Volume-II:

Scope of work and specifications

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1. INTRODUCTION

The Department of Youth Services and Sports was created during 1982-83 with an objective of involving youth in the task of National re-construction and to hamess their energy towards eradication of social evils. About 40% of the population consists of youth who need ample opportunity for self-expression, self-development and cultural attainment enabling them to assume social and civic responsibility. To become socially useful, functionally effective and economically well being, the Department is providing requisite institution and infrastructural facilities to these youth in its various programs. The main aim/of the Department is to make the youth a powerful instrument in effecting social, cultural and economic changes and to channelize their energies, idealism and aspirations towards building up a strong and modem India.Chamba is a town in the Chamba district in the Indian state of Himachal Pradesh. According to the 2001 Indian census, Chamba has a population of 20,312 people. Located at an altitude of 1,006 metres (3,301 ft) above mean sea level, the town is situated on the banks of the Ravi River (a major tributary of the Trans-Himalayan Indus River), at its confluence with the Sal River. As of 2001 India census,[26] Chamba had a population of 20,312. Males constituted 52% of the population and females 48%. Chamba has an average literacy rate of 81%, higher than the national average of 59.5%; with a male literacy of 85% and female literacy of 77%. Away from the urban centre, the tribal people of Chamba (popularly known as Chambial) are divided into two major groups; the Gujjars and the Gaddis who have athlectic built and can play sports like kabaddi, wrestling,boxing, taekwondo etc. The Chaugan (a Sanskrit word meaning: "four sided") is the nucleus of all activity in Chamba, surrounded by impressive administrative buildings and a shopping arcade built during the British period, with the old Akhand Chandi palace standing nearby. It has a terraced grass green, and is exceptionally large for a hill station, measuring 800 metres (2,600 ft) length and 80 metres (260 ft) width/In 1890, the British converted five small chaugans into a single chaugan for use as an esplanade and sports complex, and today it is commonly used for cricket matches.Besides this there is no infrastructure for sports and thus this sports complex is proposed in

chamba.

2. PROJECT OBJECTIVE:

In order to increase the interest of youth towards sports in Himachal Pradesh and to encourage them for sports activities as well as to create awareness among the general public about staying fit, the main objective of this scheme is to construct two multipurpose playgrounds of the size of football field as far as possible along with the facility of open gym park in a phased manner in each assembly constituency by the department. With its implementation, along with the inclination towards sports among the youth of the state, the general public of the state will also get inspiration to stay healthy and will also stay away from addiction.

3. EMPLOYER'S REQUIREMENTS

The broad items of works Covered are listed below:

3.1. General Scope of Work:

- Design development based on the indicative concept site plan (Volume-III) including preparation of architectural brief, design concept, concept for services etc.
- Detailed design parameters and their respective technical and administrative approvals from all concerned government regulatory bodies including but not limited to deptt. Of Town and Country planning, Municipal Councils/Fire/ Mining/ electricity / Public health/ Structural Safety and any relevant department. All engineering including architectural design and construction documents (based on the approved option), structural engineering, electrical engineering, Lifts, PHE, Fire Fighting, ventilation plans, fire detection & protection plan and waste management, car parking, CCTV, Fire Alarm & entrance gate of complex for entry and exit, Pre fabricated guard room, construction of boundary wall including the Retaining wall where ever required as per the design/ drawings approved by the WAPCOS , swimming pool, boxing hall, table tennis, badminton hall, Indoor Gymnasium hall, Internal roads and path, culverts, street lighting, landscaping, plantation of tree, all electrification and public health installations as per codal requirements, site logistics including internal & external signage's etc. as required

to complete the project. All above architectural and engineering designs, specifications and all approvals and sanctions (pre construction and post construction) shall be procured by the EPC contractor at his own cost.

- Site clearance and dismantling of obstructions and tree cutting (if any) for locating the buildings as shown in the Plan (Bid Volume III), before commencement of work after obtaining all statutory approvals.

1. The detailed scopes of Construction work are project specific. However, any item of work required to be carried out as per the Contract for **proper satisfactory completion and operational sufficiency of the** work with good standard of workmanship shall be deemed to be included in the scope of work, with no additional cost for such items**, whether, or not it is specifically included/described in the tender documents.**
2. The EPC Contractor shall ensure to meet the schedule milestones, quality and safety requirements of all works as mentioned in the bid documents.
3. The EPC Contractor shall work in close co-ordination with the Engineer-in-Charge and Employer's Representative and shall attend various meetings to meet the schedule and quality requirements of the Work.
4. The EPC Contractor shall make his own arrangement for the protection and safety of his material and equipment at site. The Contractor shall also make his own arrangement for the electricity and water for construction purpose. Alternatively the EPC Contractor may be allowed to drill bore well/s in the institute and use the water. However after completion of the work the contractor has to handover the bore well/s, casing, pump, piping & control panel, if any, to the WAPCOS without additional charge. Water to be tested and approved before use The EPC Contractor must ensure the proper housekeeping of the Site at all times to the satisfaction of Engineer-in-charge so as to Work in a very safe and clean manner.
5. The EPC Contractor shall ensure timely submission of all reports, test results, samples.

6. The EPC Contractor shall arrange his own access to the Site and nothing shall be paid extra for temporary roads/ access to the site. The contractor shall maintain and keep in good condition all the access to the site at his own cost.
7. The EPC Contractor shall **carry out all the survey & layout works in relation** to the work. The EPC Contractor shall make the reference pillars/bench mark etc. required for setting out of the buildings and shall be responsible for safeguarding them till the completion of the Contract.
8. The EPC Contractor shall submit his detailed Construction Program within 15 days from award of Letter of commencement of work /work order based on the milestones given in the Bid documents describing in details the mobilization and requirement of labour and equipment in the form of CPM analysis and notes, working process for main activities / critical activities / new activities, Monitoring of work Progress, Financial Planning and cash flow charts, Survey and layout, Construction methodology, Quality plan including mix design requirements, Approved external Laboratory facilities, Testing frequencies, Acceptance Criteria,Calibrations, Control of Non-Conformities, Details of Site Quality Records, Various documentation in a formats approved / issued by Engineer-in-Charge, performance of tests etc, Approved vendor list for various standard materials like Cement, steel, bitumen, concrete frames, tiles, plumbing and electrical fixtures, wood, plywood, SS steel and accessories and flushed doors etc.
9. The EPC Contractor shall prepare requisite documents, its submission on time, coordination, follow-up with concern statutory Authority e.g. Police/ Labour / Health/ Power/ Water/Telecommunication and other Authorities to obtain requisite permission, NOC, supply and avail their facilities and to perform legal formalities to avoid any encumbrance on Work program.
10. The EPC Contractor shall submit all necessary reports and data's required for monitoring the progress and quality of Works mentioned in the Scope of Work and in the formats approved by Engineer-in-charge.
11. Shop drawings for all fabrication work of permanent as well as temporary structures for approval of Engineer-in-Charge before execution at site.
12. As Built drawings for all works mentioned in the scope of Work.

13. Site safety management and Supervision.
14. Construction of labour camp at approved space.
15. Fencing, Barricading and proper illumination of the site at no extra cost. The EPC Contractor shall provide and maintain a suitable approved temporary fencing and gates to adequately enclose all boundaries of the site for the protection of the public and for proper execution of the works including all costs incurred for the security of the works and in accordance with the requirements of the Engineer - In-Charge and regulations of local authorities. These shall be altered, relocated and adapted from time to time as necessary and removed on completion.
16. The EPC Contractor shall include all taxes as applicable and cost towards packing, handling, transportation and placing in position in the rates to be quoted by the EPC Contractor.
17. The cost towards all the items listed above is deemed to be covered in the rates quoted by the EPC Contractor for the specified items and no separate payments shall be made.
18. The EPC Contractor shall have to make Coordination with other agencies engaged at the site by the employer at no extra cost.
19. EPC Contractor shall prepare and deliver the inventory for all the works for handing over of project.
20. The scope of work includes the detailed architectural and engineering design and construction of the Indoor stadium at Chamba following the SAI guidelines and the applicable building byelaws of the competent local body/Town and country planning (HP), with full satisfaction and handing over. The Scope of work shall include execution of work in accordance with Detailed Specifications of all the works, Tender Drawings, Architectural drawings , Approved Structural & Services Drawings, list of Approved makes of works, General Technical specifications of works based on HP PWD/Relevant IS codes and other conditions stipulated in Tender Document. Apart from the same any other site and project specific requirements if necessary for successful contruction and operational commissioning of the project with respect to the applicable

building codes and the requirements of Department of Youth Services & sports shall be sole responsibility of the contractor.

3.2. SITE OFFICES AND FACILITIES

The cost of providing the facilities stated in this clause is to be borne by the Contractor.

i. The Contractor shall supply, erect and satisfactorily maintain in good condition until final completion of works, a well-lighted, well ventilated and adequately weather proofed temporary, burglar proof readily available Site Office (Portable Cabins) of adequate size consisting of office rooms, as per approved layout for use at all times by the and the Engineer-in-Charge. The contractor shall provide adequate access to the office. The Contractor shall be responsible during the continuance of the contract for the security of the office and for all plans, documents and papers and other clauses contained therein. The sitting of the office shall be in accordance with the instructions of the Engineer-in- Charge. Service personnel shall also be made available at the Office at all times and shall clean site office daily. The office shall be adequately equipped with furniture and fittings, including Executive Tables and Chairs and cabinets, file cabinet, wall display boards, well equipped Tea/Coffee/Drinking Water, pantry with refrigerator. The Contractor shall provide uninterrupted power and water to the Office as directed for 24 hours. The Contractor shall provide computers of approved brand with LAN connection, Internet Connection (Active) and Licensed Software for Windows OS, MS Office 2007, MS Projects. CCTV cameras (Minimum 4 nos.) to be installed to cover the periphery of the construction site and the cameras are to be moved / shifted to the floors wherever works is being executed as directed by the Engineer in charge, at the construction site including all hardware and software. The Contractor shall also provide Printer (Colour and Laser) and Photocopier along with the consumables required will be provided and maintained.

   The contractor shall dismantle and remove from site all such temporary structures on completion of contract or whenever the WAPCOS may require

such dismantling and removal on account of obstruction of work, nuisance value or any other reason at his own cost.

ii. The Contractor shall provide at all times for the duration of the contract all chainmen, staff men, workmen and survey instruments for the exclusive use at site as directed by the Engineer-In-Charge for carrying out of his duties in connection with the contract.

iii. The Contractor shall provide at his own cost, One Site sign Boards, at directed location of overall size 2.40 metres wide and 1.50 metres height and of approved design.

iv. The names of the Project, Employer, Consultants, Engineer, and Contractor etc. shall be exhibited as directed.

v. The Contractor shall maintain daily weather record. Daily maximum and minimum temperature and corresponding, humidity shall be recorded and charted. Rainy days shall be recorded when the rain lasting more than one hour hampers the work. Any other inclemency in weather shall be recorded. The records shall be regularly shown to the Engineer - In - Charge and his signature obtained.

vi. The Contractor shall arrange at his own cost to maintain a progress record of the works by taking (5”x 7”)/ 8’X10” size colour photographs minimum 6 Nos. or more per month as directed by the Engineer - In - Charge during the construction stages and after completion and shall supply one set to the Employer and one set to the Consultants at no extra cost. These photographs shall also be submitted as part of the contractors R.A Bills.

vii. The same shall be furnished as per requirement of Monthly Progress report.

viii. The Contractor shall provide arrangements for firefighting at his own cost. For this purpose, he shall provide requisite number of fire extinguishers and adequate number of buckets, some of which are to be always kept filled with sand and some with water. These equipments shall be provided at suitable prominent and easily accessible places and shall be properly maintained. The Contractor may be subject to periodic fire prevention inspections and any deficiency or unsafe condition shall be corrected by the Contractor at his own cost and to approval of the Engineer - In - Charge and the relevant authorities.

3.3. DOCUMENTATION, INSTRUMENTATION & RECORDS

The following items shall be deemed to be included in the tendered cost and no additional payment shall be made:

"Operational and Maintenance Manual" (During Defect Liability Period) Manual describing access arrangements to various portion of the Project for maintenance and repair without affecting the intended operation of the project, important arrangements from the point of view of structural safety, procedure for minor and major repairs of each components of the project, renewals of finishes and treatments periodically shall be supplied by the EPC Contractor free of cost.

"Quality Assurance Manual" covering mix-designs, materials, testing, statistical quality control, etc. shall be prepared and supplied by the EPC Contractor free of cost well before starting the work.

"Construction manual" covering various aspects of construction methods, difficulties faced and how they were overcome during execution etc. shall be supplied by the EPC Contractor free of cost at the time of completion of work.

3.3.1. All the records of testing material reports, material challans, labour reports, etc. are to be maintained by the EPC Contractor. Records connected with the execution of the work should be maintained in a proper manner. The registers/files, wherein important data such as record of the mandatory test, record of hindrances, record of receipt and supply of materials, record of issue of drawings/design etc. are kept should be properly bound and page numbered. These records should be maintained under the signature of designated senior officials.

Following check-points are suggested:

i. The registers are to be properly bound and having machine numbered pages.
ii. The registers to keep record of important data like mandatory test, hindrances etc are to be issued under the signature of designated senior officer/ Engineer in charge.

iii. Records to be maintained properly with signatures of EPC Contractor/ his authorized representative and attestation of the designated officers/ Engineer in charge.

iv. No tampering/manipulation is permitted in these records. Corrections, if any, shall be duly signed and attested by the Engineer in charge/ Senior Officer.

The EPC Contractor will sign the following registers whether by himself or through his authorised representative.

i. Cement register
ii. Steel register
iii. Testing of materials Register.
iv. Site order Book
v. Materials at site account
vi. Hindrance Register
vii. Sieve analysis Register
viii. Ready Mix Concrete Batch Register
ix. Drawing Register
x. Site Inspection Register

3.4. Project Specific Scope of Work

The building complex shall consist of the following facilities which are to be constructed by EPC Contractor: The Scope of work includes but not limited to:

S.No.	Section/Department	Area	Particulars
	Total Ground floor Area	**629.15 sqm**	
a)	Ground Floor Area (Excluding Ramp, Entrance Lobby, entrance stairs as per tender drawing):	184.15 Sqm	Reception cum waiting hall, Adm. Room, Snack Bar, Electric Panel Room, Toilet Block, coach room, First

			Aid room, lift well & Stair case
b)	Indoor Swimming pool at G.F: size	445 Sqm	Swimming pool 10x 14.5 mtr, Gents & ladies toilet and locker facility, Filtration plant
	Total First floor Area	**641.43 sqm**	
a)	First floor: Part 1	445 Sqm	Wrestling/Boxing hall
b)	First floor: Part 2	196.43 Sqm	Gents & ladies toilet and locker facility, coach room, Gymnasium Hall
	Total Second floor Area	**641.43 sqm**	
a)	Second floor: Part 1 (Pre-Engineered steel structure)	445 Sqm	Badminton Hall
b)	Second floor: Part 2	196.43	Gents & ladies toilet and locker facility, coach room, Table Tennis Hall

NOTE: All Sports equipment shall be provided as per the SAI/YSS guidelines and listed below in tender document.

4.0. DESIGN OVERVIEW

A conceptual design for the building has been provided as a part of this tender document. The design development, detailing and any further improvisation or modification, as per the applicable building byelaws, site specific considerations,

National building code reuirements etc. which may be needed to ensure the good functional and technical usage of the buildings or any changes as per the client's need shall be done with the approval of the competent authority (WAPCOS and or the client). The design development and detailing shall be done by the EPC Contractor in accordance with the outline requirements mentioned in **Volume-I &Volume-II.** The building will have all necessary functionalities, but not limited to Engineering services.

The building would be fitted with following Engineering services:

- Civil works including with acoustical treatment whereever required
- Internal and External Electrical works
- Internal and External PHE works including septic tank, UGSR, Borewell as per requirement
- Fire Detection, Fire alarm & Fire suppression system
- CCTV system and Public Address system
- Interior and Fixed Furniture
- Horticulture indoor & out door

The EPC Contractor is advised to follow the design provided but not limited to the drawings provided. WAPCOS/client shall be the final approving authority for detailed design for construction drawings. EPC Contractor would be required to make presentations with detailed drawings along with 3D drawings (both internal and external) in hard & soft copies to EPC consultant/Client for approval of concept drawings and detailed drawings. The elevation and facade of the building shall be based on the conceptual 2D & 3D design provided in **Volume-III**.

The tentative sports and engineering service requirements of are being provided in the concept Design Base Reports (DBRs) and service level requirements, scope of work (i.e. Bid Volume III).

1. Detailed Topographical Survey, Geotechnical Investigation, Preparation of Detailed Structural Drawings/GFC drawings as per Architectural Drawings

provided by WAPCOS, duly updated by the EPC contractor and got approved by him from the designated authorities.

2. The works/buildings shall be designed to withstand static/dynamic loading (wind/seismic) and the design shall be strictly in accordance with the latest Indian Standard Code of Practices/National Building Code. The structural analysis and design shall be done by using latest version of software packages preferably STAAD Pro/Etab. The software used in the preparation of 2-D and 3-D drawings should be AutoCAD, Revit Architect, and Navisworks. The soft-copy files in DWG, RVT, and NWD formats shall also be submitted. The provisions in various BIS Codes shall override the packages output.

