement only. The supplying of additional fastenings, accessory features and other items not mentioned specifically herein, but which are necessary to make a complete installation shall be a part of this contract.

2.2 GENERAL:-

Aluminium doors, windows etc. shall be of sizes, section details as shown on the drawings. The details shown on the drawings indicate generally the sizes of the component parts and general standards. These may be varied slightly to suit the standards adopted by the manufacturer. Before proceeding with any manufacturing, the contractor shall prepare and submit complete manufacturing and installation drawings for approval of the Engineer and no work shall be performed until the approval of these drawings is obtained.

2.3 SHOP DRAWINGS:-

The contractor shall submit the shop drawings of doors, windows, louvers, cladding and other aluminum work, based on architectural drawings, to the Engineer for his approval. The drawings shall show full size sections of doors, windows etc. thickness of metal (i.e. wall thickness), details of construction, sub frame / rough ground profile, anchoring details, hardware as well as connection of windows, doors
and other metal work to adjacent work. Samples of all joints and methods of fastening and joining shall be submitted to the Engineer for approval well in advance of commencing the work.

2.4 SAMPLES:-

Samples of doors, windows, louvers etc. shall be fabricated, assembled and submitted to the Engineer for his approval. They shall be of sizes, types etc. as decided by Engineer. All samples shall be provided at the cost of the contractor.

2.5 SECTIONS:-

Minimum doors and windows shall be fabricated from extruded section of profiles of detailed on drawings. The sections shall be extruded by the manufacturers approved by the Engineer. The aluminium extruded sections

shall conform IS designation 63400-WP (HV9WP Old designation) with chemical composition and technical properties as per IS: 733 and IS:1285. The permissible dimensional tolerance of the extruded sections shall be such as not to impair the proper and smooth function / operation and appearance of doors and windows.

2.6 FABRICATION:-

Doors, Windows, etc. shall be fabricated to sizes as shown, as shown, at factory and shall be of section, size combinations and details as shown in the Architectural Drawings. All doors, windows etc. shall have mechanical joints. The joints shall be designed to withstand a wind load of 150 kgs. Per sqm. The design shall also ensure that the maximum. All members shall be accurately machined and fitted to form hairline joints prior to assembly. The joint and accessories such as cleats, brackets, etc. shall be of such material as not to cause any bimettalic action, the design of the joints and accessories shall be such that the accessories are fully concealed. The fabrication of doors, windows, etc. shall be done in suitable sections to facilitate easy transportation, handling and installation. Adequate provision shall be made in the door and window members for anchoring to support and fixing of hardware and other fixtures as approved by the Engineer.

2.6.1 For fixed portion, the aluminium angle cleat used shall be 38mm x 38mm x 4.8mm size and minimum 50mm long. The quantity of minimum 0.9m length shall be used for 39.13 kg. of extruded sections fabricated.

2.6.2 For shutters of doors, windows and ventilators, aluminium angle cleat used shall be of the size mentioned above having minimum length of 35mm. Minimum 0.42 m length of angle cleat shall be used for 20.21 kg. of extruded sections fabricated.

No extra payment shall be made for using such quantity of cleat as mentioned in para 7.6.1 & 7.6.2 above.

2.7 ANODISING:-

All aluminium sections shall be anodised as per IS:7088 and to required colour if specified in the item as per IS;1868 grading as specified in item schedule after cutting the member to requisite sizes before the final assembly. Anodising to conform to specified grade with minimum average thickness of 15 microns when measured as per IS:612. The anodic coating shall be properly sealed by steams or in boiling water are cold sealing process as per IS:1868/IS:6057. Polythene tape protection shall be applied on the anodised section before they are brought to site. All care shall be taken to ensure surface protection during transportation, storage at site and installation. The tape

protection shall be removed on installation. The sample will be tested in the approved laboratory and cost of samples, cost of testing, shall be borne by the contractor.

2.7B POWDER COATING:-

Pure polyester powder coating of 50 micron thickness shall be applied of approved shade of Goodlass Nerolac or equivalent make of powder.

2.8 PROTECTION OF FINISH:-

All aluminium members shall be wrapped with approved self adhesive non-staining PVC tapes.

2.9 HANDLING AND STACKING:-

2.9.1 Fabricated materials shall be stacked in an approved manner to protect the material against any damage during transportation. The loading and unloading shall be carried out with utmost care, on receipt of materials at site, they shall be carefully examined to detect any damaged pieces. Arrangements shall be made for expeditious replacement of damaged pieces / parts. Materials found to be acceptable on inspections shall be repacked in crates and stored safely.

2.9.2 In the case of composite windows and doors, the different units are to be assembled first. The assembled composite units should be checked for line, level and plumb before final fixing is done. Units may be serial numbered and identified as how to be assembled in their final location of situation so warrants.

2.9.3 Where aluminium comes into contact with masonry brickwork, concrete, planter or dissimilar metals, it shall be coated with approved insulation lacquer, paint or plastic tape to ensure that electro-chemical corrosion is avoided. Insulation material shall be trimmed off to a clean flush line on completion.

2.9.4 The contractor shall be responsible for assembling composite, bedding and filling the groove with polysulphide sealant inside and outside, at the transoms and mullions, placing the doors, windows etc. in their respective openings. After the doors / windows have been fixed in their correct assigned position, the open hollow sections abutting masonry concrete shall be fitted with approved polysulphide sealant densely packed and neatly finished.

2.9.5 The contractor shall be responsible for doors, windows, etc. being set straight plumb, level and for their satisfactory operation after fixing is complete.

2.10 INSTALLATION:-

2.10.1 Just prior to installation the doors, windows, etc. shall be uncrated and stacked on edge on level bearers and supported evenly. The frame shall be fixed into position true to line and level using adequate number of expansion machine bolts, anchor fasteners of approved size and manufacturer and in an approved manner. The holes in concrete / masonry members for housing anchor bolts shall be drilled with an electric drill.

2.10.2 The doors, windows assembled as shown on drawings shall be placed in correct final position in this opening and marks made on concrete members at jambs, sills and heads against the holes provided in frames for anchoring. The frame shall then be removed from the opening and laid aside. Neat hole with parallel sides of appropriate size shall then be drilled in the concrete members with an electric drill at the marking to house the expansion bolts. The expansion bolts shall then be inserted in the holes, struck with a light hammer till the nuts is forced into the anchor shell. The frame shall then be placed in final position in the opening and anchored to the support through cadmium plated machine screws of required size threaded to expansion bolts. The frame shall be set in the opening by using wooden wedges at supports and be plumbed in position. The wedges shall invariably be placed at meeting points of glazing bars and frames.

2.11 NEOPRENE GASKETS:-

The contractor shall provide and install Neoprene gaskets of approved size and profile at all locations as shown and as called for to render the doors, wndows etc. absolutely air tight and weather tight. The contractors shall produce samples of the gaskets for approval and procure after approval only.

2.12 FITTINGS:-

Hinges, stays, handles, tower bolts, locks and other fittings shall be of approved quality and manufacturers shall be approved by the Engineer.

2.13 MANUFACTURER'S ATTENDANCE:-

The manufacturer immediately prior to the commencement of glazing shall adjust and set all windows and doors and accept responsibility for the satisfactory working of the opening frames.

2.14 MASTIC CEMENT:-

The gaps between frames and supports and also any gaps in the door and windows section shall be raked out as directed and filled with mastic cement of approved colour and make to ensure complete water tightness. The mastic cement shall be of such colour and composition that it would not stain the masonry / concrete work, shall receive paint without bleeding, will not sag and shall not set hard or dry out under any conditions of weather. The samples of mastic cement to be used for this purpose shall be got approved by the Engineer before its actual use.

2.15 DETAILS OF TESTS:-

2.15.1 The various tests on aluminium sections shall be conducted in accordance with the relevant IS codes.

2.15.2 The minimum number of tests for anodic coating and corrosion resistance shall be as given below:-

S.NO.	DETAILS	NO. OF TESTS
(i)	Doors, Windows & Ventilators manufactured.	5% of Nos.

2.15.3 The samples of major member of each unit of doors / windows shall be selected at random by Engineer as such that all the aluminium section shall be got tested.

2.15.4 Work shall be carried out as per CPWD Specifications - 1996 Vol.I to Vol. VI with correction slips 1 to 8 unless specified.

2.16 PROTECTION & CLEANING:-

The sub-contractor shall adequately protect all components and accessories from damage during shipments, storage at jot site, erection and after completion of the work. At such time as may be directed, the sub-contractor shall remove all protective tapes or coating, thoroughly clean all anodized/powder coated aluminium and glass surfaces with suitable cleaning agent, make final adjustments to all ventilators, etc. and hardware leaving all in first class working order.

2.17 SCOPE OF WORK:-

The sub-contractor shall design, supply, fabricate, deliver and install and guarantee all construction necessary to provide a complete aluminium

composite panel cladding, complete with all necessary anchors, hardware and fittings to provide a total installation, fully in conformity with the requirements and intent of the drawing and specification herein.

The scope of work shall be read in conjunction with those in the specification of structural glazing.

2.18 ACCEPTANCE CRITERIA:-

The aluminium sections shall conform to the provisions of the relevant item of BOQ. For payment purposes only actual weight of sections shall be taken into account. If, however, the sectional weight of any aluminium section is higher than the permissible variation then the weight payable shall be restricted to the weight of the section including permissible variation.

Measurement : Payment by weight shall be made for aluminium sections including beading only and all fixing angles, fittings / fixtures such as handles and hinges etc. shall not be included in the weight to be paid.

2.19 GUARANTEE BOND : All aluminium work shall carry two years guarantee after completion of the work against water leakage, unsound material and workmanship and defective anodising as per approved proforma.

Two years guarantee in prescribed proforma must be given by the specialised firm, which shall be counter signed by the contractor, in token of his overall responsibility in addition 10% (Ten Percent) of the cost of these items would be retained as guarantee to which the performance of the work done. The cost guarantee against this item of work shall be in addition to the security deposit mentioned elsewhere in the contract form. If any defect is noticed during the guarantee period, it should be rectified by the contractor within seven days, and if not attended to, the same will be got done from another agency at the risk and cost of the contractor. However, this security deposit can be released in full, if bank guarantee of equivalent amount for two years is produced and deposited with the department.

2.20 Work shall be carried out as per CPWD Specifications - 1996 Vol.I to Vol. VI with correction slips 1 to 6 unless specified.

2.21 LIGHTENING PROTECTION:-

The structural glazing contractor shall incorporate lightning protection device. The structural glazing contractor shall install all necessary conductors, wiring connection etc. for the structural glazing. The electrical contractor will be responsible for contracting the earthing system for the lowest and top point of the structural glazing to ground level.

Proposal on the lightning protection system shall be endorsed by a qualified lightning protection engineer. The whole of the system shall be tested to ensure

its compliance with the requirements as laid down in the British Standard Code of Practice CP 326:1965 at the cost of the Contractor.

2.22 RATES:-

2.22.1 The rate of the item shall include the cost of materials, T&P, Double Scaffolding and labour , water charges etc. required in all the above operations.

3.00 CERAMIC TILE DADO

3.01 **DESCRIPTION :**

This section covers the requirements for furnishing of all materials, labour tools and equipment for completion of ceramic tile dado including preparation of surface under layer.

3.02 **Applicable codes and standards:**

The codes and standards generally applicable to the work of this section are listed hereinafter:

IS : 8112 Ordinary Portland cement (43 grade)
IS : 383 Coarse and fine aggregates from natural sources.
IS : 777 Glazed Earthenware tiles.
IS : 1489 Portland Pozzolona Cement.
IS : 8042 White Portland Cement.

3.03 SAMPLES:

The contractor shall furnish samples of ceramic tiles to the Engineer well before the commencement of dado work for his approval.

3.04 CERAMIC TILES :

The ceramic tile slabs shall be of the approved make colour, texture and sizes conforming to IS:777. the thickness of the tiles shall be as specified in the item. A tolerance of + or - 1mm in facial dimensions and + pr - 0.5mm shall be allowed in thickness of tiles. The tiles shall be of uniform colour and shade without crazing. they shall be true to size and shape and free from cracks, twists uneven and chipped edges and corners and other defects. The underside of the tiles shall be ribbed or some other formation so that the tiles adhere properly to the base. The tiles shall have the following properties:

3.05 SPECIFIC GRAVITY:

The mean specific gravity shall be 2.40 gm/cu.cm with a minimum of 2.3 gm/cu.cm

3.06 ABSORPTION OF WATER:

The mean water absorption shall be as per relevant IS standards.

3.07 WEAR RESISTANCE:

The average wear by abrasion shall not exceed 3.5mm and wear on any individual specimen shall not exceed 4.0 mm.

3.08 CEMENT :

Ordinary cement shall be either ordinary Portland Cement confirming to IS:8112 or Portland Pozzolona Cement confirming to IS:1489. White cement shall be white Portland Cement conforming to IS: 8042. Cement shall be fresh when delivered to the site.

3.09 FINE AGGREGATE :

Fine aggregate shall be clear pit sand or other approved sand confirming to IS:383. It shall be free from injurious amounts of soft and flaky particles and free from vegetable, organic, clayey matter, loom, mice, salts and other deleterious substances.

3.10 WATER :

Water used for both mixing and curing shall be fresh, clean, free from oil, salt, acid, alkali or other chemicals and deleterious matter confirming to IS : 456 :1978

3.11 PREPARATION OF SURFACES :

The joints shall be raked out to a depth of atleast 15-mm in masonry wall, preferably when the masonry is being done. In case of concrete walls the surface shall be hacked and roughened with wire brushes. The surface shall be cleaned thoroughly, washed with and keep wet before skirting is commenced.

3.12 LAYING :

Unless specified otherwise in the item, 12-mm thick cement mortar shall be applied and allowed to harden. The plaster/base shall be roughened with wire brushes or by scratching diagonal at closed intervals. The tiles should be soaked in water washed clean, and a coat of cement slurry applied liberally at the back of tiles and set in the bedding mortar. The tiles shall be tamped and corrected to proper plane and lines. The tiles shall be set in required pattern and jointed. The joints shall be as fine as possible. Top of dado shall be truly horizontal and joints truly vertical except where otherwise indicated. Dado shall not be fixed. These shall be cut/sawn to the required size and their edge rubbed smooth.

3.13 CURING AND FINISHING :

The joints shall be cleared off the cement grout with wire brush or trowel to a depth of 2 mm to 3 mm and all dust and loose mortar removed. Joints shall then be flush jointed with white cement mixed with pigment required to match the shade of the tiles. The dado shall be kept wet and finished clean. The finished work shall not sound hollow when trapped with wooden mallet.

3.14 MEASUREMENTS :

Length and breadth shall be measured correct to a centimeter. Height shall be measured correct to a centimeter in the case of dado and 5 mm in case of riser and skirting. The area shall be calculated in SqM, correct to two places of decimal. Length and height shall be measured along the finished face of skirting or dado including curves where specials such as coves, internal and external angles and beads are used. Where cornices are used the area of dado shall be measured excluding the cornices.

Nothing extra will be paid for cutting (sawn) the tiles to sizes.

3.15 RATE :

The rate includes the cost of all materials & labour involved in all the operations described above. the specials like covers, internal & external angles, beads & cornices, where required, shall be measured & paid forseparately.

4.00 EPOXY BASED JOINTLESS ANTISTATIC FLOORING

4.01 The jointless flooring consists of 3 mm thick epoxy resin based antistatic flooring, self levelling with smooth finish, in required shade and of required conductor loading. Epoxy based flooring should be applied in several layers in order to insure permanent connection for the elimination of static electricity between the supporting base and the surface and should confirm to IS: 9197. The entire job is to be undertaken by manufacturer's trained and skilled technicians to lay the epoxy-based floor as per IS :4631.

4.02 The top layer of epoxy resin in 3 or more coats in the desired colour and shade is applied so as to achieve the required thickness, shade and finish.

4.03 The mechanical parametric properties to be achieved are as follows.

9.03.1 Resistance to compression	800 Kgf/Cm2
9.03.2 Resistance to deflection	400 Kgf/Cm2
9.03.3 Resistance to abrasion	0.35 g/h
9.03.4 Fire behavior	Class IV/1
9.03.5 Resistance to current leakage	1.10 Ohms

4.04 Measurements will be done for the finished and completed area to the nearest centimeter.

5.0 BORE WELLS

5.01 Scope of Work

The general character and the scope of work to be carried out under this contract are illustrated in the following specifications. It gives only general guidance as regards design, drilling and construction of tubewells. Before selecting the method of construction to be adopted ,the contractor shall give due consideration to site condition and Geological data of the site. The construction and testing of tubewells shall be as per IS 2800- 1979 (Part 1 and 2). This contract is an item rate contract. All payments shall be made for the actual work executed. The Contractor shall ensure the required minimum yield.

5.02 Selection of Site

The site where the tubewell is proposed, shall be examined by tenderer, and changes if required shall be discussed with the engineer prior to start of work. Any previous data available with the Contractor regarding nearby tubewells should be made use of to evolve suitable procedure for drilling , developing, testing etc.