3. Site Preparation & Leveling as required for the construction of the indoor hall complex and associated structure. Remove all grass and low vegetation and remove all bush wood, trees, stumps of trees, and other vegetation only after consultation with the Engineer-in-Charge as to which bushes and trees shall be saved no additional cost shall be paid for the same.

4. Installation of Functional Site Office at Site and Installation of CCTV Cameras at site.

5. The RCC structure and pre engineered steel structure and walls shall be as per the technical/structural drwaings and aesthetical requirements.

6. Changing rooms/toilet blocks shall be provided near to the sports facilities by keeping the consideration of privacy for female and male sportspersons. Number of lockers and changing rooms shall be as per the standards and corresponding to the minimum number of sport person enrolled with each facilities Changing rooms shall have the provision of coat hooks and hangers and **seating for the sport persons**. The space must be handicapped friendly and all accessories need for the same shall be provided.

7. **External Development with Landscaping:** The sports complex is proposed with road network, pathways, PHE services layout, street light layouts, inter connecting all the buildings as per site plan (but not limited to) provided. All other

service layouts such as Underground water tank, Fire tank shall be suitably located and connected to respective service lines. The external development will include construction of boundary wall and retaining wall as per design & drawing wherever required. It would also include the landscape and horticulture works indoor & outdoor as per the detailed landscape specification. The un-utilized site will be neatly dressed with grassing and plantation as required. If there is any level difference in site the connecting roads, it will be laid to appropriate slope and will be designed as per IRC standards. Sports INSIGNIA may be provided in reception area as per the approved drawing by WAPCOS officals.

The UG tanks shall be 450 mm high from the adjacent ground level. The top slab of the tank shall be covered with grass. Care should be taken to ensure proper water proofing and slope of the slab to take care of surface water run off.

8. Construction of Boundary Wall and main entrance M.S gate & wicket gate including the Retaining wall as per site requirement and approved drawings /design.

9. Prior to commencement of construction, the contractor shall in consultation with the Engineer-in-Charge, establish several site datum bench-marks, their number depending on the extent of the site. The bench-marks shall be sited and constructed so as to be undisturbed throughout the period of construction.

10. The contractor shall carry out the survey of the site and shall establish sufficient number of grids and level marks to the satisfaction of the Engineer-in- Charge, who shall decide on the basis of this information, the general level of the plot and the plinth.

11. Excavation in all type of soil, soft rock, hard rock without blasting and Filling Work. Earth work as required for construction of Indoor Hall/ multipurpose hall complete in all respect.

    i. **Anti-Termite Treatment** (four stages) as per the requirement of National Building codes.

ii. **Foundation Work**- Concreting, Centering & Shuttering, Steel work complete in all respect.

12. Execution/Construction of the building super structure (Civil Work, MEP works, Interiors etc.) including but not limited to the following

i. Construction of columns, beams, concreting, brickwork, woodwork, flooring, finishing including plastering, pointing, painting as per approved drawing.

ii. Roofing/roof-work all in RCC framed structure & pre-fabricated structure and roofing complete in all respect as per the prior approved drawings.

iii. All aluminum Work, PVC works, Wood works and other works as per the approved drawing, if not shown in drawing but required for the completion of the Structure.

iv. All type of Plumbing, water supply, sanitary works and Electrical work required for the completion and operation of building/indoor stadium complex and as per the drawings provided.

v. Providing and Installion of UV resistant HDPE **water strorage Overhead Tank as per codal requirements w**ithout Independent Staging Height with Firefighting Provision. Construction of pump house & UGSR of sufficient capacity for water storage.

vi. Construction of sufficient capacity septic tank with soak pit as per requirement/ approved drawing in the indoor stadium.

vii. Providing and Installing Automatic Fire Alarm System, Fire Fighting with Wet Riser System. The contractor shall design and construct suitable firefighting system along with pump sets as per relevant IS or national standards. The system shall be complete with electric motor driven fire pump and diesel driven fire pump including Jockey pump/ terrace pump & controls & fire hydrant etc and other accessories for meeting the firefighting requirement of as per the national building code. Delivery head for the pump should be sufficient to supply the water to all corner of the building and to meet the firefighting requirement. Fire hydrant shall be provided near all the buildings conforming to the directions of Engineer. All firefighting network

shall be of pressurized Black M.S pipes of heavy class etc, a adequate capacity water storage tank should be constructed in RCC M30 as liquid retaining structure at exclusively for firefighting propose only. The approval of firefighting design and completion certificate should be taken from concerned local fire Department Authority.

viii. All type of External Service Connections including sewerage connection, Power line connection, and Water Supply connection.

ix. Construction/providing and installing water supply distribution line, storm water drain, service trenches.

x. Providing and installing power wiring & plugs, Lighting Conductors, Telephone Conduit System etc.

xi. External electrical service connection to be provided.

xii. Installation of Lift of 8 persons with 1m/s speed.

xiii. Supplying installation testing and commissioning of cables from Transformer/ Utility Meter to LT Panel, LT Panel, Automatic power factor corrector panel, Essential Panel i/c Earthing, inter connecting power cables in sub-station, safety equipment's (Minimum 75 KVA or as per requirement).

xiv. Supplying testing commissioning of CCTV System for building security comprising of controllers, E&M Locks, reader, smart cards, cabling recording, display system, hardware and software support (Covering at least approx. 2000 Sqm of area).

xv. Supplying testing commissioning of LED Street Lighting to cover all around the building campus.

xvi. **Horticulture work and landscaping**: Horticulture work including potted plants etc as decorative elements in the indoor hall complex and perennial and seasonal plants in the outdoor landscaping with decorative landscape lighting as per the instructions of Engineer-in-Charge.

xvii. Execution of the Exterior façade claddings etc as per drawings approved by WAPCOS.

xviii. Providing and placing Signboards as per directions of Engineer in Charge.

xix. Providing and installing (01) No. of Water Cooler/Commercial RO system for drinking water.

xx. Providing and installation of approved sports flooring in Indoor halls and 2 nos. badminton court mat (Yonex/Gerflor), table tennis, boxing & wrestling and Gymnasium as per the norms of SAI/YSS and as per norms.

xxi. Providing and installing of sports equipment including movable net posts (minimum 2 Num) & net for badminton court, table tennis table duly approved from YSS/SAI authorities.

xxii. Providing 1 Nos. referee chair for each sports facility as per sports requirements, bench for sports persons (provision for seating of 30 Nos. players) for different sports facilities providing at complex.

xxiii. Complete indoor hall and associated structure constructed & ready for operation complete in all respect with full satisfaction of YSS & WAPCOS.

xxiv. Upon completion of the work all the areas should be cleaned. All floors, doors, windows, surface, etc. shall be cleaned down in a manner, which will render the work acceptable to the Engineer-in-Charge. All rubbish due to any reason, shall be removed daily from the site and the contractor as a part of the contract will clean an area of up to ten metres on the outer boundaries of the premises. Upon completion of the project, the contractor shall turn over to the Engineer-in-Charge the following:

- Written guarantee and certificates,
- Maintenance manuals, if any, and
- Keys three sets.

1. The covered areas for the project are as follows:

   a. Ground Floor Area (Excluding Ramp, Entrance Lobby, entrance stairs as per tender drawing): 629.15 Sqm
   b. First floor: 641.43 Sqm
   c. Second floor (RCC Structure): 196.43 Sqm
   d. Second Floor (Pre Engineered) =445 sqm
   e. Mumty :38.975 Sq m

f. Approach Road shall be constructed as per required distance of approx. 30 m as per IRC norms and connect to main road.

5.0 METHODOLOGIES AND GOOD CONSTRUCTION PRACTICES

a) **Acceptance of Site**: In accordance with these specifications, the EPC Contractor shall have examinedthe site and familiarized himself withall existing conditions before bidding for this work. He shall accept the site in its existing condition at the time of award of contract.

b) **Mobilization:** Upon award of the Contract and within a reasonable time but not exceeding 21 days the EPC Contractor shall mobilize all such labour, equipment and materials that are necessary to complete the project in due time.

c) **Demobilization:** Upon due performance of the Contract and before the Taking Over Certificate is issued to the EPC Contractor, he (the EPC Contractor) shall demobilize all such labour,equipment and materials that are necessary to clear the site within one (1)month to the WAPCOS/ Employer's satisfaction.

d) **Access:**The EPC Contractor shall provide and maintain adequate access to the projects it eand all areas related to the works at his expense.If existing roads are to be used for access to the site, the EPC Contractor shall maintain such roads to the satisfaction of WAPCOS/ Employer for the duration of their use.

e) **Permits and Licenses:** Except as expressly stated in the Employer's Responsibilities, the EPC Contractor shall obtain all pre & post construction permits and licenses necessary for the execution and completion of the Works. The EPC Contractor shall pay all associated fees including royalty. He shall also give the Employer a copy of all relevant correspondence and other documents relating to the EPC Contractor's permits and licenses in name of

Employer.

f) **Temporary Works**

The EPC Contractor shall design, install and maintain all temporary facilities required for the construction of facilities under this contract Package, which he requires on or at the site throughout the execution of the work, and remove the same on completion of the works. He shall provide all such buoying, fencing, watching, lighting, connections to public utilities etc.as he needs or as required by authorities and shall install and use his temporary facilities in accordance with all statutory regulations and the requirement of the relevant authorities.

The EPC contractor shall submit his plan for temporary works to the Employer/ WAPCOS, for approval, within 30 days of award of contract.

Temporary construction shall be adequate for intended uses and for all loads imposed without excessive settlement, deflection or deformation. All parts and members shall be properly strengthened to prevent displacement or failure.

Before or upon completion of work, unless otherwise required or directed, preparatory structures, installations and utility service shall be disconnected and removed from the site.

g) **Utilities**

Temporary utilities used for construction shall have to be adequate for the intended uses and not to be overloaded or otherwise used or arranged in any manner endangering persons, premises or works. Connections shall be properly made, lines and wiring securely anchored in place andprotected against accidents.

h) **Water**

The EPC Contractor shall provide his own arrangements for sourcing and for distribution adequate supply water for the Project including:

Drinking water: Providing and maintaining canisters, coolers of sufficient number to reasonably serve the Project.

Construction water: Providing and maintaining temporary water service and distribution of adequate capacity for construction. The water shall be fit for construction. Moreover, If water is not found to be suitable for construction purpose, EPC Contractor shall arrange sufficient quantity of water fit for construction as per IS456 2000. The cost shall be borne by EPC Contractor.

i) **Electricity**

The EPC Contractor shall make his own arrangement for power supply.

If found necessary, the EPC Contractor shall provide and maintain generators including a stand-by generator of adequate capacity to meet his additional Power requirements.

The EPC Contractor shall make his own arrangements as outlinedhereunder:

- Distribution of adequate capacity for power, lighting and other construction needs.
- As necessary to properly and safely perform work at enclosed spacesor under hazardous conditions. Likewise, providing lights for night work/ protection as necessary.
- Temporary electrical systems shall comply with the local codes and regulations.

j) **Waste and Rubbish**

The EPC Contractor shall provide regular daily clean-up and removal of trash, waste, scraps, construction debris, etc. from site and temporary work yard and shall arrange fordisposalof waste andrubbish to appropriate disposal areas.

k) **First Aid and Fire Protection**

i. **Emergencies:** The EPC Contractor shall maintain the contact number/lists of nearest available police,hospital or medical services at the EPC Contractor's Site Office and the same are to be displayed at a number of locations &work places.

ii. **Fire Protection:** The EPC Contractor shall establish and submit th

following measures to the EPC Consultant/ Employer.

- Establish appropriate emergency escape routes andprocedures;
- Maintain fire extinguishers, connected hoses and other facilities necessary for reasonable fire-fighting action at the site andtemporary work yard;
- Provide and maintain a first aid kit containing bandages, medicines and sterilized materials for first aid treatment of minor injuries at the EPC Contractor's Site Office.

4 Excavations

Trenches intersecting roads shall have to be provided with crossings suitable to carry the type of traffic involved. Vehicular kerbs and pedestrian railings shall be provided as necessary.Open pits and in openings in floors and other accessible surfaces shall be protected by barricades or railings.

5 Access

Access to structures such as scaffolds, ladders, ramps, hoists etc. shall be provided, maintained and operated as necessary.

6 Storage Areas

Storage and shop areas shall be provided, arranged and maintained at approved locations as necessary to properly store, handle and fabricate the various materials and equipment required.

7 Protection of the Public

The EPC Contractor shall providebarricades and enclosures as necessary for public protection.

7.3 EPC Contractor's Laboratory & Equipment

The EPC Contractor shall provide site laboratory in order to carry out the specified tests. This laboratory shall be completely staffed and properly equipped to the satisfactionof the EPCConsultant/ Employer to carryout the tests as specified.

The EPC Contractor's site laboratory shall be available for the use of or inspection

by the WAPCOS/Employer as required by him. The WAPCOS/ Employer may require his representative to be present during any test and at any time during the working hours of the laboratory.

The EPC Contractor shall furnish and maintain the laboratory, apparatus and supplies necessary to permit execution of the tests required by the Specifications. The EPC Contractor shall submit to the WAPCOS/Employer for his approval, within 28 days after award of work, a complete list of the equipment, apparatus and supplies he proposes to furnish the laboratory. The list shall include the manufacturer's name and descriptive literature.

7.4 Environmental Protection

The EPC Contractor shall comply with all the conditions stipulated by the relevant statutory and regulatory organizations like NGT, Govt. of Himachal Pradesh / Govt. of India etc.

7.5 Fires

Fires and burning of rubbish on the Site are not permitted.Where fires or burning is permitted, the EPC Contractor shall prevent the structures which are to be preserved from staining, smoke and damage. The EPC Contractor shall restore, clean and make good stained or damaged work to new condition.

7.6 Disposal of Waste and Cleanliness

The EPC Contractor shall not bury rubbish and solid waste materials on the Site and he shall not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into the waterways, storm water drainage or sanitary sewers.The EPC Contractor shall keep all pavement sand areas leading to and from the site, clean and reeofmud, dirt, anddebris at alltimes form ovement of vehicles andpedestrians.

4.8 Drainage

The EPC Contractor shall provide temporary drainage and pumping facilities as

necessary to keep the areas of work site and adjoining areas free from water logging and flooding.

4.9 Pollution Control

The EPC Contractor shall cover or wet down dry materials and rubbish to prevent blowing dust and debris, and provide dust control for temporary roads and yards.The EPC Contractor shall take all measures necessary to ensure that no pollution of the water ways or any land areas occurs as a result of his activities.He shall undertake at his own expense all measures necessary to clean up or otherwise rectify any pollution arising from his activities under this Contract to the satisfaction of the WAPCOS/ Employer.

4.10 Environment

The EPC Contractor prior to the commencement of works shall prepare and implement an Environment Management Programme. The EPC Contractor shall deploy most suitable construction equipment to minimize the suspension of fine sediments at the work site.

4.11 SUBMISSION OF DOCUMENTS DURING PROJECT EXECUTION

4.11.1 Programme of Works

The EPC Contractor shall prepare and submit (both hard copy and soft copy) to the EPC Consultant/ Employer within 30 days of receipt of Letterof Award the following:

- Detailed CPM Schedule showing the various activities of the Work using MS Project
- List of designs /drawings / documents along with their schedule of submission.
- The above shall be updated every month and submitted to the EPC Consultant/ Employer.

4.11.2 Work Schedules, Survey Data & Drawings.

The EPC Contractor shall prepare and submit construction schedules,survey

data,and field drawings to illustrate the appropriate portion of work. The work items shall be described and related to responsibility, fabrication, layout, and setting or erection details as specified in appropriate Sections.

The EPC Contractor shall keep allowance in program of work sfor any stoppages during monsoon period, and he has to take all necessary measures to protect his equipment and the partly completed structures. The EPC Contractor is expected to build such stoppages of work during monsoon in his overall schedule for completion.The WAPCOS/ Employer will not entertain any claims from the EPC Contractor on this account.

All the drawings shall be submitted in six sets in hard copy and a soft copy (in AutoCAD format).

4.11.3 Maintenance Plan General

The EPC Contractor shall prepare maintenance plan covering all aspects of the works for there view of the WAPCOS/Employer.This plan shall be prepared to ensure that the design life periods stated are met in full and where no design life periods are stated, the maintenance plan shall be prepared to maximize the serviceable life.

4.11.4 Maintenance Document

The EPC Contractor shall provide six copies of the maintenance plan and manuals to the WAPCOS/ employer to retain by the WAPCOS / client upon the request of the EPC Consultant/ Employer or following receipt of attention to the WAPCOS/Employer's comments.

4.11.5 Weekly and Monthly Progress Reports

The EPC Contractor shall maintain a daily log describing the important events pertaining to the Works, (the working hours, the number of laborers employed, effective operation time of equipment, overtime hours), progress made in the Works. This daily log shall be submitted to the WAPCOS by 1:00 PM of the following

day.Compilation of these logs and their summary shall be submitted to the WAPCOS /Employeras Weekly Progress Report in three (3) copies by middle of the next week.

The monthly progress reports shal linclude progress photographs taken at a fixedpoint and angle. The photographs shall be sufficient in numbers and locations to record the exact progress of works.The colour photographs shallbeinsize 200 mm x2 50mm and the soft copy containing the digital version of the same shall be provided.
The EPC Contractor shall furnish the WAPCOS with three (3) copies along with soft copy of the monthly progress reports within seven (7) days after the end of every month.