5.03 Geological Data

During the drilling operation, contractor shall collect the samples of different strata from suitable intervals or where change in strata is met with. It shall be carefully examined and analysed and the data shall be preserved carefully and handed over to Engineer. The contractor shall make one drilling time log during the execution of work for the bore well.

5.04 Design and lowering of pipe assembly

The length and diameter of the housing pipe shall be selected on the basis of static water level, the drawdown and the discharge expected from the well and the size of the pump to be installed. The size and length of blind pipes and the slotted/ strainer pipes shall be selected according to the expected discharge and the depth of tubewell. The size and distribution of the slots shall be as per IS 8110. After completion of the bore hole the contractor shall assemble the tube well assembly according to the water bearing strata met during boring, after getting the same approved from the Engineer and shall lower in to the drilled hole the same keeping the slotted strainer opposite to water bearing strata from which the water is to be extracted . The bail plug shall rest on firm ground. Before the bail plug is lowered, about one metre depth of the bore hole shall be packed with the gravel to avoid sinking of the assembly. In case part of a bore hole is not proposed to be utilized, it shall be filled with gravel before lowering the assembly. The slotted pipe and other pipes shall be provided with proper guides to keep them in the centre of the bore to ensure uniform gravel packing all around.

5.05 Gravel Packing

All gravel shall consist of hard rounded particles reasonably uniform in diameter and shall be of size, determined after analyzing the character of the water bearing formation tapped. The gravel shroud around the screen shall be uniform. It should be free from dust, dirt and other vegetable matters. Gravel packing once started shall be carried out continuously until it is completed. Pea gravel/Stone Chips shall be thoroughly washed.

5.06 Development of Borewell

The well shall be developed either by surging and agitating or by over pumping and back washing with an air lift and high velocity jetting. The tube well shall be developed as per IS 2800 -1979 or latest by air compressor to be arranged by the contractor as required and stipulated in BOQ to obtain the maximum discharge available from the completed tubewell. Another acceptable method may also be adopted. This development process shall be continued until the stabilisation of sand and gravel particles has taken place. The development shall continue until the gravel should stop sinking, discharge of depression ceases to improve and the sand content is not more than 20parts per million. A record of the hours of working of Air compressor shall be maintained by Employer Engineer which will be signed by the contractor or his authorised representative. Payment for development of tubewell shall be made at the hourly rate indicated in the schedule of quantities for the actual period during which the Air-Condition has worked. A statement showing the quantity of gravel initially filled in the bore and the quantity added during development should be prepared by the contractor and got signed by the representative of the Engineer.

5.07 Disinfection

The well shall be disinfected after completion of test for yield. All the exterior parts of the pump coming in contact with the water shall be thoroughly cleaned and dusted with powdered chlorine compound. In fact it shall be disinfected every time a new pump is installed or the one installed is replaced after repairs.

The stock solution of chlorine may be prepared by dissolving fresh chlorinated lime. For obtaining an applied standard concentration of 50 ppm, 1 litre of the stock solution shall be used to treat 300 litres of water.

5.08 Grouting and sealing

Grouting and sealing of tubewell may be done, if required depending upon the site conditions and the quality of the discharge of the strata encountered. To ensure that the grout shall be provided a satisfactory seal, it shall be applied in one continuous operation. Sealing of the tube well may be done by grouting the annular space between bore and the

housing pipe, with cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 : coarse aggregate 20 mm nominal size) to a depth of 5m below the grouted level.

5.09 Handing over of the borewell.

The tubewell shall be handed over in complete shape. The housing pipe shall be closed by a well cap for the period between the completion of the tube well and the installation of the pump set.

The following information shall be furnished by the drilling agency on completion of the tubewell :

a) Strata chart of the tube well indicating the different types of soils met with, at different depths.
b) Samples of strata collected , neatly packed and correctly marked in sample bags.
c) Chart of actual pipe assembly lowered indicating the size of pipes, depth ranges, where slotted/ strainer pipes have been used, depth and diameter of housing pipe, reduced level of the top of the housing pipe and the diameter and depth of the bore hole.
d) Position of every joint in the well assembly.
e) Hours of development done by the compressed air, pump sets or by other means.
f) Pumping water level at the developed discharge.
g) Two copies of test certificates of the water samples results from approved testing agency.
h) Results of development along with levels of static subsoil water and depth of draw for steady discharge.
i) Results of mechanical (sieve) analysis of samples of aquifer materials wherever applicable.
j) Yield analysis and recommendation on the safe pumping yield, pump settings and specifications for suitable pumps etc.
k) Verticality tests results to be recorded in accordance with IS:2800-1979

5.10 TUBEWELL DATA

1. Yield required 150 lpm (Sand free delivery from borewell)

3. Bore - 250 mm dia.

4. Approximate depth – 260 metre

5. Assembly - Blind/ Slotted Pipes – 200 mm dia. Upto complete depth.

6. Material – MS Class “C” pipes (Heavy Class)

7. Verticality – True verticality as per IS – 2800- 1979

8. Packing – Pea Gravel/Stone Chips

9. Developing – Minimum 60 Hrs or till sand free discharge is obtained.

10. Water for drilling – Contractor shall make his own arrangement for water required for drilling purposes as well for development purposes.

11. The design for the tube well indicating the depth range of the aquifer zones to be tapped shall be given after a detailed study of the data collected during drilling operations.

12. All the casings shall be of ERW steel quality confirming to IS specifications and carry manufacturer's certificate. The pipes shall have a wall thickness of not less than 7 mm or as per IS 1239. The slotted pipes must have an effective open area of atleast 15% and the slotted size should be 1.6 mm. All pipes shall be painted fresh before lowering. The pipes shall be welded thoroughly all round to prevent leakage and breakage. Centering guides may be used to maintain the verticality of the tube wells which shall be tested in accordance with the norms stipulated in IS 2800.

13. The annular space between the bore well and tube well assembly shall be packed with well-graded pea gravel of good quality, durability and high sphericity.

5.11 Guarantee

On award of the work contractor shall submit a guarantee covering the quality and performance of all material supplied and installed under the contract. This guarantee shall cover each and every material whether manufactured by the contractor or not.

5.12 Rate

The rate quoted for Borewell items shall provide for the cost involved in all the above described operations.

6.00 PLUMBING & SANITARY INSTALLATIONS

6.01 Wall Caps

Wall caps shall be provided on all walls, floors, columns etc. wherever supply and disposal pipes pass through them. These wall caps shall be chromium plated brass snugly fittings and shall be large enough to cover the puncture properly and shall conform to IS: 4291.

6.02 Pipes, Hangers, Brackets, etc.

Sturdy hangers, brackets and caddles of approved design shall be installed to support all pipe lengths, which are not embedded over their entire runs. The hangers and brackets shall be of adjustable heights and painted with red oxide primer, and two coats of enamel paint of approved make and shade. Clamps, coils and saddles shall be provided to hold pipes with suitable gaskets of approved quality. The brackets and hangers shall be designed to carry the weights of pipes safely. Wherever required pipes may run along ceiling level in suitable gradient and supported on structural clamps. Spacing for clamps for such pipes shall be as follows:

	Vertical	Horizontal
G.I. Pipes	300 cms	240 cms
H.C.I. Pipes	180 cms	120 cms

6.03 Pipe sleeve

Adequate number of sleeves (pipe inserts) of Cast Iron or Mild Steel shall be provided where pipes cross through concrete, masonry and similar work. The pipe inserts shall be provided with removable timber plugs to keep foreign matter out till installation of the services pipe cross the sleeve. The diameter of sleeve should be one size higher than the proposed dia or as instructed by the Engineer.

6.04 Floor trap inlet

Bath room traps and connections shall ensure free and silent flow of discharging water. Where specified, contractor shall have a special type G.I. / M.S. inlet hopper without or with one, two or three inlet sockets to receive the waste pipe. Joint between waste and hopper inlet socket shall be lead caulked/welded/threaded. Hopper shall connected to a C.I. P or S trap with at least

50mm water seal. Floor trap inlet hoppers and traps shall be set in cement concrete 1:2:4 blocks without any extra cost.

6.05 **C.P. gratings**

Floor trap and urinal trap shall be provided with 110mm square or round C.P. grating, with rim of approved design and shape. Minimum thickness shall be 3 mm.

6.06 **Hot Water Supply**

The chase will be closed in cement mortar 1:2 (1 cement : 2 coarse sand). Pipes shall be clamped to the wall inside the chase.

6.07 **Making Connections**

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

6.08 **Water Heater**

Water heater shall be automatic pressure type water heater (with pressure release valve) with heavy gauge copper container duly tinned, thermostats, indicator lamp and glass wool insulator. the water heaters shall be fitted with pressure release valve, non-return valve and inlet and outlet stop valves as required. Water heaters to conform to IS:2082.

6.09 **FULLWAY BALL VALVE**

The valves shall be of full-bore type and of quality approved by the Engineer. The body and ball shall be of copper alloy and stem seat shall be of Teflon.

7.00 PUMPS

7.01 Pumps

1) Submersible pumps

Submersible pumps for drainage shall be totally submersible single stage, single entry pump.

Pump shall be with C.I. casing and C.I. two vane open type dynamically balanced impeller connected to a common shaft to the motor. The vane for sewage pump will be open type, while for drainage pump, etc. It will be of semi open type.

Stuffing box shall be provided with mechanical seals.

Each pump shall be provided with water cooled squirrel cage induction motor suitable for 415 volts, 3 phase, 50 cycles A.C. power supply.

Each pump shall be provided with in built liquid level controller for operating the pump between predetermined levels.

The pumping set shall be for stationary application and shall be provided with pump connector in it. The delivery pipe shall be joined to the pump through a rubber diaphragm, and bend and guide pipe for cash installation, without disturbing delivery pipe the pump unit shall have a back pull out design. A rust proof chain shall be provided for each pump.

Pump shall be provided with all accessories and devices necessary and required for the pump to make a complete working system.

Pumps shall operate with high water level in sump and stop at low water level by means of an electronic level controller or auto float.

2) Pump and Motor for Bore Well

a) Pump and motor of borewell shall be submersible type. Delivery of pump shall be connected with C.I./G.I. pipe via non-return valve.
Pump and motor shall be sinked into water with suitable GI pipe.

b) The pump and motor shall be lubricated by water. Thermometer shall be PVC coated of B class insulation. The motor shall be capable of 415-440 V, AC 3 phase supply.

c) The capacity of pump and motor for Borewell shall be as specified in the Schedule of Quantities.

7.02 Vibration Eliminators

Provide on all suction and delivery lines double flanged reinforced neoprene flexible pipe connectors. Connectors should be suitable for a working pressure of each pump and tested to the test pressure given in the relevant head. Length of the connector shall be as per approved manufactures details.

7.04 Jointing of G.I. Pipes

a) Welding of pump suction and delivery headers may be permitted if so required due to site conditions at no additional cost.

7.05 Electrical Works

All related electrical works shall be executed in accordance with the specifications given in the Electrical Part.

7.06 Measurement

G.I. pipes shall be measured per linear metre of the finished length and shall include all fittings (except flanges), jointing, clamps for fixing to walls or hangers and testing.

Flanges shall be measured by numbers and shall include 3 mm thick insertion rubber gasket, nuts. bolts and testing.

Suction and delivery headers shall be measured per linear metre of finished length and shall include all items as given in the schedule of quantities. Painting shall be included in the rate of headers.

Pumps shall be measured by numbers and shall include all items as given in the specifications and schedule of quantities.

Motor control panels, earthling station, vibration eliminators, flanges and suction strainer shall be measured by numbers and shall include all items as given in the schedule of quantities and specifications.

Power cables, earth wire and tape shall be measured per linear metre and shall include all items given in the specifications and schedule of quantities.

7.07 Commissioning and Guarantees

Scope of work

Work under this section shall consist of recommissioning, commissioning, testing and providing guarantees for all equipment, appliances and accessories supplied and installed by the contractor under this contract.

General requirements:

a. Work under this section shall be executed without any additional cost. The rates quoted in this tender shall be inclusive of the works given in this section.
b. Contractor shall provide all tools, equipment, metering and testing devices required for the purpose.
c. On award of work, contractor shall submit a detailed proposal giving methods of testing and gauging the performance of the equipment to be supplied and installed under this contract.

Pre - Commissioning of Pumps

On completion of the installation of all pumps, piping, valves, pipe connections, electrical wiring, motor control panels and water level controlling devices the contractor shall proceed as follows:-

a.) Testing of M.C.C.

Tests to be carried out for motor control centres shall be:

i) Insulation resistance test with 500 volt megger, before and after high voltage test, on all power and control wiring.
ii) high voltage test at 1000 volts A.C. for one minute on all power and control wiring.
iii) low voltage continuity test (6 volts) on power wiring of each feeder, between bus bars and the outgoing terminals with switches and contactors in closed position.
iv) low voltage continuity test (6 volts) on all control wiring.
v) operation test for all feeders with only control supply made `on' to ensure correctness of control wiring, operation of the various equipment used such as push buttons, protective devices, indicating lamps and relays etc. All contractors shall be checked and there shall be no chattering.
vi) earth continuity test with voltage not exceeding 6 volts between various noncurrent carrying metallic parts of equipment, steel work etc. And the each bus provided in the MCC.
vii) operation of all instruments and meters provided on the MCC.

b) Pumping Systems

i) check all suction and delivery connections.
ii) test run and check rotation of each motor and correct the same, if required.

c) Pipe work

i) check all clamps, supports and hangers provided for the pipes.
ii) fill up pipes with water and apply hydrostatic pressure to the system as given in the relevant section of the specifications. If any leaking is found, rectify the same and retest the pipes.

7.08 Commissioning & testing

Start the duty pump on manual controls, check its operation and then test run on auto controls. Change over the duty pump and test it in the same manner a the first pump.

Handing Over.

All commissioning and testing shall be done by the contractor to the complete satisfaction of he Engineer and the job handed over to the Engineer or his authorised representatives. Contractor shall also hand over, to the Engineer, all maintenance & operation manuals and all to the items as per the terms of the contract.

7.09 Guarantees

a) The contractor shall submit a warranty for all equipment, materials and accessories supplied by him against manufacturing defects, malfunctioning or under capacity functioning.
b) The form of warranty shall be as approved by the Engineer.
c) The warranty shall be valid for a period of one year from the date of commissioning and handing over.
d) The warranty shall expressly include replacement of all defective or under capacity equipment. Engineer may allow repair of certain equipment if the same is found to meet the requirement for efficient functioning of the system.
e) The warranty shall include replacement of any equipment found to have capacity lesser that the rated capacity as accepted in the contract. The replacement equipment shall be approved by the Engineer.
f) the contractor shall separately submit with this offer his charges per month for operation of mechanical equipments after commissioning and handing over.

7.10 Relevant I.S. Codes

Following codes and Indian standards shall be applicable as amended up to date :

Pumps & Motors	
Centrifugal pumps	I.S. 1520
Electrical motors	I.S. 7538
Piping & Valves	
G.I. Pipes	I.S. 1239
C.I. double flanges sluice valves Class	I.S. 780
C.I. Double flanged non return valves	I.S. 5312

8.00 FIRE FIGHTING WORKS:

8.1 FIRE PROTECTIONS

1. **SCOPE OF WORK**

The Scope of work covers the supply, installation, testing & commissioning of Fire Fighting Wet Riser Hydrant system proposed for the building. It will be the responsibility of the Contractor to get all approval and completion certificate from the Local Fire Department without which the work will not be taken over by the owner. Fee payable to the local bodies for such activities shall also be borne by the Owner on production of receipts for money paid and the all other expenses barring the fee will be borne by the Contractor.

2. **SPECIFICATION**

The work of Wet Riser Hydrant system will be carried out as per CPWD specifications 1985 electric work and for Wet Riser system as per enclosed specification.

3. **TENDER DRAWINGS**

For guidance of the bidder, drawings as listed in Annexure are enclosed with these tender documents. These drawings are broadly indicative of the work to be carried out. The Contractor on award of work will furnish detailed stage-wise working drawings as required in advance for approval of Engineer and get the same approved by Local Fire Authority/other statutory bodies. No claim whatsoever shall be admissible on account of changes that may be introduced by the Engineer /Local Fire Authority.

4. **SHOP DRAWINGS**

The Contractor shall prepare and furnish all shop drawings in quadruplicate at no extra cost for approval by the Engineer before commencing fabrication/manufacture of the equipment. Such shop drawings shall be based on the Architect drawings and requirements laid down in the specifications and as per site conditions. the manufacture of equipment shall be commenced only after the shop drawings are approved in writing by the Engineer. Such drawings shall be co-ordinated with all disciplines of work.