4.12 DESIGN & DRAWING SUBMISSIONS

4.12.1 Design Submissions – General

The scope of drawings listed in this Volume is issued for information and guidance to the extent mentioned in the Tender document. EPC Contractor shall make all arrangement of design & drawings and submit the same for checking to the WAPCOS /Employer and will have to be proof checked from Reputed Govt. Institute after approval from WAPCOS Limited. The fee payable for proof checking and vetting shall be borne by Contractor. The final approval of IIT/ NIT/ PEC shall be submitted to WAPCOS on letter head of the Institute (forwarding letter)/Firm along with the stamped and duly signed drawings. Detailed Engineeringshallbe done by the EPC Contractor.EPC Contractor shall duly submit the design and calculations alongwith the drawings. The EPC Contractor shall not be entitled to any extension of time for completing construction/commissioning or any other relief on account of delay caused due to providing any clarifications or in resubmitting any designs and drawings. **Approval /vetted design from the IIT/NIT/ PEC does not absolve the contractor of their responsibility of structural stability and correctness of structural design. The contractor shall bear all the losses if arises out of the failure of any part of the project**.

The EPC Contractor shall not change any design and drawings reviewed by

WAPCOS/Employer, with out submitting such revised designs and drawings for the review of Employer.

The EPC Contractor shall submit for the approval of WAPCOS, progressively from the date of receipt of the Letterof Award, six (6) copies along with soft copy (AutoCAD) of the following:

a) Detailed Design Basis reports for Architectural, structural, MEP, Acoustic and engineering services
b) Layout of Master Plan
c) Elevations (all), sections (as required), 3D views of the buildings with actual finishing schedule, interior views with actual finishing schedule
d) Detailed drawings of landscaping and horticulture drawings (Indoor& outdoor) along with plantation plan.
e) Detailed site development drawings showing road cross sections, road slopes, coordinated services layouts
f) Areacalculation
g) General arrangement drawings of all structures
h) Cross sections and other details showing important particulars such as overall dimensions, clearances, etc.
i) Specification / catalogues of all standard bought-out items.
j) All drawings including shop fabrication / manufacturing drawings.These will include, but not be limited to assembly, sub-assembly, key components, etc. However, two week prior to fabrication, fabrication and part drawings shall be made available to WAPCOS.
k) Wiring drawings and equipment inter-connection diagrams of local control panels & Single Line Diagram of facility power distribution.
l) All design calculations pertaining to all structures and servicesalong with STAAD pro files.
m) A further digital copy (in AutoCAD format and other relevant format) of the submission shall be given on soft editable format.This digital copy shall include

the full submission with scanned copies of any documents prepared by hand. The list of submission will however be discussed with the EPC Contractor after the award of work.

4.13 SUBMISSION OF CALCULATIONS

All calculations submitted to the WAPCOS approval shall comply with the followings:

A. Each calculation page shall be uniquely numbered.

B. Each section of calculations shall have a cover sheet, listing the subject of the calculations, document number and date of submission, name and qualifications of the Designer (s), the name and qualifications of the Design Verification engineer(s), and the relevant Standards, books and drawings which are the basis of the calculations.

C. Each section of calculations shall have aTable of Contents, including page numbers.

D. Calculations shall be accompanied by all necessary sketches or extracts from drawings.

E. Calculations shall include introduction sex plaining the purpose of the calculations and the methods and design philosophies adopted. This shall clearly state the Standards on which the calculations are based.

F. Equations and values from International Standards and Codes of Practice are to be clearly referenced which are used in the design shall be attached to the submission.

G. Where values used in the calculations are brought forward from previous calculation pages, the page reference shall be included.

H. At the end of each section there shall be a summary, listing the conclusions of the calculations, and referring to construction drawings.

I. If calculations are revised due to design changes or corrections or comments of the WAPCOS /Employer, the calculations sheets shall be clearly marked with a revision letter.

J. All calculations shall be signed/initialed by the designer and design verification engineer.

K. The design calculations shall be written in English. In case any software is utilized to perform the calculations a sample set of manual calculations with references of various formulae used shall also be submitted for proper verification.

4.14 SUBMISSION OF DRAWINGS

All drawings submitted for the WAPCOS / Employer's approval shall comply with the following:

A. All drawings shall be in metric system, and be finally prepared in ink with legible lettering on appropriate size drawings using AutoCAD format compatible with AutoCAD 2016 or lower version. The submitted prints shall be clearly legible throughout and there shall be no ambiguity.
B. All drawings shall be submitted in digital format in soft copy,as well as six(6)hard copy print outs.
C. Drafting Standards employed in the preparation of all drawings shall be sufficient to produce legible drawings.
D. Drawings from various sub-contracting services, specialist supplier set c.shall also be presented in a similar manner (identical title blocks/format etc.) to provide a matched set of drawings.
E. All drawings shall clearly show the status and revision of the drawings. Revised drawings shall clearly indicate the nature and details of the revision work and also revision cloud & revision mark shall be marked wherever revised.
F. All drawings shall clearly identify the drafts-person responsible together with the identity of the drawings checker.
G. Each drawing shall show the scale(s) of the components illustrated by the drawing related to the original drawing size, A0, A1, A3 etc.

4.15 Inspection of Drawings at Site

The WAPCOS/EMPLOYER shall have the right at all reasonable times to inspect all drawings at the premises of the EPC Contractor or call for any drawing to be given to WAPCOS/ Employer's office.

A. GEOTECHNICAL INVESTIGATION

Soil exploration and soil investigation work shall be carried out by contractor immediately after the award of the work. Geo-technical investigation done on the nearby land is attached herewith the tender document for the understanding of the topography/soil characteristics only for that location. However, Contractor have to carry out fresh geo-technical investigation for the site on his own cost and submit the detailed report to this office.

After award of work, Contractor shall carry out detailed Geo technical investigation at its own cost through reputed NABL accredited laboratory only as detailed in tables below. The Scope of work shall comprise of in general, but not limited to the following for Geotechnical investigations.

a. Drilling of at least 2 nos boreholes upto a depth of 10m or refusal.

b. Conducting standard Penetration tests and collection of disturbed, undisturbed soil samples from boreholes.

c. Recording water table in the boreholes.

d. Laboratory tests on soil and water samples collected from boreholes.

e. Any other tests/works not specifically mentioned in this document but are required to ascertain the bearing capacity of soil at different depth, type of foundation and other engineering properties of the soil to the satisfaction of the Owner/ WAPCOS.

Preparation and submission of soil reports (4 nos. hard bound final reports and soft copies). Contractor will submit soil report as per project schedule submitted by contractor.

B. TOPOGRAPHICAL SURVEY

The detail Topographical Survey work of entire site has already been carried out by WAPCOS and enclosed with this tender Document in drawing section. However, Contractor/Bidder may carry out detail survey at his own cost, to verify the survey data provided by the WAPCOS and make own assessment about topography of site, before quoting rate and start of the Construction. No claim of Contractor in respect of discrepancy in topographical survey /levels shall be entertained.

2.0 WORKS OF THE PROJECT

The works of the project shall be executed as per Architectural, Approved Structural & Services Drawings, Bill of Quantity (If applicable), list of Approved makes of works, General Technical specifications of works and other conditions mentioned in the tender document. Contractor will finalize the brand of material in consultation with WAPCOS before execution of work from the following list of approved makes which are applicable for this work.

4.15 PRACTICES REGARDING GENERAL SPECIFICATIONS

The EPC Contractor shall submit the source and method of execution for the EPC Consultant/Employer's review before any execution. All materials used in the construction of permanent works required under this Contract shall be of 1st class quality as specified herein, samples approved from WAPCOS, and comply with the latest IS Codes or equivalent. The material shall be tested before bringing it to the site.

This specification establishes and defines there quirements of various materials to be used in Civil and Structural works. Whenever any reference to IS Codes is made, the same shall be taken as the latest revision (with all amendments issued there to) as on the date of submission of the Tender. Apart from the IS Codes mentioned in particular in various clauses of this specification, allother relevant codes related to specific job under consideration regarding quality, tests, testing and /or inspection procedures shall be applicable.Reference to some of the codes in various clauses of this specification does not limit or restrict the scope of

applicability of other referred orelevant codes.

In case of any variation/contradiction between the provision of IS Codes and this section, the provision given in this section shall be followed, unless the Employer agrees /consents to follow IS codes or other proposal of the EPC Contractor as provided in the Contract.

All materials shall be of standard quality and shall be procured from renowned sources/manufacturers approved by the EPC Consultant/Employer. It shall be the responsibility of the EPC Contractor, to get all materials/manufacturers approved by the EPC Consultant/Employer prior to procurement and placement of order.

Wherever brand is not mentioned, EPC Contractor shall take prior approval of brand complying with the tender specifications how ever mentioning the brand considered in the Bid submission shall prevail if specified earlier.

Whenever called for by the EPC Consultant/Employer, all tests of the materials as specified by the relevant IS Codes shall be carried out by the EPC Contractor in an approved laboratory and test reports duly authenticated by the laboratory, shall be submitted to the EPC Consultant/Employer for his approval. If so desired by the EPC Consultant, tests shall be conducted in the presence of the EPC Consultant or his authorized nominee.

Quality and acceptability of materials not covered under this section shall be governed by the relevant IS Codes. In case IS code is not available for the particular material, other codes e.g. B.S. or DIN or API /ASTM etc.shall be considered. The decision of EPC Consultant/Employerin this regard shall be final and binding on the EPC Contractor.

The General Technical Specification of Civil Works will be as per the provision within DSR/HP PWD, IS Codes, CPWD Specifications, Building Codes, approved drawings, Standard Norms and standard specifications of particular works.

All this specification covers furnishing, installation, finishing, curing testing, and protection, maintenance till handing over, complete Building like structure, floor finishes and other sanitary installations. In general, all materials shall be as per HP PWD specification or relevant IS Codes.

Whenever asked for, the EPC Contractor shall submit representative samples of materials to the EPC Consultant /Employer for his inspection and approval.Approval of any samples does not necessarily exempt the EPC Contractor from submitting necessary test reports for the approved material, as per the specification / relevant IS Codes.

The EPC Contractor shall submit manufacturer's test reports on quality and suitability of any material procured from them and their recommendation on storage,application, workmanship etc. for the intended use. Submission of manufacturer's test reports does not restrict the EPC Consultant/ Employer from asking fresh test results from an approved laboratory of the actual material supplied from an approved manufacturer/source at any stage of execution of work.

All costs relating to or arising out of the tests and submission of test reports and or samples to the EPC Consultant/ Employer for his approval till the dateof issuanceof Performance Certificate shall be borne by the EPC Contractor.
Materials for approval shall be separately stored and marked, as directed by the EPC Consultant/Employerand shall not be usedin the Works till these are approved.

All rejected materials shall be immediately removed from the site by the EPC Contractor at his own cost.

4.12.1 General Standards

The new facilities shall be completed to high standards of construction and specification. The facilities shall be technically and functionally suitable to meet the Employer's objectives:

i. The Architectural finishes shall be of such quality that will ensure better hygienic conditions.

ii. The architectural design should take into account the requirements of differently abled persons

iii. All the material procured or to be used should be to the satisfaction of the Engineer before being used for the works intended to.

iv. All sanitary/ water supply fixture and fittings shall be of approved make confirming to IS specifications and with ISI Marks.

v. There should be separate inlets for hot and cold water in the building. The building should have sufficient number of water coolers and filters points to cater to the needs of different users.

vi. The design should provide for underground & overhead water tank with necessary pumping arrangement for both potable andfire fighting requirements.

vii. The design should incorporate fire fighting system with pumps, hydrants, sprinklers, fire extinguishers and fire detection & alarm system in accordance with the rules and regulations of the local fire authority and that of the Tariff Advisory Committee (TAC) of the Insurance Association of India, as amended up to date.

viii. Lighting should confirm to NBC/ sports lighting standards. All electrical system, fixtures, fittings etc. should confirm to CPWD specifications, latest IS code etc.

ix. The planning should include landscaping and horticulture to increase the comfort conditions inside the building. The EPC Contractor shall create parking, approach roads and other requirements for the building.

x. Provision should be made for internal and external signages, display boards, public address system in the required area.

xi. Finishing in the room of all buildings should be complete in all respects including, communication networking for microphone for announcement, telephone connection, Cable TV up to the terminal point of service provider, power points etc.

The following standards shall apply unless otherwise stated:

- The standards set out in National Building Code of India 2016 & BIS Codes.
- The relevant Development Control Rules/ Planning Act/ Development Act/Municipal Act/any other applicable statutes and local by-laws
- The National Electrical Code,1985
- The Indian Electricity Act 2003
- Requirements of the local Water Supply Company,Electricity Supply Company/ Department
- Requirements of the Pollution Control Board,Environment clearances,NOC from Fire department, Forest Department for tree cutting, Lift license, Explosive department, Aviation authorities if applicable
- Any other statutory requirement for execution of work and to occupy the buildings and run the services in all respects.
- EPC Contractor shall organize all inspections of concerned authorities & obtain the NOC's within the time for completion.
- The EPC Contractor is required to submit there event drawings like completion Drawings and any other statutory documentary requirement of local bodies in copies as per requirement to obtain the approval etc. at their own cost.

4.12.2 Unacceptable Materials and Processes

The materials and processes given below must not be used in the New Facilities or in connection with the New Facilities.

- Highalum in a cement in structural elements
- Calcium chloride as a concrete additive
- Seadredged aggregates or aggregates for use in reinforced concrete
- Asbestos cementproducts; orasbestos inanyotherform including vermiculite containing asbestos fibrous dust
- Lead or any products containing lead for use in connection with drinking water
- Materials which are generally composed of mineral fibres either man made

or naturally occurring which have a diameter of 3 microns or less and a lengthof 200microns or lessor which contain any fibres not scaled or otherwise stabilised to ensure that fibre migration is prevented

- Ureaformaldehyde
- Plastics for water storage and delivery that release toxic materials
- Materials containing vinyl chloride unless risk form carcinogen is shown to be negligible.
- Vermiculite containing asbestos fibrous dust
- Cellulose fibre
- Polyurethane foam or polyisocyanurate foam unless the risk is shown to be negligible
- Plywoodwithglues,resins and surface treatments that produce irritant volatiles
- Decorative finishes containing lead or asbestos
- Materials containing chlorofluoro carbons(CFCs)
- Paints and wood preservatives containing pentachlorophenois (PCPs) tributyltin oxide (TBTO) or Lindane
- Any treatment of materials either before or after installation which give rise to toxic or hazardous emissions or particles
- Any other substances generally known at the time of use to be deleterious to health and safe tyortothedurability of the works in the particular circumstances they are used.
- **PROJECT SPECIFIC SPECIFICATIONS**

4.13. CIVIL WORK AND MEP SERVICES

S. No.	Particular	Specification	Ref.to DSR 2016 item no.
	CIVIL WORK		
1	**Site development**	Jungle clearance required levelling, dressing, cutting, filling upto plinth level and approach road upto construction site,	

		barricading surrounding to construction site to isolate site from road and public.	
2	**Excavation**	Earth work in all kind of soil/semi rock/ hard rock in trench/ raft footing upto required depth as per the approved Drawings including de-watering.including getting out and disposal of excavated earth to all leads, as directed by Engineer-in-charge. Supplying and filling in plinth with good earth under floors, including watering, ramming, consolidating and dressing complete.	2.1&2.6
3	**Anti-Termite Treatment**		
	Pre Anti-Termite Treatment	After excavation for foundation, below PCC levelby Diluting and injecting chemical emulsion @ one litre per hole, 300 mm apart including drilling 12 mm diameter holes With Chlorpyriphos/Lindane E.C. 20% with 1% concentrationfrom specialized agency with 10 years warranty period	
	Post Anti-Termite Treatment	After earth filling at plinth level, below PCC of flooring by Diluting and injecting chemical emulsion @ one litre per hole, 300 mm apart including drilling 12 mm diameter holes with Chlorpyriphos/ Lindane E.C. 20% with1% concentration	

		from specialsied agency with10 years warranty period.	
	Peripheral Post Anti- Termite Treatment	Along external wall where the apron is not provided using chemical emulsion @7.5litres/sqm to a depth of 300mm with Chlorpyriphos/ Lindane E.C. 20% with 1% concentration from specialsied agency with 10 years warranty period.	
	Water proofing Above plinth level	Damp Proof course as per standard norms and specifications	
	PCC: In trenches / raft and under flooring etc.	**As per Structural design based on Soil Investigation** **Minimum 100 mm thick PCC of minimum grade M10 under RCC footings** **Minimum 150 mm thick PCC of minimum grade M-10 under masonry work**	**4.1.5** **4.1.5**
4	**RCC Sub and Super Structure**	Depth of foundation as per the structural requirement/ design and soil investigation. Design as per IS Codes and as per Earthquake Seismic Zone Complaint. Structural load will be as per Standard IS Codes Required design Mix as per the structural requirement/ design and approved drawings. RCC Framed Structure /Prefabricated Structure Shuttering and scaffolding for RCC works	5.33,5.34 ,5.37,5.40 &5.38

		Construction/ expansion joints between RCC members by PVC Water stops confirming to IS: 12200 along with machine moulded Aluminium sheet for horizontal and vertical joints (80 to 300mm size) RCC fins as per the tender and approved drawings **Minimum grade M25 or above for RCC .** **Centering & shuttering** **Steel shuttering along with steel scaffolding shall be used for all RCC work**	5.9
5	**Steel Reinforcement**	Thermo-Mechanically Treated bars of 500 D or more grade confirming to relevant BIS codes & tests, As per the approved makes.	5.22+5.22A
6	**FILLERWALLS**		
	Structure Masonry Work in F&P and Super Structure	Damp Proof Course 40 mm thick of Cement Concrete 1:2:4 with bitumen coating @ 1.7 kg/sqm Masonry work RCC Framed structure with filler walls in Non modular bricks of 230 mm thick in cement mortar 1:5 with intermediate columns wherever necessary.	
	Internal Partitions	Internal partition 115 mm Non modular bricks in Cement mortar 1:3 including providing and placing 2 Nos. 6 mm dia bars and lintel band as per structural requirement.	
		Providing Chicken Mesh /groove at the joint	

		of concrete and Brick work	
	NOTE: Thickness of wall may vary if Fly AshBrick/AAC blocks/ Concrete blocks used at site after prior approval from Engineer.		
7	**PLASTERING,PAINTINGANDFINISHING**		
a)	**Internal**	12/15 mm thick plaster on wall fair/rough side in C:M1:5 over dubbing coat on uneven surface and finishing in even & smooth finish above skirting / dado on walls and 6mm thick on ceilings withC:M 1:4 and providing Chicken Mesh at the joint of concrete and Brick work. Internal walls and ceiling 2mm or more thick (to maintain plumb) with PoP and putty over plastered surface. **Premium** Acrylic emulsion paint with 2 or more coat over surface preparation with readymade approved brand **White cement based** putty and priming coat.	
b)	**External Finishing (As per approved elevation drawings)**	i. 20mm thick plaster in cm 1:4 mixed with waterproofing compound @3% weight of cement in two layer i.e. 12mm and 8mm as specified. ii. Aluminium composite panels of 4mm total thickness with top and bottom coil of 0.5mm thick aa3105 alloy grade produced from direct chill process and following en 485-2. The top and bottom aluminium coil should be coated with lead free	vi.

			pvdf (polyvinyl diene fluoride) paint of 70:30 ratio by double coat double bake method following aama2605 in matt rustic series finish. The core should be mineral core with minimum 72% inorganic matter passing resistanceto fire astm e119 for 2 hours and reaction to fire en13501-1 class b s1 do. The manufacturer should be having all the required test equipment's (yearly calibrated from nabl accredited lab) for providing technical data sheet parameters mentioned in the technical specifications.	
			iii. Approved exterior glass reinforced concrete stone texture cladding tiles (of appprox size 200x75 mm to 200x200mm) 10 to 12 mm thick laid with groove upto all heights duly installed with approved wall tile adhesives on rcc surface/stone brick surface as on elevations of masonary walls etc.	
			iv. Texture and exterior paint with 2.5-3.5 sq.ft/kg/coat having density 1.85 percent at 0.5 and voc less than 50 gm/l. The work shall include providing and applying one coat of weathercoat primer/seal-o-prime,	

		acribond primer as recommended with a drying time of 4-6 hr. Above the primer two coats of texture paint shall be applied with trowel with a time interval of 12-16 hrs between the coats. Top coat having two coats of weathercoat exterior paint (antidust and anti fungal of approved make and shade) with the recommended dillusion ratio as finishing coat, complete in all respects upto all heights and to the complete satisfaction of the engineer in-charge. v. Anodized aluminum sections for windows and ventilators with extruded built up standard tubular and other sections of approved make conforming to is 733 and is 1285 anodized transparent or dyed to required shade according to is 1868 (medium anodic coating of grade ac 15) expansion hold fasteners including necessary filling up of gaps at junction's at top bottom and sides with required pvc/neoprene felt etc, aluminum sections shall be smooth rust free straight, mitered and jointed mechanically. Aluminum swap beading for glazing/paneling c.p	

		brass/stainless, steel screws, including providing and fixing hinges pivots aluminum joinery fitting and lock & providing and fixing glass panes of 6mm thickness tinted in approved color for exterior glazing, weight not less than 14.75 kg/sqm.glass panes in basket ball hall shall be 8mm thk toughened glass.all internal glass panes shall not be tinted. The work shall include aluminum snap beading up to any storey complete in all respects as per approved drawings and design to the entire satisfaction of engineer in charge.	
8	**FLOORING/DADO/SKIRTING/SILL**		
	Badminton Court , Table Tennis Hall, Boxing Hall & Gymnasium	BWF Certified TARAFLEX® BADMINTON 7mm thick vinyl badminton sports mats Surface treatment-100% PVC Surface treatment, Weigh 4.7KG/M2, Roll Length 26.4, w 1.5m, Shock absorption, EN 14808 > 25%. Vertical deformation<=3.5mm Sliding coefficient, Anti-bacterial activity(E. coli - S. aureus - MRSA), ISO 22196>99% inhibit growth, Abrasion resistance, EN ISO 5470-1<=350,Impact resistance, Impact sound insulation EN ISO 717-2, 19DB laid over a self levelling layer	

	Gymnasium	Natural rubber Rubber Tile Flooring, Thickness: 10-15 Mm Size: 1 Meter By 1 Meter alongwith locking system laid over BWF Certified TARAFLEX® BADMINTON 7mm thick vinyl badminton sports mats Surface treatment-100% PVC Surface treatment, Weigh 4.7KG/M2, Roll Length 26.4, w 1.5m, Shock absorption, EN 14808 > 25%. Vertical deformation<=3.5mm Sliding coefficient, Anti-bacterial activity(E. coli - S. aureus - MRSA), ISO 22196>99% inhibit growth, Abrasion resistance, EN ISO 5470-1<=350,Impact resistance, Impact sound insulation EN ISO 717-2, 19DB laid over a self levelling layer	
	Badminton hall	BWF Certified TARAFLEX® BADMINTON 7mm thick vinyl badminton sports mats Surface treatment-100% PVC Surface treatment, Weigh 4.7KG/M2, Roll Length 26.4, w 1.5m, Shock absorption, EN 14808 > 25%. Vertical deformation<=3.5mm Sliding coefficient, Anti-bacterial activity(E. coli - S. aureus - MRSA), ISO 22196>99% inhibit growth, Abrasion resistance, EN ISO 5470-1<=350,Impact resistance, Impact sound insulation EN ISO 717-2, 19DB laid over Surface Board Made of Imported Aacer Maple wood/ Rebowood Hevea Species sports flooring as per	

		specification and condition metioned below:- Aacer Maple wood/Rebowood Hevea, MFMA/FIBA/BWF approved Hard Maple/Rebowood Hevea wood Flooring 20mm thick each individual strip of Hard Maple/ Rebowood Hevea. Flooring system shall have been independently tested to the International Standards: EN 14904 or MFMA, FIBA, BWF International Standards Minimum width of Aacer Hard Maple/Rebowood Hevea 25/32" x 2-1/4" Hard Maple/Rebowood Hevea flooring, MFMA, FIBA, BWF grade. MFMA, FIBA, BWF sports Flooring 25/32" x 2 1/4" (20mm x 57mm), Min. Expansion Space-1 1/2" (38mm), Wall Base: 3" x 4" (76mm x 101mm) Vent Cove Base, jointed together with the help of tongue an groove on all four sides of all boards, Substructure of mappi wood flooring shall consist of antitermite treated sleeper of Spruce or Nominal 2"x3"x4', Spruce, Pine or Fir with pads attached 12" on center laid perpendicular to the main floorin planks at a spacing 305mm centre to centre including 3/8" (10mm-19mm) rubber shock pads at 305mm centre to centre spacing. Vapour Barrier. 6 mil polyethylene installed over the concrete base beneath the flooring system as a vapor barrier between the concrete and	

		wood floor. Machine sanding two coat of oil modified Polyurethane Gym sealer and one coats of oil modified Polyurethane Gym sports finis in accordance with manufacturer specification or prefinish fro factory with 7 layers UV Lecquer and Game line marking in accordance with manufacturers specifications and project drawings etc. complete laid over a self levelling layer	
	All around Swimming Pool, A Administration Room , Coach Office,First Aid Room Snack Bar Toilet Flooring	Flooring: Providing and laying full body Vitrified tiles 598mmx598mm, 9 mm thick, in floor with water absorption less than 0.08% and conforming to IS:15622, of approved brand & manufacturer, in all colours and shade, laid on 20 mm thick cement mortar 1:3 (1 cement: 3 coarse sand) jointing with grey cement slurry @3.3 kg/sqm including grouting the joints with approved shade of epoy filling and matching pigments etc. The tiles must be cut with the zero chipping diamond cutter only. Laying of tiles will be done with the notch trowel, plier,wedge, clips of required thickness, leveling system and rubber mallet for placing the tiles gently and easily.	
	Swimming Pool Floor & Wall	Providing and laying JOHNSON ENDURA ORIENT BLUE size 247X122 and conforming to IS:15622, of approved brand & manufacturer, laid on 20 mm	

		thick cement mortar 1:3 (1 cement: 3 coarse sand) jointing with grey cement slurry @3.3 kg/sqm including grouting the joints with approved shade of waterproofepoxy filling and matching pigments etc. The tiles must be cut with the zero chipping diamond cutter only. Laying of tiles will be done with the notch trowel, plier,wedge, clips of required thickness, leveling system and rubber mallet for placing the tiles gently and easily.	
	Swimming Pool Floor	Providing and laying JOHNSON ENDURA DARK BLUE size 247X122, with lane marking , laid on 20 mm thick cement mortar 1:3 (1 cement: 3 coarse sand) jointing with grey cement slurry @3.3 kg/sqm including grouting the joints with approved shade of waterproof epoxy filling and matching pigments etc. The tiles must be cut with the zero chipping diamond cutter only. Laying of tiles will be done with the notch trowel, plier,wedge, clips of required thickness, leveling system and rubber mallet for placing the tiles gently and easily.	
	All Around Swimming Pool	Flamed granite with leather finish (Shade Royal Brown) laid on 20 mm thick cement mortar 1:3 (1 cement: 3 coarse sand) jointing with grey cement slurry @3.3 kg/sqm including grouting the joints with	

		approved shade of waterproofepoxy filling and matching pigments etc	
	Filtration Plant Room	25 mm th. Kota stone slab flooring over 20 mm (average thick base laid over and jointed with grey cement slurry mixed with pigment to match the shade of the slab, inclu rubbing and polishing complete with base of cement mortar 1:4 (1 cement: 4 coarse sand):	
	Electrical Panel Room	50mm thick ironite floor with M 20 cement concrete laid over 200mm thick base course.as per approval from engineer incharge.	
	Toilet Wall Tiles	Ist quality 300 x 300 mm ceramic glazed wall tiles conform to IS: 15622 (thickness to be specified by the manufacture of NITCO, Rustic series (Jaipur Moti/ Jaipur Coral Shar in dados, over 12 mm thick bed of cement mortar 1:3 (1 cement: 3 coarse sand) and jointing with grey cement slurry@ 3.3kg per sqm, including pointing in white cement mixed with pigment of matching shade complete.	
	Flooring: **Main Entrance, Reception Lobby , Corridors Reception & Snack Bar Counter**	Flooring: 19 mm thick pre polished Granite stone laid over 200mm thick base course consist of 100mm sand filling & 100mm thick PCC in 1:5:10 cement concrete at G .F and 50mm thick screed with brick ballast at F.F & S.F in cm 1:4 over RCC surface after applying coat of cement slurry @3kg/m2 as specified.	

		Skirting: 100 mm high 19 mm thick pre polished granite stone with 20 mm thick mortar in CM 1:4.	
	Lift Entrance Lobby	Flooring: 19 mm thick pre polished Granite stone laid over 200mm base course at G .F and 50mm thick screed at F.F & S.F in cm 1:4 over RCC surface after applying coat of cement slurry @3kg/m2 as specified. Skirting/dado: 100 mm high skirting and dado on lift entrance wall up to ceiling on all floor over 12 mm thick bed of cement mortar 1:3 (1 cement :3 coarse sand) and jointed with grey cement slurry @ 3.3 kg/sqm, including pointing in white cement mixed with pigment of matching shade complete. at all floors with 19 mm thick pre polished granite stone with 20 mm thick mortar in CM 1:4.	
	Flooring and Skirting: **Staircases of all Floors and Stairs at Entrance**	**Flooring:** 19mm thick with leather finish Granite stone (single piece) on tread & riser with proper edge moulding/ nosing and polishing with the arrangement of anti-skid grooves. **Skirting**: 19 mm thick pre polished granite stone 100 mm High Skirting with 20 mm thick mortar in CM 1:4	
	Snack Bar and all Entrances outside Building	19 MM Granite stone slab flooring over 20 mm (average) thick base laid over and jointed with grey cement slurry mixed with pigment to match the shade of the	

		slab,including rubbing and polishing complete with base of cement mortar 1 : 4 (1cement : 4 coarse sand) **Skirting**: 19 mm thick pre polished granite stone 100 mm High Skirting with 20 mm thick mortar in CM 1:4	
	Flooring: **On Ramps Parking Area at Entrance**	Flooring: 60 mm thick prepolished concrete cobble stone design tiles m50 concrete laid over 20mm thick bed of ordinary cement mortar 1:3ith a base course of 100 mm sand &100mm thick 1:5:10 PCC to be laid as approved by the Engineer incharge.	
	All Toilets, All Floors	**Flooring :** Providing and laying anti-skid rectified Ceramic floor tiles of size 300x300 mm or more (thickness to be specified by the manufacturer), of 1st quality conforming to IS : 15622, of approved make, in all colours, shades, except White, Ivory,Grey, Fume Red Brown, laid on 20 mm thick Cement Mortar 1:4 (1 Cement : 4 Coarse sand), jointing with grey cement slurry @ 3.3 kg/ sqm including pointing the joints with white cement and **matching pigments etc., complete.** **Dado:** Rectified Ceramic floor tiles upto 2.1 metre with 20 mm thick mortar in CM 1:4	
	SILL: Windows Sill, Balconies Sill and all Other	19 mm thick finished granite stone with proper edge moulding/ nosinglaid on 20 mm thick cement mortar 1:4 (1 Cement : 4	

	Sills of Building	Coarse sand), including pointing the joints with white cement and matching pigment etc. complete.	
9	**False Ceiling**	NOTE: **Contractor shall also do the work of min. 10mm thick plaster in cm 1:4 in the ceiling areas where false ceilings is to be installed.**	
	Office Toilet	12.5 mm thick Grid ceiling PVC coated tiles/ powder coaded metal sheet with frames, fittings and fixtures	
	Administration & Coach Rooms or as per requirement of approved drawings	Providing and fixing false ceiling with 8 mm thick Calcium Silicate Perforated board fixed on GI steel runners frame i/c cost of screws, angles, cleats, rawel plugs, with taping filling with compound etc. complete in all respects. Providing and fixing false ceiling at all height including providing and fixing of frame work made of special sections, power pressed from M.S. sheets and galvanized with zinc coating of 120 gms/sqm (both side inclusive) as per IS : 277 and consisting of angle cleats of size 25 mm wide x 1.6 mm thick with flanges of 27 mm and 37mm, at 1200 mm centre to centre, one flange fixed to the ceiling with dash fastener 12.5 mm dia x 50mm long with 6mm dia bolts, other flange of cleat fixed to the angle hangers of 25x10x0.50 mm of required length with nuts & bolts of required size and other end of angle hanger fixed with intermediate G.I. channels 45x15x0.9 mm running at the	

		spacing of 1200 mm centre to centre, to which the ceiling section 0.5 mm thick bottom wedge of 80 mm with tapered flanges of 26 mm each having lips of 10.5 mm, at 450 mm centre to centre, shall be fixed in a direction perpendicular to G.I. intermediate channel with connecting clips made out of 2.64 mm dia x 230 mm long G.I. wire at every junction, including fixing perimeter channels 0.5 mm thick 27 mm high having flanges of 20 mm and 30 mm long, the perimeter of ceiling fixed to wall/partition with the help of rawl plugs at 450 mm centre, with 25mm long dry wall screws @ 230 mm interval, including fixing of Calcium Silicate Perforated board 1200mm x 1200mm to ceiling section with backing of 50mmRockwool 48 kg density and perimeter channel with the help of hilux dry wall screws of size 3.5 x 25 mm at 230 mm c/c, including jointing and finishing to a flush finish of tapered and square edges of the board with recommended jointing compound , jointing tapes, finishing with jointing compound in 3 layers covering upto 150 mm on both sides of joint for board, all as per manufacturer's specification and also including the cost of making openings for light fittings, grills, diffusers, cutouts made with frame of perimeter channels suitably fixed, all complete as per drawings,	

		specification and direction of the Engineer in Charge but excluding the cost of painting.	
10	**INTERIOR DOOR & WINDOWS FRAME AND FITTINGS & FINISHING**		
	Door Frame & Finishing:	Double rebate Second Class teak wood Frame with provision of ventilator/sky light. Size of frame **150mm x 65mm**. Final finishing of frame will be melamine polished after rubbing, smoothing and primer coat etc.Wooden edge moulding / architectural moulded beading surrounding to door frames at inside and outside of door frame	
	Door Frame & Finishing:	Single rebate Second Class teak wood Frame with provision of ventilator/skylight. Size of frame **150mm x 50mm**. Final finishing of frame will be melamine polished after rubbing, smoothing and primer coat etc.Wooden edge moulding / architectural moulded beading surrounding to door frames at inside and outside of door frame	
11	**DOOR & WINDOWS SHUTTERS**		
	Door Shutter & Finishing:	35 mm thick flush doorshutter with gurjan wood core bwp and termite resistant fixed with all around wooden beading minimum 20mm depth and both side1.0mm thick laminate sheet of shade and make approved by WAPCOS. Including ISI marked Stainless Steel butt hinges with necessary screws and flush door shutter	