5. **COMPLETION AS BUILT DRAWINGS**

On completion of the work and before issuance of certificate of virtual completion, the Contractor shall submit to the Engineer. General layout drawings, drawn at approved scale indicating layout of pump house piping and its accessories " As installed ". These drawings shall in particular give the following :

a. General layout of pump house.

b. Panels and other equipment location and sizes etc.

c. Complete Schematic as installed.

d. Location of Hydrants, Earth pipes, route of earthling conductors etc.

e. Route of all cables and pipes run along with detail sizes and mode of installation.

6. **DOCUMENTS**

The Contractor shall submit to the Engineer, the following documents on completion of the work and before issuance of virtual completion.

i. Warranty for equipment installed.

ii. Test certificates.

iii. History sheets of the equipments.

iv. Catalogues.

v. Operation and Maintenance manuals.

vi. List of recommended spares and consumables.

vii. Reconciliation statement.

viii. All approvals and sanctions.

7. SANCTION/APPROVALS FROM STATUTORY AUTHORITIES/LOCAL FIRE AUTHORITY

The Contractor shall be fully responsible and shall carry out following activities :-

a) Submission of working drawing.

b) Obtaining the approval of drawings.

c) Arranging inspection of site by officials of the Authority.

d) Obtaining the final no objection/completion certificate after submitting required documents.

e) Any other statutory approvals required.

8. MANUFACTURING

The responsibility for ensuring the manufacture of the equipment as per the specifications shall be solely that of the Contractor. The Contractor shall be responsible for selection of materials as per agreed specifications.

9. MAKE OF MATERIALS

Only Approved make of material shall be used. The contractor shall get the samples of all the items approved from the Engineer before commencing the supply.

10. MANUFACTURER INSTRUCTION

Any specific instruction furnished by manufacturer covering the points not mentioned in technical specifications of the tender shall be brought to the notice of Engineer in writing for further instructions in this regard at the time of tendering.

11. MATERIAL TESTING

The Engineer shall have full power to get any material of work to be tested by an independent agency at Contractor's expense in order to prove the soundness and adequacy.

12. INSPECTION AND TESTING

a) All equipment shall be inspected and tested as per an agreed quality Assurance Plan before the same is packed and dispatched from the Contractor's Works. The Contractor shall carry out tests as specified/directed by Engineer.

b) Contractor shall perform all such tests as may be necessary to meet requirements of Local Authorities, Municipal or other statutory laws/ bye-laws in force. No extra shall be paid for these.

c) The Engineer may, at his sole discretion, carry out inspection at different stages during manufacturing and final testing after manufacturing.

d) Approvals or passing of any inspection by the engineer or his authorized representative shall not, however, prejudice the right of the Engineer to reject the plan if it does not comply with the specification when erected or give complete satisfaction in service.

13. **TRAINING OF DEPARTMENT PERSONNEL**

a) The Contractor shall train the Owner's personnel to become proficient in operating the equipment installed. Training shall be done before the expiry of the defects liability period.

b) The period of training shall be adequate and mutually agreed upon by the Engineer and Contractor.

c) The Owner's personnel shall also be trained for routine maintenance work and lubrication, overhauling, adjustments, testing, minor repairs and replacement.

d) Nothing extra shall be paid to the Contractor for training Owner's personnel.

14. **PERFORMANCE GUARANTEE**

At the close of the work and before issue of final certificate of virtual completion by the Engineer, the Contractor shall furnish a written guarantee indemnifying the Owner against defective materials and workmanship for a period of one year after completion and handing over. The Contractor shall hold himself fully responsible for reinstallation or replace free of cost to the Owner.

a. Any defective material or equipment supplied by the Contractor.

b. Any material or equipment supplied by the Owner which is proved to be damaged or destroyed as a result of defective workmanship by the Contractor.

8.2 PIPING FOR WET RISER & FIRE HYDRANT SYSTEM

1. Scope

This Section covers the details of requirement of piping used in wet riser & Fire hydrant system, including the associated auxiliary equipments.

2. General

The wet riser system shall remain pressurized at all times during operation, and as such the piping work shall be carried out to withstand the same. Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workman like manner. Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

3. Pipes and fittings

Pipes for Wet Riser system shall be of black steel conforming to IS: 1239 (Heavy Class)

Fittings for black steel pipes shall be malleable iron suitable for welding or tapered screwed threads.

4. Jointing

Joint for black steel pipes and fittings shall be metal to screw grid upto 65mm dia welded joints. A small amount of red lead may be used for lubrication and rust prevention in threaded joints.

Joints between C.I. or black steel pipes, valves and other appurtenances, pumps etc. shall be made with C.I. or M.S. flanges with appropriate number of bolts. Flanged joints shall be made with 3mm thick insertion rubber gasket.

5. <u>Dia of Flange and Hole conforming IS:</u>

Size of pipe	→	80mm	100mm	150mm	200mm	300mm
Dia of flange	→	200mm	220mm	285mm	340mm	445mm
Dia of bolt	→	16mm	16mm	16mm	16mm	16mm
No. of hole	→	4	4	8	8	12

6. Pipe Protection

a) All pipes above ground and in exposed locations shall be painted with one coat of red oxide primer and two or more coats of synthetic enamel paint of approved shade.

b) Pipes and fittings buried underground and concealed in brick/RCC shall be provided with two coats of hot bitumen , wrapped with bituminised hessian cloth and finished with one coat of hot bitumen paint with fiber glass tissue paper . All items should be IS marked. All the layers, as described above shall be calendared together to finish it to not less than 4mm thick .

Application

a. Clean the exterior surface of pipe with wire brush and remove all foreign materials.

b. Apply a coat of primer as supplied by the manufacturer of wrapping tape. Primer shall be applied at he rate of 100 gm/sqm. When the solvent evaporates and surface becomes tacky, wrap tape around the pipe spirally. Overlap shall be in accordance with the recommendations of the manufacturer. Thermofusion process should be used to ensure that the tape adheres to the surface of pipe in a proper manner.

b) Pipe passing through structural members will be provided with M.S. pipes.

7. Pipe Supports

All pipes shall be adequately supported from ceiling or walls from existing inserts by structural clamps fabricated from M.S. structurals e.g. rods, channels, angles and flats. All clamps shall be painted with one coat of red lead and two coats of black enamel paint. Where inserts are not provided the Contractor shall provide approved type anchor fasteners.

Pipe Support Spacing	**Horizontal**	**Vertical**
Pipe upto 50 mm	2 Mtr	3 Mtr
Pipe 65 - 100 mm	1.75 Mtr	3 Mtr
Pipe above 100mm	1.50 Mtr	3 Mtr

8. Orifice Flanges

Contractor shall provide orifice flanges fabricated from 6mm thick stainless steel plates on the branch lines feeding different zones/floors so as to allow required flow of water at 3.5 Kg/sq.cm. pressure. The Contractor shall furnish design for these orifice flanges.

9. Air Vessel and Air release Valve

Air vessel on top of each wet riser piping shall be installed before execution for approval fabricated out of at least 8mm thick steel to withstand the pressure, with dished ends and supporting legs. This shall be of 300 mm dia and 1m high. This shall be completed with necessary flange connection to the wet riser piping and air release valve with necessary piping to meet the functional requirement of the system. The air vessel shall be of continuous welded construction and galvanized to IS: 4736-1968. This shall be tested for twice the working pressure.

10. Valves, gauges and orifice plates.

Sluice valves above 65mm shall be of cast iron body and bronze/gunmetal seat. They shall conform to type PN 1.0 of IS: 780-1980, valves upto 65mm shall be of gunmetal construction. Valve wheels shall be of right hand type and have an arrow head engraved or cast thereon the direction for turning open and closing.

Non return valves shall be of cast iron body and bronze / gunmetal seat. They shall be swing conform to Class 1 of IS: 5312 and have flanged ends. They shall be swing check type in horizontal runs and lift check type in vertical runs of piping. They shall not be spring loaded type.

Check valve shall be of cast iron double flanged conforming to IS:5312.

Valves on pipes 65mm and below shall be heavy pattern gunmetal valves with cast iron wheel seat tested to 20kg/sqcm pressure. Valves shall conform to IS:778.

Air Valves:

25mm dia screwed inlet cast iron single acting air valves on all high points in the system or as shown on drawings.

Drain Valves:

50mm dia black steel pipe conforming to IS:1239 heavy class with 50mm gunmetal full way valve for draining and water in the system in low pockets.

Pressure gauge of suitable range shall be installed on the discharge side of each pump vacuum gauge shall be provided on suction side for pumps with negative suction. The dial size shall be 250mm. The gauges shall have brass cocks.

Orifice plates shall be of 6mm thick stainless steel to reduce pressure on individual hydrants to operating pressure of 3.5kg/sq.cm. Design of the same shall be given by the Contractor as per location and pressure condition of each hydrant.