		fixed with all around wooden beading minimum 25 mm depth of all around shutter.	
	Exterior Window Shutter & Finishing: Aluminum Work	3 Track Bombay sliding (with fixed glass, glass sider and jail slider) Factory made anodized 'z' section Aluminum shutter of side and top and bottom style, fixed with float glass 6 mm TH with necessary aluminium beading and fittings, locking arrangements, grills etc. complete as per shop drawings approved by WAPCOS	
	Ventilator/Window	Factory made anodized 'z' section Aluminum shutter of side and top style 100x35mm, middle style 150 x35 mm and bottom style 150x 35 mm, fixed with float glass 6 mm TH with necessary aluminium beading and fittings, locking arrangements, grills etc. complete as per shop drawings approved by WAPCOS	
	Door Fittings & Accessories: All Fittings & Accessories for all above Wooden Doors	Stainless Steel heavy duty matt finish such as Hinges, tower bolt 8 inches and 6 inches, L- drop, Handles, door Stopper, rubber spacer etc. and fitted by SS Screws only. Providing and fixing aluminium extruded section body tubular type universal hydraulic door closer (having brand logo with ISI, IS : 3564, embossed on the body, door weight upto 36 kg to 80 kg and door width from 701 mm to 1000 mm), with double speed adjustment with necessary	

		accessories and screws etc. complete as per shop drawings approved by WAPCOS	
	Door Fittings & Accessories: All Fittings & Accessories	Stainless Steel SS304 heavy duty matt finish such as Hinges, tower bolt 8 inches and 6 inches, Mortice Lock (Basic min. MRP. Rs. 4500/-), door Stopper, rubber spacer etc. and fitted by SS Screws only.	
	Corridor Windows	Full size Fixed toughened glass (6mm thick or as per size requirement) fixed with Factory made champagne shade anodized 'z' Aluminum section as per shop drawings approved by WAPCOS	
	All other Windows and Ventilators	Toughened Float glass of 6 mm thickness fixed with Factory made champagne anodized 'z' Aluminum section/ wooden section as per approved drawings. Windows may be fixed OR movable or openable, as per shop drawings approved by WAPCOS	
	Reception/ Entrance area	Full size Double door of toughened glass 12mm thick with stainless steel floor spring and fittings. as per shop drawings approved by WAPCOS	
13	**Locker**	Thickness of Compact Laminate:: 3mm (Side & Back Parti ti on) & 9mm (Top, Bott om, Shelves & Bott om Base) Special Remarks For Customizati on: N/A: Color of HPL Boards: Single Standard Compact Color	

		Model Type : A5 (5 Tier in 1 Column) Size of Column : 300mm (W) X 450mm (D) X 1800mm (H) Excluding 100mm Bott om Base Size of Locker : 300mm (W) X 450mm (D) X 360mm (H) Accessories: Standard- Merino Make Aluminum, Stainless Steel - 304 Grade accessories a) Aluminum Interlocking Supporting Channels b) CAM LOCK-THREADED P-MCL2-25 c) SS Hinges - Stainless Steel d) Door Stopper Rubber Lining e) SS Hanger Rod (Providing only in A2 Model) f) SS Screws & pvc Wall Plugs SPECIAL NOTE - Warpage Criteria is 3.0 mm/1000mm for MRS panels as per EN standard- 438.	
14	**Staircase Railing**	**0.90m high Stainless Steel Railing SS304 of approved pattern. Minimum weight shall be 15 Kg/Sq.mt** as per shop drawings approved by WAPCOS	10.28
	Balcony Railing	**1.20 m highStainless Steel Railing of approved pattern. Minimum weight shall be 15 Kg/Sq.mt** as per shop drawings approved by WAPCOS	10.28
	Structural Steel	Structural steel work riveted, bolted or welded in built up sections, trusses and	

	Works	framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer & painting with synthetic enamel paint of approved brand and manufacture of required colour to give an even shade1st quality enamel paint i/c pre coated sheets complete in all respect as per the design & drawing.	
	Roofing Sheets	Providing and Fixing of Tata BlueScope Steel LYSAGHT® TRIMDEK SHEET,COLORBOND XRW sheet of nom.1072 mm supplied width and nominal 28.5 mm deep ribs with subtle square fluting in the five pan at nominal 203 mm centre-tocentre. The end rib shall be designed for anticapillary action, to avoid any seepage of water through the lateral overlap.The feed material is manufactured out of nominal 0.45MM BMT (Base Metal thickness) & 0.53MM TPT (Total Painted thickness), Hi-Tensile steel with min. 550 MPa yield strength, metallic hot dip coated with Aluminum-Zinc alloy (55% Aluminum, 45% Zinc) as per AS 1397 - Zincalume AZ150 (Min. 150 gms/sq.mt total on both sides) with Super Polyester Colorbond XRW (THERMA TECH TECHNOLOGY) quality paint coat as per AS/NZS 2728 Class 3 of Tata BlueScope Steel make. The paint will have a total coating thickness of nominal 35 µm,comprising of nominal 20	

		µm exterior coat on top surface and nominal 5 µm reverse coat on back surface over nominal 5 µm primer coat on both surfaces of APPROVED COLOUR SHADE approved by wapcos .	
	Insulation	Providing and Fixing INSUreflector (Thermal insulation Underdeck for metal roof –PEB shed) Supply of INSUreflector, Radiant heat barrier, having 9 micron aluminium foils encasing an air space within a FR polyethylene bubble pack. The composite weight shall be 270 gsm +10% with composite thickness of 3.8 mm + 0.2 mm.The material shall have a high reflectivity of 99% and low emissivity of 1% as per ASTM C 1371. The material shall conform to BS 476 Part 6 & 7 Fire Characteristics and offer high Puncture resistance. Thermal Resistance of material must be13.70 Km2/W as per ASTM C 236.Material shall be in form of rolls to reduce number of joints.	
	Stainless Steel Jali for Natural Ventilation.	Providing and fixing fly proof stainless steel grade 304 wire gauge, to windows and clerestory windows using wire gauge with average width of aperture 1.4 mm in both directions with wire of dia. 0.50 mm all complete with 12 mm mild steel U beading.	

		Supplying & sealing the Sanitary pipe inserts, provided in the floor & walls with Dr.FixitBathseal Tapedouble sided bituminuos tape and supplying & grouting the gaps around the pipe inserts with Dr.FixitPidigrout 10M non shrink free flow grout.	
		SUPPLY OF PIPE BEND TBSL LYSAGHT® DOWN TAKE BEND 133X94MM DIA, COLORBOND®XRW, 0.50MMTCT, G550 AZ150 STEEL	
		DOWNTAKE PIPE COLORBOND SUPPLY OF TBSL LYSAGHT® DOWN TAKE PIPE 133X94MM DIA,COLORBOND®XRW, 0.50MMTCT, G550 AZ150 STEEL	
	Metal Porch Structure	Providing and installing ms structure for entrance porch with rust free paint coating and 12 mm th toughened glass / 4mm acp cladding on all sides as per shop drawings approved by WAPCOS	
	Roller Blinds	Roller Blindes in office/ coach room with HEAD RAIL (VISTA ASCREEN SERIES/Mac OR EQUIVALENT) chain system drive with ball chain pulley automatically locked on release of ball chain. Plastic idler plug roller tuhes corrosion proof outside dia 38mm , bottom rail stiffening element , ball chain acetel balls endless	
	External Signages	Providing & Installing Pictogrames & Signages for exteriors with LED backlit acrylic	

		sheet. The signage shall be of a minimum height of 400 mm or as approved by WAPCOS.	
	Internal Signages	Providing & Installing Pictogrames & Signages for Locating the area like toilets,gymnasium, indoor halls ,canteen etc. in rowmark sheet	
	Second Floor RCC Terrace	Polymeric membranes water proofing treatment on rcc surface after applying a coat of cement slurry @3kg/m2 as specified. Gola on terrace all around parapet wall. Heat reflecting tiles with approve SRC VALUE be laid on a base of PCC 1:2:4 (laid to slope)above water proofing works to reflect the as per the green building norms	
	Rain Water Pipes	UPVC rain water pipes confirming to IS:13592 Type A with requisite accessories & clips	**12.41+12.42+ 12.43**
15	**PH Services**		
	Toilet Counters	19mm thick gang saw cut, mirror polished,pre-moulded and pre-polished,machine cut Granite stone.	
	Mirror in Toilets	Frameless mirrors with SS fittings along full length of counter.	
	WC	floor mounted, white vitreous china single piece, double traps syphonic water closet of approved brand/ make, shape, size and pattern including integrated white vitreous china cistern of capacity 10 litres with dual flushing system, including all fittings and fixtures with seat cover, cistern fittings, nuts,	

		bolts, jet spray and gasket etc including making connection with the existing P/S trap, complete in all respect as per directions of Engineer-in-Charge..	
	WC in Office Toilet	Wall mounted , white vitreous china single piece, double traps syphonic water closet of approved brand/ make, shape, size and pattern including integrated white vitreous china cistern of capacity 10 litres with dual flushing system, including all fittings and fixtures with seat cover, cistern fittings, nuts, bolts, jet spray and gasket etc complete in all respect as per directions of Engineer-in-Charge.	
	Wash Basins	Under Counter Oval shape Wash basin size 560X450mm with Single lever basin mixer with 32 mm size waste coupling and bottle trap with all fittings and fixtures complete, including cutting and making good the walls and floors where ever required shall be fixed with granite counter.	
	Urinals for Boys	Providing and fixing white vitreous china battery based infrared sensor operated urinal of approx. size 610 x 390 x 370 mm having pre & post flushing with water (250 ml & 500 ml consumption), having water inlet from back side, including fixing to wall with suitable brackets all as per manufacturers specification and direction of Engineer-in-charge.	

	Special Provision for Handicapped Bathrooms	All related fittings and fixtures as per the standard norms and Grab Bars provision	
	Other Fittings	As detailed in PHE works	
	NOTE: Modification in common bathroom/toilets may be made by client/ WAPCOS as per the requirement of building and usage by male/ female.		
	OH Water Storage Tanks	UV resistant HDPE water storage tank triple layer with cover and suitable locking arrangement sufficient capacity as per requirement/ approval by the Engineer incharge.	
17	**PLUMBING WORK**		
	Water Supply Pipes and Fittings and Joints	Chlorinated Polyvinyl Chloride (CPVC) for concealed works and GI for exposed works of required Pressure and diameter as per design and drawing (having thermal stability for hot & cold water supply including all CPVC plain and brass threaded fitting, valves etc. & including fixing the pipes with clampsate)	
	Fire Fighting Tank- Pipe Connection and Fittings and Joints	Black MS heavy class pipes of required Pressure and diameter as per design and drawing	
	Soil waste pipes, Rain Water Pipes, Vent	Unplasticized Polyvinyl Chloride **(UPVC)** PIPES of required Pressure and diameter as per design and drawing	

	Pipes, Anti-Siphonage Pipes, Fittings & Joints		
	Gully Trap and Manhole Connections	Stoneware Pipes with chamber complete.	
	Rain Water pipe end to Rain water harvesting pit/ Catch Basin Connection	PVC/RCC/TBSL Pipes of required Pressure and diameter as per design and drawing	
	Water Cooler & Commercial RO (1 No.)	Supplying, fixing, testing and commissioning of Water Cooler of Storage Capacity of 100 litres and Normal Cooling Capacity of 20 litres per hour with features of stainless steel body, stainless steel tank, externally mounted thermostat makes it easy to set water temperature; speedy drainage; eco-friendly; faster cooling; silent during operation; auto-cut off with all fittings & accessories complete. Commercial RO with Purification Production Rate 20L/hr, Wall Mounted, Filter Cartridge-Sediment, Activated Carbon, UF, Post Carbon, MembraneType- Thin Film Composite RO.	
	Bathroom Fixtures		
	C.P.Pillar Cock Long Neck	Jaquar Cat.No.CON-021or approved equivalent make	

	C.P.Brass Waste	Jaquar Cat.No.ALD-709or approved equivalentmake	
	C.P.Bottle Trap	JaquarCat.No.ALD-769B or approved equivalent make.	
	Urinal	Sensor urinal HSI.Cat. No. 60018 or approved equivalent with C.I. hangers with built-in electronic solenoid valve operate autoflushing system complete with all electrical works required for completion of work with all required accessories.	
	C.P.Brass Bib Cock (Straight Line Model) With Wall	Jaquar Cat NO.FLR-5047N or approve dequivalent	
	Mirrr	Providing & Fixing 5mm thick with bevelled edge Looking glass fix with SS studs & screws on 6mm ply panellled surface of . The looking glass shall be duly polished, grinded with smooth edges.	
	Flange	C.P. brass of equivalent brand of sanitary fittings	
	C.P. Brass Bib Cock With Wall Flange	Jaquar Cat NO. OPL-15037 or equivalent make	
	Stainless Steel Sink	Jaquar Cat. No. 767 or approved equivalent make with complete in all respect	
	Single Bowl With Single Drain Board	940mm x 465mm x 178mm deep JAYNA JUPITER Cat. No. SBSD 02 or approvaled equivalent with CP brass mixing fittings Jaquar Cat. NO. 309 or approved equivalent	

	C.P. Brass Towel Ring	JAQUAR Cat No. ACN-1121N (CONTINENTAL SERIES) or approved equivalent complete with C.P. brass brackets fixed to rawl plug of approved design with C.P. brass screws	
	S.S. Hinged Grating	1.5mm thick with frame (Neer Cat. No. - NRG 7006 or equivalent make CHILLY-CRG-R-127 (Square Classic)/JAYNA NEW HEAVY GRATINGS Cat. No. NHG 140 or approved equivalent	
	Robe Hooks,	JAQUAR Cat. No. 1161 or approved equivalent make	
	Glass Bottle Liquid Soap Dispenser	JAQUAR Cat No. ACN-1135N Make or approved equivalent	
	CP Wall Mixer non Telephonic Type	Jaguar Cat No. CON-CHR-219KN or approved equivalent	
	Shower Rose With Shower Arm	Jaguar Cat No. OHS-1989 & SHA-477 or approved equivalent.	
	Health Faucet	JAQUAR Cat. No. 573 (ALLIED SERIES) or equivalent make	
	Soap Dish	Jaquar Cat. No. CAN-1131N or approved equivalent	
	Towel Rail	24" JAQUAR Cat. No. ACN-1111NM or approved equivalent	
	Concealed Stop Cock	Jaquar Cat No. CON-089KN or approved equivalent	
	Angle Valve with	15mm C.P. brass Angle Valve with C.P. brass connection pipe Jaquar Cat No.	

	C.P. Brass Connection Pipe	CON-053KN & ALD- 803B or equivalent make	
	Toilet Paper Holder	JAQUAR Cat. No. ACN-1151N or equivalent make	
20	**Fire Fighting**	To be done as per the national building code for buildings of 21 metre height complete in all respects.	
	Fire Hydrant System	Fire hydrants fabricated from 16 gauge CRCA M.S. sheet double door including 2 nos allen key lock for locking along with padlock arrangement & fully glazed with 5 mm thick float glass approved by local Fire Authority, stove enameled fire red finish with " fire hose' written on front with radium strip suitable to house 15 m long four length of canvas hose with couplings, one no of branch pipe, one fire mans axe and two numbers of portable extinguishers, first aid fire hose and supports for hoses, branch pipes, Axe and hose reel as per approved design including necessary fixing arrangement for hoses & axe and branch pipe including 1 no. Fire booster pump (450 lpm). The nos. of fire hydrant system shall be as per the latest NBC norms. NOTE: The above specification of fire hydrant system and capacity of overhead fire tank shall be modified as per NBC norms, if number of storeys increased as per "Para-1A of Scope of work. No extra	

		cost in this regard shall be entertained upto 6 storeys of proposed building.	
	Fire Extinguishers	**ABC powder stored** pressure type fire extinguishers consisting of welded MS cylindrical body, squeeze lever discharge valve fitted with pressure indicating gauge internal discharge tube, 30 cms long high pressure discharge hose, discharge nozzle, suspension bracket, conforming to ISI finished externally with red enamel paint and fixed to wall with brackets complete with internal charge. Capacity 6 kg. IS 13849. The nos. of fire extinguisher will be as per the latest NBC norms. **Carbon-di-oxide fire extinguisher**s consisting of welded M.S cylinderical body,squeeze lever discharge valve fitted with internal dischargetube, 30cms long high pressure discharge hose, discharge nozzle, suspension bracket, confirming to IS : 934 finished externally with red enamel paint and fixed to wall with brackets with rawl plug/dash fasteners complete with internal charge. Capacity 4.5 kg. I.S.I. Marked. The nos. of fire extinguisher will be as per the latest NBC norms.	
	Fire Detection and Alarm System	**Automatic Sensor based electric** Fire detection and Alarm System for the Building including MCP, Hooters, Control Panel with batteries & Charger etc. The nos. of fire alarm system will be as per the	

		latest NBC norms.	
	Airconditioners	Only provision for electrical power points and wiring for ACs/heater are to be kept as per satisfaction of engineer incharge.	
EXTERNAL SERVICES			
21	**Plinth Protection Surrounding Building**	50 mm thick of cement concrete 1:3:6 (1 cement: 3 coarse sand : 6 graded stone aggregate 20 mm nominalsize) over 75mm thick bed of drybrick ballast 40 mm nominal size, well rammed and consolidated and grouted with fine sand, including finishing the top smooth.(900 mm Wide) with 9inch th brick masonry toe wall at corner of CC	
	Waste Disposal	After construction of building different colours of dustbins to be provided by the contractor to segregate dry and wet waste at minimum 3 locations as per the waste developed during running of hostel building.	
	Rainwater Harvesting	Structure as per tender & approved drawings and storm water drainage network of Multipurpose hall be connected with brick masanory/ RCC rain water harvesting pit through collecting tankby PVC pipes/ RCC pipes as per design drawings to recharge ground water by gravity flow.	
	Parking /Pathway	Providing and laying at or near ground level factory made kerb stone of M-25 grade	

		cement concrete in position to the required line, level and curvature, jointed with cement mortar 1:3 (1 cement: 3 coarsesand), including making joints with or without grooves (thickness of joints except at sharp curves hall not to more than 5mm), including making drainage opening wherever required complete etc. as per direction of Engineer-in-charge (length of finished kerb edging shall be measured for payment). **(Precast C.C. kerb stone shall be approved by Engineer-in-charge).**	
	Parking /Pathway	Finishing with Epoxy paint (two or more coats)at all locations prepared and applied as per manufacturer's specifications including appropriate priming coat, preparation of surface, etc. complete on kerbs/ channel	
	Parking /Pathway	Providing and laying 60 mm th cobble stone design tiles M50 concrete laid over 20mm thick bed of ordinary cement mortar 1:3ith a base course of 100 mm sand &100mm thick 1:5:10 PCC to be laid as approved by the Engineer incharge.	
	Other Important		
	Provision For Barrier Free Building	Ramps, toilets for physically challenged, Chequered tiles use of Braille signages & lifts etc. as per the mandatory norms.	
ELECTRICALWORKS			
a	**Airconditioners**	Only provision for electrical power points and wiring for ACs are to be kept	

b	**Wiring**	FRLS PVC insulated copper conductor of suitable size as per CPWD and IS specifications.	
c	**Conduits**	Recessed heavy class PVC conduit of suitable size as per CPWD and IS specifications.	
d	**Switch Sockets**	Modular switch, sockets modular plate, suitable GI box of suitable size as per CPWD and IS specifications.	
e	**Telephone Cable**	0.5 mm dia FRLS PVC insulated annealed copper conductor	
f	**TV Cable**	co-axial TV cable RG-6 grade, 0.7 mm solid copper conductor PE insulated, shielded with fine tinned copper braid and protected with PVC sheath	
g	**Distribution Board**	Suitable way, horizontal/ vertical type three pole and neutral/single pole, sheet steel, MCB distribution board, 415 V/220 V, on surface/ recess, complete with tinned copper bus bar, neutral bus bar, earth bar, din bar, interconnections, powder painted including earthing etc. Separate DB for Light, Power and AC to be kept for each block on each floor as per latest CPWD specifications and IS codes	
h	**MCB/RCCB**	"C" curve, miniature circuit breaker suitable for inductive load of suitable poles	
i	**Earthling (body)**	G.I. earth plate 600 mm X 600 mm X 6 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of	

		required length etc. with charcoal/ coke and salt as required.	
j	**Earthing (Neutral of DG and Transformers)**	Copper earth plate 600 mm X 600 mm X 3 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of required length etc. with charcoal/ coke and salt as required.	
k	**Earth Strip**	G.I and copper of suitable size as per IS Standards	
l	**Cable**	PVC insulated and PVC sheathed / XLPE power cable of 1.1 kV grade of suitable size as per CPWD and IS specifications	
m	**Lighting Fixtures As Per Community Level Non Televised Sports Lighting Norms**	Slim surface mounted/ Recess LED lighting fixture as per specifications Slim surface mounted LED lighting fixture as per specifications Surface/Recess mounted LED lighting fixture as per specifications Surface/ Recess mounted LED mirror lighting fixture as per specifications - LHEXARP6PN1W009 or equivalent.	
	Fan & Exhaust Fan	• 1200mm 5 star rated Ceiling fan sweep complete • Exhaust fan with 250 mm and 300 mm sweep with rust proof body and noise less operation complete with louvers.	
n	**Main Distribution Panel**	CRCA sheet of 2 mm thick for frame work and covers , 3 mm thick for gland plates i/c cleaning and finishing complete with 7 tank	

		process for powder coating in approved shade having suitable capacity extendable type TPN aluminium alloy bus-bars of high conductivity,DMC/SMC bus bar support with short circuit withstand capacity of 31 MVA for 1 sec. including suitable rating MCCBs and MCBs and control circuit for transformer, DG sets and suitable number of outgoings as per CPWD, IS Specifications and site requirements. -Main LT Panel of hostel -Floor panels, light and power - AC Panels	
o	**Lighting Arrestor**	Lighting arrestor with suitable nos of earth pits, horizontal and vertical run of earth strip on parapet wall of hostel and up to the earth pits as per Indian standards	
p	**Safety Equipment**	Suitable nos. of Rubber mat, fire extinguisher, danger board etc. as per IS.	
	Other Allied Facilities		
	Swimming Pool	Supply, installation & commissoning of swimming pool filteration system for proposed indoor sports hall Total water volume : 205 m3 (turnover time – 4.5 hrs) (turn over volume– 50,000 ltrs)	

1		**SAND FILTERS WITH 6WAY MPV2" (WATERCO, AUSTRALIA)** Providing & fixing side mount double in flow diffuser, gilter glass commercial sand filter with manual 6way multiport valves inner dia 800mm dia,bed depth 440 mm,for flow of 25.2cum/hr and filter area of 0.53 sqmt with sand media of Make Waterco, Australia with all accessories & with hydraulically balanced laterals preferably fishtail type, installation & commissioning complete job at site of work	
		SAND FILTERS 900 mm Dia in main pool	02Nos
2		**SELF PRIMING PUMPS 2.50 H.P. (MAKE WATERCO, AUSTRALIA)** Providing& fixing horizontal multi stage self priming centrifugal pumping set each of capacity 35.8cum/hr of 2.50 HP of Make Waterco, Australia with prefilter, glass filled thermos plastic rotection & automatic reset A.C. electric supply complete with enclosed fan cooled motor, barrel union 50 mm, suction strainers & necessary valves complete for drawing water from raw watertank & supply to treatment plant.	
		SELF PRIMING PUMP 2.5H.P.in main pool	02+01Nos
3		**SWIMMING POOL S.S.304 LADDERS CWG INDIA** Swimming pool ladders in S.S. 304 having antiskid design (German) 4 Step with anchor & complete accessories as required.38mm	

		Each ladder is made in SS AISI 304 and is brightly polished & 4 anti slip treads.Ladders are designed for any slippery surface and sharp edges and are complete with anchoring fixture sand earthing lugs. Distance between the treads is 250 mm and the size is 500 mm long and 100 mm wide for efficient grip. All the tread sare screwed to the pipe.Ladders will not have any welded joint sand treads.	
		S.S.LADDERS main pool 4 step	02Nos
		S.S.LADDERS main pool 3 step	02Nos
4		**RETURN INLETS WATERCO** Each floor inlet shall be made from unalterable ABS UV resistant with 2" side connection and shall be distributed evenly on the bottom floor of the pool. Each floor minlet shall have a maximum discharge capacity of 83lpm with a facility to regulate the flow through each inlet. The outlet flow through each floor inlet shall be radial instead of vertical. These floor inlet sshall be fixed on the bottomPipe and shall distribute the filtered water back to the pool. ETURNINLETS2”	
		RETURN INLETS MAIN POOL	14NOS
5		**SWIMMING POOL ACCESSORIES (WATERCO,AUSTRALIA,CORAPLAX,SPAIN,CWGINDIA)** **1.1 MS VACUUM HEAD** The vacuum head is with 2"connection and shall have the facility to be maneuvered with telescopic handle. The cable shall also form	01Nos 01Nos

		part of the vacuum head supply. **1.2 VACUUM HOSE** The vacuum hose shallbe 30m long andshall be made from EVA transparent blueco-polymer and shall be complete with hose end, adapercuffs etc. **1.3 TELESCOPIC HANDLE** Telescopic handle shall be 5.0m long and shall be made of anodized aluminium and with butterfly nut connection and shall be suitable to mountall the accessories like nets and brushes. **1.4 DEEP BAG NET** Deep Bag Net shall be made from polypropylene and white polyesternetting with 1.5" butterfly nut/ clip connection and suitable to trap deep pool larger sediments. **1.5 CURVEDBRUSH** The brush shall be 450 mm long in white polypropylene with blue-black polypropylene bristles with butterfly nut connection. **1.6 TEST KIT** The Test Kit shall be for residual chlorine and pH.Chemical reagent used shallhave satisfactory long self life, which shall be indicated on the box, Reagent DPD and phenol red solution shall be used along with a special sampling and testingcalibratedcontainer.	01Nos 01Nos 01Nos 01Nos

		1.7 POOL SUCTION PUMP Self priming Suction pump mounted onTrolley having same specifications as 1.5 H.P.forfilters The water quality is maintained as per IS 3328.1993	
6		**PVC PIPING & FITTINGS FOR MAIN POOL AS TRAL/ EQUIVALENT)** All the Pipe sand fittings are PVCu of 2". These pipes are designed to handle a pressure of 10 bar and the fittings are capable of handling a pressure of 16 bar.The seal lare high rated to handle burst pressures even though the system works at 2.5 bar. Job includes making connection with the existing pipelines for inlet toexisting pool & between various fixture. It includes making trenches & bringing the surface to original condition. (SOCKET,ELBOW ,TEES)	01lot
7		**6"PIPING & FITTINGS FOR SLUICE VALVE UPVC MAKE ASTRAL/EQUL.10KG**	01lot
8		**SLUICE VALVE 6"(BIR/EQUL.–INDIAN)–01NOS** MS Sluice valve will be installed in the Drain Line of 6"	01NOS
9		**Pvc NON RETURN VALVE2"–03NOS (CEPEXSPAIN)** Fitting Non Return Valve on Drain line /Balancing tank	02NOS
10		**Pvc BALL VALVE2"–03 NOS (CEPEXSPAIN)**	06NOS

		Fitting Ball valve of 2"for various lines of injector,pumping	
11		**ABS MAIN DRAIN COVER FOR MAIN POOL (CWGINDIA)** Providing and fixing ABS Main Drain complete with buffing on pool side and required no of holes complete in all respects.(CWGINDIA)	01Nos
12		**OVER FLOW ABS GRATTING (CWGINDIA)** Over flow grating in ABS 12" in white colour flexible suitable for all straight & Curved pools.	
		OVER FLOW GRATTING in mainpool	52mtrs
13		**LED UW LIGHTS 18W/ 27W/ 15W (CWGINDIA)** Supply & Fixing of LED Lights with sumps and conduiting and wiring complete in all respect	14Nos
14	**Swimming Pool Heating System**	**Indoor Swimming Pool Size – 14.5Mtrs.X11Mtrs.X(1.2Mtrs)**	
	1	SITC of Air Source Heat Pump of 90 KW with necessary Ball Valves, Stainers, MS Stand Support Etc C.O.P. – 5.3 Working Conditions - From 45 Deg. C to -5 Deg. C Input of Heat Pump - 17 KW/Hr Output Of Heat Pump - 90 KW/Hr Output - 77490 K. Calories//Hr Dimensions: 2000*1100*2300 Make: INTER SOLAR	2NOS.
	1.1	SITC of Motor Pump Set of make Grundfos/Wilo/Leo for primary and secondary circuit for circulation of water	2nos

		between Heatpump And Swimming pool with necessary Isolation Valves, Stainers, Non-Return Valves, Temperature Gauges, Pressure gauges Complete for Supply of Motor Pump Set of make Grundfos/Wilo/Leo for circulation of water between Heat pump and Pool. Having flow rate of 40-50 meter cube, Head 20mtrs.	
	1.2	Electrical Control Panel Powder Coated with necessary Indicators and MCB's, Control Fuse for Heat pump units.	1nos
	1.3	UPVC Pipe. (OD 70mm, ID 60mm)	30mtr
	1.4	Providing of other Accessories like: 1. NRV : 2 nos. 2. Stainers : 2 3. Pressure guage- 2 nos. 4. Ball valve : 8 nos. 5. Temp. Guage : 2 nos.	1set
	2	Supply of Cross laminated floating Type isothermal covers for covering/uncovering Of swimming pool with necessary S.S. reels for rolling/rerolling of covers.	2sets
Note: All other times in addition to time mentioned above the pool will remain covered with pool covers. Usage Timing: -Total 10hours (10AM to 8 PM)			

5.0 WATER SUPPLY SYSTEM-

i. External water supply shall be designed based on total water requirement for the building.All water supply lines are to designed based on Indian Standards and Manuals with latest editions and correction slip, if any.Design Standards

   a. CPHEEO:1999–Manual on water supply and treatment

   b. CPHEEO:1993–Manual on sewage and sewage treatment

c. SP35:1987–Handbook on watersupply and Drainage

d. NBC2016

e. UPC–India:2011orLatest

f. Relevant Indian Standards

ii. The ultimate source of water supply for the proposed building shall be Municipal Water supply. The external pipeline upto underground water tank shall be designed keeping in view the water supply demand. However, during construction period/after handing over building to Department of Youth Services and Sports Chamba and till the municipal watersupply is recieved, the source of water supply shall be Tubewells/Borewells.If water is not found suitable for construction, EPC Contractor shall make alternate arrangements for getting water fit for constructions at his cost.Nothing extra shall be paid for the same.

iii. The Borewell will be installed inside the identified land of the proposed sports complex having sufficient with adequate yield capacity to meet the daily water requirement,which shall be included in scope of work. Moreover, arranging water supply from local Municipal Corporation and other approvals is the responsiblity of the EPC Contractor.

5.0 MATERIALS USED IN CONSTRUCTION

5.1Water

Water used in construction for all civil & structural works shall be clean and free from injurious amount of oil, acids, alkalis, organic matters or other harmful substances, which may be deleterious to concrete, masonry or steel. The ph value of water sample shall be not less than 6. Potable water shall be considered satisfactory.

Tests on water samples shall be carried out in accordance with IS:3025 and they shall fulfill all the guidelines and requirements given in IS: 456.

The EPC *Consulta*nt/Employer may require the EPC Contractor to prove, that the concrete prepared with water, proposed to be used, shall not have average 28

days compressive strength lower than 90% of the strength of concrete prepared with distilled water.

The EPC Contractor is required to get the water tested from an approved laboratory before starting the construction work and in case the water contains anyoil/organic matter or an excess of acid,alkalis or any injurious amount of salts etc.beyond the permissible maximum limits given in IS:456,the EPC Consultant/ Employer may refuse to permit its use. In case there is any change in source of water, watersamples shall be tested again to meet the specified requirements.

Water shall be stored in tin barrels, bricks/stone or reinforced concrete.Brick/stone masonry reservoirs shall have RCC bases lab and shall be plastered inside, with1part of cement and 4 parts of sand and finished with neat cement punning.Thes ereservoirs shall be of sufficient capacity to meet the water requirements, at any stage of construction.

Water for curing shall be of the same quality as used for concreting and masonry works.Sea water shall not be used for preparation of cement mortar, concrete as well as forcuring of plain/reinforced concrete and masonry works. Sea water shall not be used for hydro testing and checking the leakage of liquid retaining structures also.

5.2 Cement

Portland Pozzalanic cement (grade43) conforming to IS1489 Part1shall be used.

5.3 Reinforcement Steel

TMT bars of Fe 500 D grade/conforming to IS: 1786 (latest edition) and IS 13920-2016, IS 456:2000 (with update amendments) and relevant CPWD specification shall be used.

In design calculation, stresses in reinforcement in Stirrups shall be taken as 415N/mm^2 as per IS: 456-2000 and other relevant Codes.

NOTE:

- **Minimum M 25 (Design Mix) to be used for slabs and beams etc. of all RCC structures, unless specified.**
- **Minimum M30 (DesignMix) to be used for columns of the building, RCC walls in basement and if any other places.**
- **Minimum M30 (DesignMix) to be used for water retaining structures.**

Materials of following specification are to be used in work. The Bidders are expected to possess and be well conversant with the following IS standard and code of practice.

1.	Cement	Portland Pozzalanic cement (grade43) conforming to IS 1489 Part1 shall be used
2.	Steel	IS1786,IS456,IS13920
3.	Vibrator	I.S.7246
4.	Aggregate	I.S. 383,I.S.515
5.	Water for mixing and curing	Shall be clean, free from injurious amount of oil, salt, acid, vegetable materials and other substances and harmful to concrete in conformity to I.S.456 and I.S.2025.
6.	Sand/FineAggregate	I.S. 2116,383
7.	Binding wire	I.S.280(galvanized minimum 1.25mm)
8.	Rain water pipe	I.S.2527
9.	Construction joints	I.S.3414
10.	Steel Window Frame	I.S.1038/83
11.	Steel Door Frame	I.S.4351/75
12.	Fitting &Fixtures for joinery works	Conforming toI.S.7452/82 strictly conform toI.S. specification and as per direction of Engineer-in-Charge.