12. Internal Hydrants

The internal hydrant outlet shall comprise 'single/double headed double outlet gunmetal landing valve' conforming to type A/B of IS: 5290-1993. Separate valves one on each of the two heads shall form part of the landing valve construction.

A brass cap with chain is provided on one head of the outlet which will have an instantaneous pattern female coupling for connection to the hose pipe. The landing valve shall be fitted to a tee connection on the wet riser at the landing.

13. First Aid hose reel equipment

First aid hose reel equipment shall comprise reel hose guide fixing bracket, hose tubing globe valve, stop cock and nozzle. This shall conform to IS: 884-1969. The hose tubing shall conform to IS: 1532-1969.

The hose tubing shall be 20mm dia and 30 m long with gunmetal nozzle and control valve, shut off valve, all mounted on circular hose reel of heavy duty mild steel construction and cast iron

brackets. Hose reel shall be connected to the fire hydrant pipe directly as shown on the drawings. The gunmetal /brass nozzle and globe valve shall be of 25mm size.

The fixing brackets shall be of swinging type. Operating instructions shall be engraved on the assembly.

14. Hose pipes, branch pipes and nozzles

Hose pipes:- Hose pipes shall be rubber lined woven jacketed 63mm in diameter and 15m long. They shall conform to type 2 (reinforced rubber lined) of IS: 636-1986. The hose shall be sufficiently flexible and capable of being rolled.

Each run of hose pipe shall be complete with necessary coupling at the ends of match with the landing valve or with another run of hose pipe or with Branch pipe. The coupling shall be of instantaneous spring lock type.

Branch pipe:- Branch pipe shall be of copper, gunmetal or aluminium alloy 63mm dia and be complete with male instantaneous spring lock type coupling for connection to the hose pipe. The branch pipe shall be externally threaded to receive the nozzle.

Nozzle :- The nozzle shall be of copper or gunmetal, 20mm in internal diameter. The screw threads at the inlet connection shall match with the threading on the branch pipe. The inlet end shall have a hexagonal head to facilitate screwing of the nozzle on to the branch pipe with the nozzle spanner.

End couplings, branch pipes, and nozzles shall conform to IS:903-1985. Each hydrant point will be provided with two hoses of 15m each and one gunmetal branch pipe.

15. Hose Cabinet

The hose cabinet to accommodate the hose pipes, branch pipe nozzle and the hydrant outlets shall be fabricated from 16 gauge thick M.S. sheet. In case of internal hydrants, this shall accommodate the hose reel equipment also. This shall have lockable, center opening glazed doors.

The scope of work includes provision of masonry or steel frame structure, as specified for installation. The hose cabinet shall be painted with red stove enameled paint.

16. Fire Brigade inlet connections/ Draw off connection

One set of 2/4 way collector head Fire Brigade connection shall be provided at under ground sumps, sprinkler system and individual wet risers as specified.

The inlet to the wet riser sprinkler header shall be with 100/150mm dia sluice valve and non return valve. The scope shall include necessary reducers, tees bends and special fittings as required.

It should be provided with M.S. enclosure fabricated from 1.5mm thick M.S. sheet, front glass locking arrangement supported on M.S. structural members, painting with two coats of postal red enamel.

17.0 Installation Valve

Contractor shall submit his detailed shop drawings showing the exact location, details of installation of the valve and alarm complete in all respects.

Installation valve shall comprise of a cast iron sluice valve with gunmetal trim, pressure gauge, double seated clapper check valves. Alarm valve with test valve and orifice assembly and drain pipe with pressure gauge, bye-pass on check valve to regulate differential pressure and false alarm, turbine water gong including all accessories necessary and required and as supplied by original equipment manufacturer and required for full and satisfactory performance of the system.

9.3 INSTALLATION AND TESTING

1. Scope

This section covers the requirements of installation of the various components of the wet riser system.

A survey of the site of the work shall be made by the Contractor before preparation of the detailed drawings for submission to the department for approval. The installation shall be carrier out strictly in accordance with the approved drawing.

The scope of installation work shall include the following, where or not expressly mentioned in the schedule of work.

i. Cement concrete (1:2:4mix) foundation for all pump sets.

ii. Vibration isolation arrangement for all pump sets.

iii. Filling up the hole in flooring with cement concrete, after laying the wet riser pipes.

iv. Necessary supports and clamps for wet riser pump room.

v. Necessary supports and clamps for wet riser plumbing the building.

vi. Supporting bracket/frame work for the fuel oil tank of the engine.

vii. Excavation of the earth, consolidation and refilling after laying of wet riser piping in ground.

viii. Provision of necessary brick base or intermediate support as required in approved manner in case of soils which are no strong enough to support the pipes, thereby likely to case different settlement.

ix. Necessary anchor block of ample dimensions in 1:2:4 cement concrete at all bends, tee connections, foot of the wet riser, and other places as required to stand the pressure thrust in pipes.

x. Necessary masonry work/steel work for supporting hose cabinets near external (yard) hydrants.

xi. Valve chambers of approved design with external (yard) hydrant.

xii. Ground level hydrants of approved design, where specifies.

xiii. Cutting and making good the damages for the installation work of the riser system

xiv. Strainers and foot valves for pumps with negative suction and strainers for pumps with positive suction.

xv. All the required control piping, exhaust piping (5m long) from engine, oil piping for fuel oil and lubricating oil for the engine, drain piping from the pumps to the drain pint in the pump room, overflow piping from priming tank to the sump. The piping work shall include all necessary fittings, valve and accessories for effective functional requirements.

xvi. Inter-connecting cable work with controls, control panel, batteries etc. including battery leads.

xvii. Orifice plates at individual hydrants, as required.

Where provision of GI/MS pipe shall below ground become inescapable, it shall be protected from soil corrosion by 2 coats of coal tar hot enamel paint and 2 wraps of reinforced fiber glass tissue or bitumenised horizon.

Each CI pipe/GI pipe shall be subjected to hydraulic pressure test before installation, in presence of the Engineer or his authorised representative.

External (yard) hydrants shall be located at least 2m away from the face of the buildings but not more than 15m and be accessible.

Where external hydrants below ground level are specifically indicated in tender specifications, there shall be enclosed in masonry or cast iron structure of size $75cm^2$ and 8cm above ground level. The hydrant shall be with in 8cm from the top of the enclosure.

Necessary facility for draining the rise pipe shall be provided at ground floor level with 40mm size sluice valve.

Internal hydrants at each floor shall be located at about 1m above floor level.

Valve chambers shall be of $1m^2$ in size, with cover.

2. Hoses and Hose Cabinet

All hoses shall be numbered and a record submitted with completion plane. The number and length shall be easily recognizable on each hose pipe.

External hose boxes shall be installed such that the hose is not exposed to sun rays.

3. Painting

Painting of the entire wet riser piping over the ground shall be done with anti corrosive primer and 2 coats of approved paint. The colour shall be red to shade No. 536 of IS. Paint shall conform to IS: 2932 / 1964.

The pumps and engine shall be painted after installation with a coat of approved paint to similar shade as per original supply.

4. Testing of the system

After laying and jointing, the entire piping shall be tested to hydrostatic test pressure. The pipes shall be slowly charged with water so that the air is expelled from the pipes. The pipes shall be allowed to stand full of water for a period of not less than 24 hours and then tested under pressure. The test pressure shall be $10kg/cm^2$. The test pressure shall be applied by means of manually operated test pump or by a power driven test pump to be provided by the Contractor. In either case precautions shall be taken to ensure that the required test pressure is not exceeded.

The open end of the piping shall be temporarily closed for testing.

Test shall be conducted on each pump set after completion of the installation with respect of delivery head, flow and B.H.P. The test shall be carried out by the Contractor at his own cost.

All leaks and defects in different joints noticed during the testing and before commissioning shall satisfaction of Engineer.

Testing of fittings/equipments shall be carried out either at site or at works in the presence of a representative of the Engineer. Test certificates shall also be furnished by the Contractor.

The automatic operation of the system for the various functional requirements and alarms as laid down in his specification shall be satisfactory carried out on pressure of the Engineer.

5. Approval by Local Bodies

It shall be the responsibility of the Contractor to obtain the approval of drawings and to get the installation inspected and approved by the concerned authorities as may be necessary as per local by laws, any fee payable to the local bodies for such activities shall also be borne by the Owner on production of receipts for money paid and the other expenses will be borne by the Contractor.

6. Pipe Work associated with Diesel Engine :

Pipe works for fuel system, lub. oil system and exhaust system shall be complete with all required supports, clamps, hangers etc. for a complete work.