Note: For roadwork (ApproachRoad) specification as per road and bridges (latest edition) published by IRC & MORTH shall be followed. In case of any

doubt and absence of provision, regarding specification I.S (Indian standard) shall be referred.

Item of Work:

1. Plain and Reinforced Concrete shall be with conformity to IS 456 and relevant BIS Codes/ CPWD Guidelines.
2. Foundation shall be with conformity to I.S.1080 and relevant BIS Codes/CPWD Guidelines.
3. Stone masonry (R.R.) shall be with conformity to I.S.1597 (Part-I) and relevant BIS Codes/ CPWD Guidelines.
4. C.R. Masonry shall be with conformity to I.S.1597and relevant BIS Codes/CPWD Guidelines.
5. Brick masonry shall be with conformity to I.S.2212 and relevant BIS Codes/CPWD Guidelines.
6. Cement plastering shall be with conformity to I.S.9103 & 6925 and relevant bIS Codes/ CPWD Guidelines.
7. Mortar shall be with conformity to I.S.2250 and relevant BIS Codes/CPWD Guidelines.
8. White and colour washing shall be with conformity to I.S.6278 and relevant BIS Codes / CPWD Guidelines.
9. CC in foundation shall be with conformity to I.S.2571 and relevant BIS Codes/ CPWD Guidelines.
10. Anti-TermiteTreatment shall be with conformity to I.S.6813. (Part–I & Part-II) and relevant BIS Codes/ CPWD Guidelines.
11. Painting to all surfaces shall be with conformity to I.S.2395(Part–I&Part–II)
12. DPC shall be with conformity to I.S.3067 and relevant BIS Codes/CPWD Guidelines.
13. Tar felt treatment should be with conformity to I.S.1346 and relevant BISCodes/ CPWD Guidelines.
14. Mosaic flooring with conformity to I.S.2114 and relevant BISCodes/CPWD Guidelines.
15. Steel painting shall be with conformity to I.S.1477 (Part–I&Part–II) I.S.1661

and relevant BIS Codes/ CPWD Guidelines.

All works shall be executed as per latest HP PWD /CPWD specification document with up to date correction slips (if any). Specifications not covered in CPWD specifications are as under.

6.0 Safety Measures

The Contractor shall be responsible for safety of all workmen and other persons entering the Works and shall at his own expense; where not stated otherwise take all measures, subject to the Engineer's approval, necessary to ensure their safety. Such measures shall include but not be limited to:

- Provision of safety and emergency regulations for fire, gas, and electric shock prevention, together with rescue operation plan.
- Safe control of flowing water
- Provision and maintenance of suitable lighting to provide adequate illumination at place of work with appropriate spares and standby unit
- Provision and maintenance of safe, sound slings, pulleys, ropes, and other lifting device
- Provision of safe access to any part of the works.
- Provision of notices in local dialect temporarily or permanently during construction at locations likely to be used by the public. Placement of such notices shall depend on the existence of the nature of work in the vicinity. These notices shall be in addition to any other statutory requirements demanded of the Contractor

The Contractor shall submit a proposal with detailed safety and emergency measures for the Engineer's approval. When the proposal has been approved, English and Hindi version of the regulations shall be made available to all of his Employees and the Engineer.

The Contractor shall ensure that all his Employees are fully conversant with the regulations, emergency and rescue procedures etc. and shall enforce a rule that will

instantly dismiss any employee committing a serious breach of such regulations. In all cases these materials shall be of the best Quality available *unless specified otherwise.*

7.0 Quality Consideration and Other Activities

- The EPC Contractor while submitting the detailed design calculations should submit the following information on the quality of materials to be used and other aspects as detailed below:
  - Metal quality,finishes and thickness
  - Glass quality, coating and thickness and proposed manufacturer's brand names
  - Aluminum extruded sections including mullions and transoms together with structural calculations and proposed manufacturer's brand name and also the name of agency proposed for fabrication work
  - Arrangement and jointing of components.
  - Field connections especially mullion to mullion and transom to mullion.
  - Fixing and anchorage system of typical wall unit together with structural calculations.
  - Drainage system and provision in respect of water leakage in the curtain wall system
  - Provisions for thermal movements.
  - Sealantand sealing methods.
  - Glazing method.
  - Windload and seismic load and any other specific load considered in the design
- Design concept over lightening protection link-up system of the curtain wall for connection and in corporation in to the lightening conduct or system of the building (Lightening conductor system of the building to be done by anyother agency)
- The maximum permissible structural tolerances of the building that the system has been designed to accommodate in case these tolerances

exceed those specified in the specification.

5.3 Tolerances

Any parts of the curtain wall, when completed, shall be within the following tolerances:

- Deviation from plumb, level or dimensioned angle must not exceed 3mm per 3.5m length of any member or 6mm in any to talrun in any line.
- Deviation from the oretical position on planor elevation, including deviation from plumb, level or dimensioned angle must not exceed 9mm total at any location.
- Change in deviation must not exceed 3mm for any 3.5mrunin any deviation.

5.4 Test of Wind Pressure

- The equivalent load of wind pressure or wind suction shall be given to the test unit as increasing or decreasing the inside pressure in the“pressurechamber”at which the test unit is fixed.
- The static wind pressure shall be applied up to 1.5 kpa at maximum wind pressure.
- The variation of dynamic pressure shall be of any approximates in curve line.
- Deflection on each observational points of the test unit shall be observed and recorded under static pressure as described above.
- Any damage and harmful permanent deformation on any parts except sealing materials shall not be found at maximum wind pressure.
- The deflection on th emainstructural parts in this condition shall not exceed:
    - 1/175 of the span between supports or 20mm, which ever is less for vertical elements.
    - 1/250 of the span between supports for horizontal elements.
    - The extent of recovery of deformation, 15minutes after the removal of the test load, is to be at least 95%.

5.5 Test of Lateral Deflection per Floor Height

- Lateral deflection per floor height shall occur on the test unit, when the structural frame which fixes the test unit is deflected horizontally.
- The deflection of every + 2.5mm shall be increased up to + 13mm on the test unit (static deflection test)
- The dynamic deflection shall be applied upto+13mm.
- The variation of dynamic deflection shall be of an approximate sine curve line, on period of 3 seconds.
- The dimensions of the deflection one achobservational point of the test unit shall be measured under the condition as described above and the dame shall be observed.
- Any damage and harmful permanent deformation shall not be found in any parts of the curtain wall except the damage to sealant at maximum deflection.

5.6 Water Tightness Test

- Water shall be sprinkled to the‘Test Unit’ under wind pressure.
- Pressure shall not be applied to the test unit
- The volume of the sprinkling water in one minute shall be 5liters per sqmt minimum (01.gal/ sq.ft.)
- All water leakage and drainage system at the joint and the openablesash of the curtain wall system shall be observedfrom the outside of the chamber.
- Hold the test two times, in sequence as described below, conforming to the above mentioned conditions.
    - Install the test unit.
    - Hold first water tightness test
    - Hold test of wind pressure as described above
    - Hold second water tightness test.
    - Lateral deflection test
- Water leakage shall not be observed inside at all parts of the test unit during first water tightness test.

3. **Anti Skid Vitrified Floor Tiles:** Fixing of Anti skid Vitrified floor tiles of premium grade having minimum thickness 10mm confirming to IS 13756 of size 60cm x 60cm coloured / printed series in floors, Trades of steps & Landing over 20mm thick bed of cement mortar 1:4 jointed with cement slurry mixed with pigments to match the shade of the tiles, including rubbing & polishing etc. complete:

4. **Granite Wall lining & Dado:** Granite work gang saw cut (polished and machine cut) of thickness18mm forwall lining, skirting anddado (veneer work) incement mortar1:3(1cement:3coarsesand) including pointing with white cement mortar 1:2 (1 white cement: 2 marble dust) with an admixture of pigment to match the marble shade: (To be secured to the backing by means of cramps.)

- **General**

Granite Stone shall be of the type specified and the material promptly in accordance with specifications, it shall be hard sound durable and tough free from cracks, and defects like cavities cracks flaws holes etc. Before starting the work the contractor shall get the sample approved by the Engineer – in – Charge.

- **Materials**

Granite Standard: Granite shall comply Standard Specification for material characteristics, physical requirements, and sampling for selection of granite.

All granite shall be of standard architectural grade, free of cracks, seams, or starts, which may impair its structural integrity or function. Color or other visual Characteristics indigenous to the particular material and adequately demonstrated in the sampling will be accepted provided they do not com promise the structural or durability capabilities of the material. Texture and finish shall be with in the range of samples approved by the Engineer – in - charge.

- **Shop Drawings**

The Contractor shall submit: copies of required shop drawings to the Engineer-in- charge for approval. These drawings shall show all bedding, bonding, jointing and anchoring details and the dimensions of each piece of granite. No final sizing or finishing shall be done until the shop drawings for that part of the work have been approved.

- **Stone Installation**

Proceed with the installation of the stone work in accordance with Drawings and using skilled mechanics capable of proper handling of the setting of the stone and able to field cut where necessary with sharp and true edges. Se tstone with joints uniform in appearance and stone edges and faces aligned tolerances indicated. Clean surfaces that are dirty or stained. Scrub with fiber brushes, and then rinse with clear water. Provide expansion, control, and pressure-relieving joints of widths and at locations shown on Drawings.

- **Cleaning**

After installation and pointing or caulking are completed, the contractor shall carefully clean the granite, removing all dirt, excessmortar, weld splatter, stains, and/ or other site incident defacements Stainless steel wire brushes or wool ma ybe used, but the use of other wire brushes or of acid or other solutions whichmay cause discoloration is expressly prohibited. Fabricator should be contacted before cleaners other than detergents are used.

- **Protection of Finished Work**

After the granite work is installed, the granite shall be properly and adequately protected from damage. Boxing or other suitable protection shall be provided wherever required, but no lumber which may stain or deface the granite shall be used. All nails used shall be non-corrosive. All granite work in progress shall be protected at all times during construction by use of a suitable strong, impervious film or fabric securely held in place.

(i) Approved make or Equivalent.

6. PL&FF TECHNICAL SPECIFICATION OF EQUIPMENTS

6.1 Sanitary Fixture & Fitting

6.1.1. Scope of Work

Work under this section shall consist of furnishing all labor as necessary and required to completely install all Sanitary Fixtures, flushing cistern, Brass and Chromium plated fittings and accessories as required by the drawings and specified here in after.

Without restricting to the generally of the foregoing the Sanitary Fixtures shall include all Sanitary Fixtures, C.P. fittings and Accessories etc. necessary and required for the Building.

Whether specifically mentioned or not all Fixtures and appliances shall be provided with all fixing devices, nuts, bolts, screws, hangers as required.

Testing of all fixture and fittings.

6.1.2. European /Anglo Indian Water Closest

- **General**

The item pertains for providing white or colour glazed vitreous chinaware European or Anglo Indian water closet with seat and cover of size and colour as specified in the schedule including fixing.

- **Material**

European type water closet shall be washing down patter nun less otherwise specified. Water closet shall be vitreous china conforming to IS 2556 (Part- I & II). The closet shall be of one piece construction and shall have minimum two hole of 6.5 mm diameter for fixing closet to floor.Closet shall have an integral flushing rim of self draining type. Each water closet shall have an integral

Trap with either 'S'or'P'outlet with and trap shall be uniform and smooth in order to enable an efficient flush. Plastic seat and cover shall be of black colour or as specified, they shall have conformity to IS 2548 Part I & II.

- **Fixing**

The water closet pan shall be placed in position as shown in the drawing. If the pan trap is damaged during handling or fixing,it shall be replaced by the contractor at his own cost. The pan, soil pipe shall be jointed in 1:1 Cement Mortar with Spun jute yarn caulked. The gap between W.C. and floor shall be finished with white/matching cement and sand as directed. Seat and cover shall be fixed to the Pan by two corrosion resistance hinge with 65 mm shank and threaded to within 25 mm from of flange. Seat shall be fixed in level by providing the washers of rubber with non ferrous or stainless steel washer to bolt.

- **Indian Water Closest**

- **General**

The item pertains for providing white or colour glazed vitreous chinaware Indian 84 water closet of size and colour as specified in the schedule including fixing.

- **Material**

Squatting Pan (Orissa Pattern) is of white or colour glazed vitreous China conforming IS 2556 Part III. Pan shall have flushing rim and are inlet ofself draining type. It shall have weep hole at the following inlet to the Pan. The flushing inlet shall be in front unless otherwise specified. The inside of the bottom of the pan shall have sufficient slope from the frontto the outlet and surface shall be uniform and smooth to enable easy and quick disposal while flushing. The exterior surface of the outlet below the flange shall be an unglazed surface which shall have groove at right angle to the axis of the outlet. In all the cases pan shall have be provided with 100 mm Glazed Vitreous China 'P'or 'S'trap with 50 mm water seal and 40 mm size vent harm.

- **Fixing**

The water closet pan shall be placed in position as shown in the drawing. The IWC shall be supported on brick masonry in CM 1:4 or as directed by the Engineer-in-charge. The pan shall be fixed slightly lower than the floor level. If the pan or trap is damaged during handling of fixing, it shall be replaced by the contractor at his own cost.The pan, trap and C.I.pipe shall be jointed in 1:1 Cement Mortar with hempyarn caulked.The gap between

W.C.and floor shall be finished with white/ matching cement as directed.

6.2. Lavatory Basin

- **General**

The item pertains for providing colour or white glazed vitreous chinaware wash basin with or without pedestal of size and colour as specified in the schedule including fixing.

- **Material**

Wash basins shall be of vitreous china conforming to IS : 2556(Part-IV) of flat back or angle back as specified shall be of one piece construction including combined over flow, basin shall be provided with single or double tap holes of size 28 mm square or 30 mm rounded. Each basin shall have circular wastehole, or 5 sq.cm slot type overflow.Pedestals for wash basin shall be exactly same glazing that of basin. Pedestal shall be capable of supporting the basin and completely recessed at the back to accommodate supply and waste pipes and fittings. The basin shall be supported on pan of C.I Cantilever brackets conforming to IS 775. Use of MS angle or Tee Section as bracket is not permitted.

- **Fixing**

The wash basin shall be fixed in position as indicated in the drawing. Basin shall be supported on a pair of C.I brackets which is embedded in cement concrete (1:2:4) block 100 x 75 x 150 mm. Oval shape or round shape wash basins are required to be fixed in RCC platform with stone tapping either fully sunk in stone top or flush with stone topping. The wall plaster on seat shall be cut to rest over the top edge of

the basin so as not to leave any gap for water seepage through between wall plaster & skirting of basin. The gap between basin and wall shall be finished with white matching cement.

6.3. Urinal

➢ **General**

The item pertains for providing colour or white glazed vitreous chinaware urinal in single or range (1, 2 & 3) and size as specified in the schedule with necessary fittings and appliances including fixing.

➢ **Material**

- **Bowl Type with Flushing Rim:** Urinal basin shall be flat back or corner wall type lipped in front. The vitreous china conforming to IS 2556 (Part VI). Urinal shall have and integral flushing rim and inlet or supply horn for connecting flush pipe. Flushing rim and inlet shall be of the self draining type at bottom of basin and outlet horn for connecting outlet shall be provided. The inside surface of the urinal shall be uniform and smooth throughout to ensure efficient flushing.
- **Bowl Type Flat Back without Flushing Rim:** They shall be of vitreous china Conforming to IS: 2556 (Part-VI) constructed in one piece with providing slot or alternative fixing Arrangement at flat back and where the integral flushing rim is not provided, they shall be provided with ridges inside the bowl to divert towards the front line of the urinal.
- **Stall Urinals:** The stall urinal and its screen shall be glazed fire clay conforming IS: 771(Part-III, Sec-2). The inside surface of stall and screen shall be regular and smooth throughout to ensure efficient flushing.
- **CP Brass Flush Pipe**: The flushing arrangement to urinals for single or in rangeshall beof CP brass with CP brass spreaderof 15 mm diaconforming to IS: 407. The capacity of flush pipe for urinal in a range shall be as follows:

Nos. of urinals in range	**Capacity of flush tank**	**Size of C.P. brass Flush pipe**	
		Main	Distribution
One	5litres	15mm	15mm

Two	10litres	20mm	15mm
Three	10litres	25mm	15mm

- **Fixing**
  - **Bowl Type Flat Back without Flushing Rim:** Urinal shall be fixed in position by using rawl plug, wooden plug, C.P screws etc. It shall be fixedat height of 65 cm from the standing level to the top of the lip of urinal or as directed by the Engineer-in-charge. Each urinal shall be connected with 32 mm size waste pipe which shall discharge into channel or a floor trap
  - **Stall Urinals:** The stall urinal shall be flush with the finished floor level. The stall urinal shall be laid over a fine sand cushion on average 25 mm thickness. The gap between wall surface, finished floor level and urinals shall not be more than 3mm and filled with water proofing plastic compound.