Fuel feed is by gravity and the fuel tank shall be located at least 60cm above the fuel injection pump.

Fuel pipe of copper shall not be soldered but brazed or welded.

No valves or cocks shall be provided in the fuel feed line to engine from the fuel tank.

Precautions shall be taken to prevent any air locks in any part of the fuel system. No air relief cock shall be permitted and where inescapable, screwed plugs shall be provided for the purpose.

The installation of the fuel supply system shall be such that a completely primed condition is maintained, free from air lock.

Filters shall be provided in fuel oil and lub. oil circuits allocations that are easily accessible for maintenance.

7. Wet Riser Pipe Work :

The suction line for each pump shall be independent.

No sluice valve shall be provided in suction line, where the pump is located above the water level in the sump foot valve and strainer shall however be provided.

Sluice valve shall be provided in situation line, where the pump is located below the water level in the sump, strainer at the suction end shall be provided.

Each external (yard) hydrant shall be controlled by a sluice valve at ground level.

Sluice valves shall be kept in open position and the scope of work includes provision of necessary leather strap and pad lock so as to prevent unauthorized closing of valve.

The installation work includes provision of all clamps, supports, anchors etc.

Spacing between vertical supports shall not exceed 1.5m and horizontally at 2m upto 50mm and 1.5m for higher diameters. Clamps shall be provided on either side of the Tee joints for internal hydrants. Necessary anchors/ thrust pads shall be provided as approved at locations of bends, tees etc. as required within the scope of work.

Under ground pipes of the wet riser system shall be laid 1m below ground level and at least 2m away from the face of the buildings. The run of piping shall be preferably along roads and foot-paths and shall not be under buildings. Where specifically indicated to cross buildings, these shall be laid in masonry trenches with removable covers. With cut off valves at the entry and exit points.

9.4 HAND APPLIANCES

1. **Scope of work**

1. Work under the section shall consists of furnishing all labour, material, appliances and equipments necessary and required to install fire extinguishing hand appliances.

1.2 Without restricting to the generality of the foregoing the work shall consist of the following:

Installation of fully charged and tested fire extinguishing hand appliances CO_2, Foam, Dry chemical powder type as required by these specifications and drawings.

2. General Requirements

2.1 Fire extinguishers shall conform to the following Indian Standard Specifications and shall be with ISI approved stamp as revised and amended upto date:-

a) Water gas type	I.S. 940
b) Dry powder type	I.S. 2171-1962

2.2 Fire extinguishers shall be installed as per Indian Standard "Code of practice for selection, installation and maintenance of portable first aid appliances “I.S. 2190-1962”.

2.3 Hand appliances shall be installed in readily accessible locations with the appliance brackets fixed to wall by suitable anchor fastners.

2.4 Each appliance shall be provided with an inspection card indicating the date of inspection, testing, change of charge and other relevant data.

2.5 All appliances shall be fixed in a true workman like manner truly vertical and at correct locations.

9.05 STANDARDS AND CODES

1.	IS 1648	Code of practice for fire safety of building (general) fire fighting equipment and maintenance.
2.	IS 3844	Code of practice for installation of internal fire hydrant in multistorey buildings
3.	IS 2217	Recommendations for providing first aid and fire fighting arrangement in public buildings.
4.	IS 2190	Code of practice for selection, installation and maintenance of portable first aid fire appliances.
5.	Part IV, fire fighting	National building code
6.	IS 5290	External fire hydrants
7.	IS 5290	Internal landing valves
8.	IS 904	2 & 3 way suction collecting heads
9.	IS 884	First aid hose reel
10.	IS 5132	High pressure rubber pipe
11.	IS 1537	C.I. Double flanged pipes
12.	IS 1538	C.I. Double flanged fittings
13.	IS 780	C.I. Sluice valves and Gunmetal valves
14.	IS 934	Specifications for portable chemical fire extinguisher soda acid type.
15.	IS 2873	Specifications for fire extinguisher of Carbon-di-oxide.

10.00 LIST OF APPROVED MAKES : CIVIL WORKS

Sl.No.	MATERIALS		MANUFACTURERS
1.	Doors & Windows fixtures/ Fittings	:	Everite, Hardima, Earl Bihari
2.	Door Closer / Floor spring	:	Doorking, Everite, Hardwyn, Amar Darmy.
3.	Aluminium Sections.	:	Indal , Bhoruka, Hindalco, Jindal
4.	Clear Glass/ Clear Float Glass / Toughened Glass	:	Modi, Gujrat Guardian, Tata, Saint Gobain(SG)
5.	Laminates	:	Formica, Decolam, Century, Marino, National, Green Ply
6.	Synthetic Enamel Paints	:	Berger (Luxol gold), Asian(Apcolite), ICI Dulux (Gloss), Nerolac (Full gloss hard drying)
7.	Oil Bound Distemper	:	Asian (Tractor), Berger (Bison), Nerolac (Super Acrylic).
8.	Cement Paint	:	Snowcem Plus, Berger (Durocem Extra), Nerolac (Nerocem with titanium),.
9.	Plastic Emulsion Paint	:	ICI, Asian, Nerolac
10.	Other Paints/Primers	:	ICI Dulux, Asian, Berger, Nerolac
11.	Cement	:	OPC 43 grade conforming to BIS-8112 and approval of source by Engineer
12.	Reinforcement Steel	:	TMT steel conforming to BIS-1786 and approval of source by Engineer
13.	Glass Mosaic Tiles	:	Italia, Bizzaza. Pallidio
14.	Back-up Rod.	:	Supreme Industries or equivalent
15.	M.S. Pipe	:	Jindal Hisar, Prakash-Surya, BST, Kalinga
16.	Polysulphide sealant.	:	Pidilite, Fosroc, Choskey, Chematal Rai
17.	Polycarbonate Sheets	:	GE Plastics or approved equivalent
18.	Metal Fire Check Doors	:	Navair, Shakti-met, Godrej, Pacific Fire Control, Promat
19.	Gyspum Board System	:	India Gypsum, Laffarge, Boral

Sl.No.	MATERIALS		MANUFACTURERS
20.	Sunken Portion Treatment	:	Choksey, Roffe, Krytone,Sika
21.	Admixtures for concrete.	:	Cico, Vam Organics, Roffe, Pidilite
22.	Epoxy Paint.	:	Nerolac, Shalimar or approved equivalent.
23.	Ceramic Tiles	:	Johnson, Somany, Kajaria, Spartek, Nitco, Orient
24.	Pre-Laminated Particle Board	:	Novopan, Greenlam, Kitlam, Bhutan Board.
25.	Flush Door Shutters.	:	Century, Kitply, Novapan, GIC Goyal, Green Ply
26.	Silicon Treatment	:	GE-Silicon, Pidilite, Choksey, Wacker, Forsoc
27.	Glazed Tiles	:	Bell, Somany, Johnson, Kajaria, Cera.
28.	PVC Water Stops	:	Supreme, Fixopan or approved equivalent
29.	White Cement.	:	Birla White, J.K.
30.	Powder Coating Material Pure Polyester.	:	Jotun , Berger, Goodlass Nerolac
31.	Masking Tapes	:	Suncontrol , Wonder Polymer.
32.	Stainless Steel Screws For Fabrication and fixing of Windows.	:	Kundan , Puja , Atul.
33.	Proposed Treatment on MS Brackets.	:	Galvanised Brackets As per IS:4759-1996 610 gms./sqm. (microns) 80-90
34.	Dash Fasteners./Anchor bolts	:	Hilti, Fischer, Bosch.
35.	Stainless Steel Bolts, Washers and Nuts.	:	Kundan, Puja, Atul.
36.	Stainless Steel Pressure Plate Screws.	:	Kundan, Puja, Atul.
37.	Stainless Steel Friction Stay.	:	Securistyle, Earl Bihari.

Sl.No.	MATERIALS		MANUFACTURERS
38.	E.P.D.M. Gaskets.	:	Anand Reddiplex, Enviro Seals
39.	Weather Silicon.	:	Dow Corning, Wacker, GE
40.	Structural Silicon at butt joints	:	- Do -
41.	PVC continous fillet for periphery packing of Glazings /Structural glazings.	:	Roop, Anand, Forex Plastic.
42.	Floor Springs.	:	Doorking, Opel.
43.	Aluminium Cleat arrangement for Glazings.	:	Deco or approved equivalent
44.	Water proofing / Injection Grouting	:	Overseas Water Proofing Corporation or approved equivalent
45.	6mm thick Reflective Glass	:	Glaverbel, Glavermas, Saint Gobain.
46.	Door Locks.	:	ACME, Godrej, Harrison
47.	Door Seal – Woolpile Weather Strip	:	Anand -Reddiplex.
48.	Aluminium Grill	:	Decogrille and approved Equivalent
49.	Vitrified Porcelene Tiles:	:	Restile (Granamite- Atena), Naveen, Bell-Ceramics, Kajaria, Somani
50.	Carpets	:	Hollitex, Standard, Mohawk
51.	Aluminium Cladding sheets	:	Alstrong , Alpolic, Alucobond,
52.	Aluminium Die-cast handles & two point locking kit	:	Giesse, Securistyle, Alu-alpha
53.	Stainless steel D-handles	:	D-line, Giesse, Dorma
54.	Auditorium Chairs	:	Penworker, Suri Cine chairs, Godrej
55.	Woollen Fabric for Auditorium	:	ESSMA, Raymonds
56.	Stainless Steel Pipes/Flats	:	304 Grade

Sl.No.	MATERIALS		MANUFACTURERS
57.	Structural Steel	:	Conforming to BIS 2062 and approval of source by Engineer
58.	Ready Mix Concrete	:	L&T,ACC,BIRLA,AHLCON
59.	Antistatic Epoxy Floor	:	Fosrock, Beck, Famaflor, STP
60.	SBS bitumen based Self adhesive membrane Material	:	Grace-Bituthene CP1.5, Texsa-Texself 1.5
61.	Acoustic Mineral Fibre	:	USG-Radar, Armstrong, 21st Century, Acostyle
62.	APP modified Bitumen water proofing membrane	:	Lloyds, STP, Bitumat
63.	Hand made ceramic tiles	:	Raja Tiles, Saraswathi
64.	Curtain wall	:	Specialised Agency to be Approved by Engineer
65.	Fire Panic bar	:	Briton, Monarch, Von-Duprin
66	Ply board	:	Greenply, Kitply, Century
67	PVC Doors	:	Rajshri or approved equivalent

Note : Wherever makes have not been specified for certain items, the same shall be as per BIS and as per approval of Engineer

11.00 LIST OF APPROVED MAKES : PLUMBING WORKS

S.No.	Materials	Relevant ISI Code	Manufacturers
1.	Vitreous China Sanitary ware	2556	Hindustan Sanitary ware, Cera, Parryware, Neycer
2.	White Glazed Fire Clay Sink	771	Sanfire, Cera, Neycer, Hindware.
3.	Stainless Steel Sink		AMC, Orient, Suhag, Jayna, Commander
4.	Plastic seat cover of W.C	2548	Commander, Bestolite, Diplomat, Jaquar, Sona
5.	Geyser		Spherehot, Racold, Batliboi, Venus, Voltas, Usha Lexus
6.	C.P. Fittings Mixer/Pillar taps Washers, C.P. brass accessories	1795 4291/4827	Parko, Kingston, Aquaplus, Ceramix Nova
7.	Centrifugally /Sand cast iron pipes & fittings	3989/1729	R.I.F., NECO, B.C., B.I.C., ISP
8.	G.I. Pipes	1239 Part I	Jindal-Hissar, Tata, Prakash-Surya B.S.T., SAIL, Bansal
9.	G.I. Fittings	1239 Part I	Unik, K.S., Zoloto
10.	Gunmetal Valves	778	Zoloto, Leader, Sant, Kilburn
11.	Brass stop & Bib Cock	781	Zoloto, Sant, L&K, Jaquar
12.	Ball valve with floats	1703	Zoloto, Leader, Sant, Jayco
13.	Stoneware pipes & Gully Traps	651	IS Marked pipes
14.	R.C.C. pipes	458	IS Marked pipes
15.	C.I. Manhole Covers	1726	RIF, NECO, B.C. , B.I.C.
16.	Water Tank		Sintex, Polycon, Uniplas
17.	Mirror		Golden, Atul, Modi guard Gujrat Guardian
18.	Hand drier		Kopal, Automat or equivalent
19.	PVC flusing cistern		Commander, Parryware, Duralite
20.	Insulation of Hot water pipes		Vidoflex insulation, Superlon insulation or equivalent

S.No.	Materials	Relevant ISI Code	Manufacturers
21.	PVC Rain Water Pipes.		Supreme, Prince, Finolex. Oriplast
22.	C.I. pipes Class LA and fittings.		Keso-spun, supra, Electrosteel.
23.	Sluice valve / NRV		Kirloskar, IVC, Kilburn, Zoloto Castle, CIM
24.	Water supply pumps	:	KIRLOSKAR, CROMPTON, KSB, MAX FLOW
25.	Submersible pumps	:	KIRLOSKAR, GRUNDFOS, KSB, Mather & Platt
26	UPVC pipes & fittings	;	FInolex , Prince, Supreme
27.	Chlrorinator	:	Watcon, Ion exchange, Sigma DH Combine Inc.
28.	HDPE Solution tank	:	WATCON, ION EXCHANGE, Water Supply Specilist P (Ltd)
29.	C.P Flush Valves	:	Jaquar, DOCOL(Germany) marketed by GEM, Ideal Orient
30.	C.P Angle Valves(Ball valve type)	:	ITAP: Italy, Bugatti, Italy
31.	Infrared Sensor operated Faucets	:	Jaquar, AOS-Robo , U-tec
32.	Gratings, Strainers, Cleanouts etc	:	Neer Brand (Sage Metals) or Equivalent
33.	Level controller	:	Femac or equivalent
34.	Drainage Pumps	:	Grundfos, KSB , Salmson Kirloskar
35.	Package Sewage Treatment Plant	:	Sriram, Watcon, Geo Miler & Co Ion-Exchange, JSC Unitherm
36	Decorative bath room fittings	:	Jaquar (Florentine range), Marc (equivalent) Aquabaths (equivalent)
37.	Softner	:	Ion Exchange, Watcon, Fontus Akar-Impex, JSC Unitherm

Note : Wherever makes have not been specified for certain items, the same shall be as per BIS and as per approval of Engineer

12.00 LIST OF APPROVED MAKES : FIRE FIGHTING WORKS

S.No.	Material	Relevant ISI Code	Brand/ Manufacturers
1.	G.I./M.S. Heavy class pipe	1239/3589	Jindal-Hissar, Tata, Prakash -Surya, B.S.T., SAIL
2.	Gate Air Valve		Leader, Zoloto, Sant, SBI, Seeko
3.	Butterfly valves	13095	Audco, Keystone, Intervalve, C & R, Zoloto, Castle
4.	Portable Fire Extinguisher	2171	Minimax, Safex, Nitin, Firex, Ceasefire, Newage
5.	First aid Fire hose reels	884	Minimax, Safex, Firex, Newage
6.	Fire hose pipes	636	Newage, Safex, Jayshree, Jyoti
7.	Fire Hydrant valves	5290	Minimax, Newage, Getech, Safex, Ceasefire, Vijay, Agnice
8.	Sprinkler Heads		
a)	Pendent type		Spray safe, HD, Reliable, Grinnel
b)	Side wall type		Spray safe, Reliable
c)	Sprinkler Side wall extended through		Spray safe, HD, Reliable,Fire Protec. Co.
9.	Sluice and non return/ check valve foot valve strainer		Kirloskar, I.V.C., Kilburn, Zoloto, Leader
10.	Rubber hose 12/20mm dia		Dunlop, Good year, Jyoti
11.	Reinforced rubber lined/canvas		Newage, Jayshree, CRC
12.	Standby battery lead acid		Exide, Standard, Amco
13.	PVC Insulated Copper Conductor.		Finolex, Plaza, National
14.	Recessed/concealed type		Spraysafe., Reliable
15.	Horizontal centrifugal pumps		Kirloskar, Mather & Platt, Greaves Cotton, Max-Flow
16.	Diesel engine		Kirloskar Cummins, Ashok Leyland
17.	Electric motors		Kirloskar, GEC, Siemens, NGEF, ABB Crompton
18.	Electrical switch gear & starters		As per Electrical Works

S.No.	Material	Relevant ISI Code	Brand/ Manufacturers
19.	Cables		As per Electrical Works
20.	Flow meter		Scientific Equipment (P) Ltd. Hyderabad or equivalent
21.	Suction strainer		Leader or equivalent
22.	Vibration eliminator connectors		Resistoflex, or equivqlent
23.	Single phase preventor		L & T, GEC, SIEMENS
24.	Electrical Pumps		Kirloskar, KSB, Siemens
25.	Submersible Pumps		Kirloskar, KSB, Siemens
24.	Fire Pumps		Kirloskar, Beacon, Mather & Platt

Note : Wherever makes have not been specified for certain items, the same shall be as per BIS and as per approval of Engineer