  - **CP Brass Flush Pipe**: The flushing arrangement to urinal in single orrange shall be of CP brass from 25 mm dia to 15 mm dia and CP brass spreader of 15mm size to each urinal including the cost of CP brass elbows, tees, coupling, crosses, clamps, clips, union CP brass check nut and screws etc. CP brass
  - **UPVC Pipes:** Waste pipes may be exposed on wall or concealed in chase as directed by the Engineer-in-Charge. Specifications for waste pipes shall be same as given in Sub Section.

6.4. Flushing Cistern

- **General**

The item pertains to provide white or colour glazed chinaware / PVC / Cast Iron flushing cistern with all inside syphonic fitting including fixing.

- **Material**

The flushing cistern shall be automatic or manually of rates high level orlow level as specified for water closets and urinals. Cisterns shall be of cast iron, vitreous china, enamelled pressed steel conforming to IS 774 for Flushing Type and IS 2326 for Automatic flushing cistern and Plastic (IS 7231). Cistern shall be mosquito proof. All working parts shall be designed to operate smoothly andefficiently. The cistern shall

have removable covers which shall fit closely on it and be screwed against top displacement where operating mechanism is attached to the cover. This may be made in two sections, but the section supporting the mechanism shall be securely fitted or screwed to the body. The outlet fitting of the cistern shall be securely connected to the cistern. The nominal internal diameter of the cistern outlet shall not be less than 32 mm and 38 mm for high level and low level respectively. Length of outlet cistern shall be 37 +/- 2 mm. Ball valve shall be screwed type 15 mm in diameter and shall confirm of IS 1703.The flat shall be made of polyethylene as specified in IS9762.A high level cistern is intended to operate with minimum height of 125 cm and a low level cistern with maximum height of 30cm between the top of the pan and under side of the cistern. A G.I chain strong enough to sustain a sudden applied pull of 10 kg or a dead load of 50 kg without any apparent or permanent deformation of the chain rings shall be attached to the ringor hook of the level manually operated high level C.I cistern. In case of low level cistern handle shall be of CP brass. In case of Plastic cistern, operation of cistern shall be through Push Button at the top for dual system and beyond plastic handle.The discharge rate of the cistern as per IS 774 shall be 10 +/- .5 litres 6 second and 5 +/- .5 litres in 3 second for cistern capacity 10ltrs .and 5ltrs.respectively.Flush pipe shall be of class 'B' G.I pipe of 32 +/- mm diameter for high level. Polyethylene flush pipe shall be low density confirming to IS 3076 or high density confirming to IS 4984 or UPVC pipe confirming to IS 4965 of 40 mm outer diameter. Over flow pipe shall not be less than +/- 5mm 'B'diameter. It shall be of G.I valve with mosquito proof jalli of 1.25 mm dia.

- **Fixing**

The china ware flushing cistern shall be placed over a pair of C.I.brackets.

C.P.brass flushpipe shall befixed tocistern and W.C. pan using check nut, spun yarn, cement mortar etc.The cast iron flushing cistern shall be placed over a pair of C.I. or G.I. or PVC flush pipe of specified diameter shall be fixed to cistern and W.C. pan by using check nut, white zinc, spun yarn, cement mortar etc.The PVC flushing cistern shall be placed or fixed as recommended by the manufacturer, PVC flush pipe of specified diameter shall be fixed to cistern and W.C. pan by using check nut,

white zinc, spun yarn, cement

6.5. Stainless Steel Sinks

- **General**

Item includes providing the stainless steel sink with or without drain board of size as specified in the schedule including fixing.

- **Material**

The sink shall be manufactured from stainless steel of Salem or equivalent steel conforming to IS: 13983. Stainless steel sink shall be of one piece construction moulded out of 19 SWG (1mm) stainless steel sheet of grade AISI 304 (18/8) with stainless steel choke – stop strainer (waste coupling) check nuts conforming to IS 13983.

- **Fixing**

The sink shall be fixed inposition asindicated inthedrawing.The sink shall be placed over the brackets or on the platform. Gap between sink and platform / wall shall be finished.

6.6. Half Round Channel

- **General**

The item pertains for providing colour or white glazed vitreous chinaware half round channel of size and colour as specified in the schedule including laying and fixing.

- **Material**

The half round channel shall be of white or colour glazed vitreous chinaware of size as mentioned in the schedule with or without dead end and shall conform to IS 2556 part VII.

- **Fixing**

The channel shall be laid to the correct alignment to required slope. It shall be fixed on 80 mm thick bed of 1:2:4 cement concrete. The channel shall be used in standard length. Pieces are not allow except where it is necessary to make up exact length.

6.7. Glass Mirror

- **General**

The item providing beveled or plain edges mirror with or without frame of size as mentioned in the schedule including fixing.

- **Material**

The mirror shall be of superior sheet glass with edges rounded off or beveled, size 600 x 450 mm unless specified in the schedule. It shall be free from flaws, specks or bubbles and thickness plated and should not be less than 5.0 mm. The back of mirror shall be uniformly silver plated and should be free from silvering defects. Silvering shall now have a protective uniform covering of red lid paint, where beveled edge mirror are not available. Fancy looking mirrors with PVC beading/border or aluminum beading on stainless steel beading/border based on manufacturer's specification, provided nothing extra shall be paid on this account. The backing of mirror shall be provided with 6mm thick marine plywood or environmentally friendly material other than asbestos cement sheet.

- **Fixing**

Mirror shall be fixed in position with 6 mm thick marine plywood backing. It shall be fixed by means of 4 nos. of CP brass screws & caps over rubber washers and rawl plug or as per the manufacturer's specification unless specified otherwise the longer side shall be fixed horizontally.

6.8. Shower Rose & CP Fittings

- **General**

The item pertains to provide chromium plated brass shower rose of specified diameter with accessories including fixing.

- **Material**

The shower rose & CP fittings shall be CP brass of approved and heavy quality. It's accessories shall conform to IS 1239 Part II.

- **Fixing**

Shower rose & CP Fittings shall be fixed to be water supply pipe line with necessary G.I fittings etc. as required by the Engineer-in-charge. Jointing shall be done with the zinc, spun yarn etc. A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain completewatertightness. Leaky jointshallberemadeto make it leakproof at his risk & cost.

6.9. Accessories

Accessories shall be of any of the following types:

- Towel rails

  Towel rail shall be C.P brass of size 610mm long and 20mm dia, and fixing with C.P brass brackets fixed to wooden cleats with C.P. brass screws.

- Towel rings

  Towel ring shall be C.P brass of size 150 mm dia, and fixing with C.P brass brackets fixed to wooden cleats with C.P. brass screws.

- Toilet paper holder

  Toilet paper holder shall be of Satin finish stainless steel AISI 316 grade wall mounted type fixed to wooden cleats with C.P. brass screws.

- Hand Dryer

  Hand dryer shall be of best quality, to be operated with 230 volts, single phase,with fully hygienic condition, with all accessories and fixing in the wall as mention in the Architectural drawing or as directed by Engineer-in-Charge.

- Coat hooks

  Coat hooks shall be of satin finish stainless steel AISI 316 grade wall mounted coat hooks fixed to wooden cleats with C.P. brass screws or as directed by Engineer-in-Charge.

- Soap dispensers

  Soap dispensers shall be of satin finish stainless steel AISI 316 grade wall

mounted liquid soap dispenser with indicator having bottom trough of soap fixed to wooden cleats with C.P. brass screws or as directed by Engineer-in-Charge.

Accessories shall be fixed with stainless steel half round head screws and cup washers in wall with rawl plugs or nylon sleeves and shall include cutting and making good.

Porcelain accessories shall be fixed in walls and set in cement mortar 1:2(1 cement: 2 coarse sand) and fixed in relation to the tiling work. The flange of the recessed fixture shall cover the recess in the wall fully.

Contractor shall install all Chromium Plated and porcelain accessories as shown on the drawings or directed by Engineer-in-Charge.

All C.P. Accessories shall be fixed with C.P. brass half round head screws and cup washers in wall with rawl plugs or nylon sleeves and shall include cutting and making good as required or directed by Engineer-in-Charge.

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

6.10. Urinal Partitions: Urinal partitions shall be white glazed vitreous chinaor 25mm/40 mm thick marble of size of 690x325mm.

Porcelain partitions shall be fixed at proper heights with C.P. brass bolts, anchor fasteners and M.S. clips as recommended by the manufacturer and directed by Engineer-in-Charge.

6.11. Toilet For The Disabled

Where specified, in washroom facilities designed to accommodate physically disabled, accessories shall be provided as per the NBC Normsfor Disable Persons architectural drawing or as directed by the Engineer-in-Charge.

Stainless steel grab bars of 600mm long suitable for expose mounting and penned non-slip gripping surface shall be provided in washroom for disabled persons. The flushing cistern shall be provided with chromium plated long handles.

6.12 Testing And Acceptance

Testing is done as per BS-5572

Internal Drainage Soil, Waste & Vent Pipes

6.13 Scope of Work

Work under this section shall consist of furnishing all labor, materials, equipments and appliances necessary and required to completely install all soil, waste, vent and rainwaterpipes as required by the drawings, specified hereinafter and as directed by the Engineer-in-Charge.

Without restricting to the generally of the foregoing, the soil, waste, vent and rainwater pipes system shall include the followings:-

- Vertical and horizontal Soil, Waste and Vent Pipes, Rainwater Pipes and Fittings, Joints Clamps and connections to Fixtures.
- Connection of pipes to GullyTraps & Man holes etc.
- Floor and urinal traps, cleanout plugs, inlet fittings and rainwater heads as specified.
- Waste pipes connections from all Fixturese.g.wash basins, sinks, urinals and kitchen equipments.
- Testing of all pipes.

6.13.1 General Requirements

All materials shall be new of the best quality conforming to specifications and subject to the approval of Engineer-in-Charge.

Soil, waste and vent pipes in shafts,ductsand inconcealed areas i.e.(false ceiling) shall consist of uPVC, SWR Pipe.

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

Pipes shall be securely fixed to walls and ceilings by suitable clamps at intervals specified. Pipes shall as far as possible be kept 50mm clear of wall.

Access doors for fittings and cleanouts shall be so located that they are easily accessible for repair and maintenance.

Every waste pipes shall discharge above the grating of properly trapped gully. Contractor will ensure that this requirement is adequately met with. Wherever floor traps are provided it shall be ensured that at-least one washbasin/washing trough is connected to such floor traps to avoid drying of water seal in the trap.

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

All works shall be executed as directed by Engineer-in-Charge.

6.13.2 Soil, Waste & Vent Pipes

a) The Soil& Waste pipe system above ground has been planned as a "two pipe system" as defined in IS: 5329, having separate pipes for waste from kitchen sinks, showers, washbasins, AHU's condensate drains and floor drains . Waste stacks have been provided with a "P" trap at basement ceiling.

b) All waste water from AHU's, A.C. plant and pump rooms, floor channels in basements will be provided with a deep seal trap before connecting to the main drain or vertical stack.

c) Vertical soil & waste stacks shall be connected to a common horizontal drain pipe at basement ceiling or to an external manhole directly wherever feasible as shown on the drawings.

d) All soil and waste from areas below general ground level (Basements) will be collected in sumps and pumped into sewer lines.

e) Anti-siphonage pipe (ASP) shall be provided for soil fittings onvertical stacks. It may also be provided for waste lines where shown on the

drawings.

f) Vent pipes shall be provided at all sewer lines at the starting manholes.

6.13.3 Rain water Pipes

a) All terraces shall be drained by providing down-takes rain water pipes.

b) A separate piped drainage system for slopping roof with leaders shall be provided.

c) Rain water pipes are separate and independent connected to the external storm water drainage system as shown on the drawings.

d) Rain water in enclosed courtyards shall be collected in catch-basins and connected to storm water drains.

e) Any dry weather flow from waste appliances, AHU' spumprooms, shall be connected to the sewerage system only.

6.13.4 Balcony/ Planter drainage

Open balconies, terraces, planters and formal landscape areas will be drained by a separate pipe connected to external storm water drainage system.

6.13.5 C.I pipe for soil & waste

Soil,waste, vent and anti-siphonage pipes,fittings and accessories shall be cast iron pipes. All pipes shall be straight and smooth and their inside free from irregular bore, blow holes, cracks and other manufacturing defects. Pipes shall be centrifugally cast (spun) iron soil pipes conformingto IS: 3989-1984.

6.13.6 Standard weight, dimensions and pig lead required for joints

For pipes conforming to IS:3989-1984 (centrifugally spun soil pipes)

Nominal	Diameter	Thickne ss	Overall weight 6' Length 1.83 mm	Internal diameter of socket	Depth oflead
In	Mm	mm	Kg	mm	mm
2	50	3.5	8.5	73	25
3	75	3.5	12.7	99	25
4	100	4.0	19.2	126	25
5.	150	5.5	35.5	178	38

6.13.7 Tolerance

Acceptable tolerance for pipes to IS:3989 shall be as follows:

a)	Wallthickness	-15%
b)	Length	+20mm
c)	Weight	-10%

6.13.8 Fittings

Fittings shall conform to the same Indian Standard as for pipes. Contractor shall use pipes and fittings of matching specifications.

Fittings shall be of the required degree of curvature with or without access door as detailed in the drawings or as directed.

Access door shall be made up with 3mm thick insertion rubber washer and white lead. The bolts shall be lubricated with grease or white lead for easy removal later. The fixing shall be air and water tight.

6.13.9 Fixing

All vertical pipes shall be fixed by MS clamps truly vertical. Branch pipes shall be connected to the stack at the same angle as that of the fittings. No collars shall be used on vertical stacks. Each stack shall be terminated at top with a cowl (terminal guard).

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

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

6.13.10 Clamps

Holder bat clamps shall be of standard design fabricated from MS flats 40x3mm thick and 12mm dia MS rod and 6mm nuts and bolts; paintedwith two coats of black bitumen paint before fixing. The clamps shall be fixed in cementconcrete 1:2:4 mix (1 cement: 2 sand: 4 stone aggregate 20mm nominal size) blocks 100x100x100mm deep.

Where holder bat clamps are to be fixed in RCC column or slotted angles, walls or beam they shall be fixed with 40x3mm flat iron “U” type clamps with anchor fasteners of approved design.

Structural clamps shall be fabricated from MS structural members e.g.rods, angles, channels, flats as per detailed drawing or as directed. Contractor shall provide all nuts, bolts, welding material and paint the clamps with one coat of red oxide and two or more coats of black enamel paint to give an even shade.

Wherever MS clamps are required to be anchored directly to brick walls, concrete slabs, beams or columns, nothing extra shall be payable for clamping arrangement, RCC block and making good with cement concrete 1:2:4 mix (1 cement : 2 sand : 4 stone aggregate 20mm nominal size) as directed by the Engineer-in-Charge.

6.13.11 uPVC pipes for rain water system

Pipes

- All pipes shall be straight and smooth and inside free from cracks and other manufacturing defects.Pipes shall be conforming to I.S. 13952 type A for rain water.
- Pipes shall be joined by approved type of socket and ‘O’ rubber ring (confirms to I.S. 5382) joints with rubber lubricant.

Fittings

- Fittings shall conform to the Indian Standard recommended for thepipes.Pipes and fittings must be of matching I.S. Specification. Interchange of pipes of one standard with fittings on the other standard will not be permitted.

- Fittings shall be of the required degree of curvature with or without access door.
- Connection from a vertical stack or position to a horizontal line shall be made only by a “Y” junction.

Fixing

- All vertical pipes shall be fixed truly vertical to walls with approved type of uPVC saddle clamp. Branch pipes shall be connected to the stack atthe same angle as that of the fittings. No collars shall be used on vertical stacks. Each stack shall be terminated at top with a cowl (terminal guard). However shaft where more vertical pipes run, the pipes may be fixed to the slotted angle/channel supports fixed to walls at intervals specified here under:-

- Horizontal pipes running along ceiling shall be fixed on **galvanized structural adjustable clamps** (Clevis clamps) of special design shown on the drawings or as directed. Horizontal pipes shall be laid to uniform slope and the clamps adjusted to the proper levels so that the pipes fully rest on them.
- Contractor shall provide all sleeves, openings, hangers, inserts during the construction. He shall provide all necessary information to the Engineer-in-charge for making such provisions in the structure as necessary. All damages shall be made good to restore thesurfaces at no extra cost.

Clamps

- Holder bat clamps shall be of standard design and fabricated from **galvanized M.S. standard flats** 40x3 mm thick and 12 mm dia M.S. Rod and 6mm nuts and bolts.Holder bat clamps shall be fixed in cement concrete 1:2:4 mix blocks 10x10x10 cms deep.
- Where holder bat clamps are tobefixed in RCCcolumn or slotted angles, walls or beam they shall be fixed with **galvanized** 40x3 mm flat iron "U" type clamps with anchor fasteners of approved design or 6 mm nuts and bolts.
- For SWR pipes conforming to IS 13592 shall be clamped to wall with approved type of uPVC saddle clamp/ U-clamp or as given in the approved drawing.

- Structural clamps shall be fabricated by electro-welding from M.S. structural members e.g. rods, angles, channels flats as per detailed drawing. Contractorshall provide all nuts & bolts, welding material. All fabricated clamps, nuts, bolts and washers shall be not dipped galvanized.
- Galvanized slotted angle/channel supports on walls shall be provided wherever shown on drawings.Angles/channels shall be of sizes shown on drawings or specified in schedule of quantities. Angles/channels shall be fixed to brick walls with bolts embedded in cement concrete blocks and to RCC walls with suitable anchor fasteners. The spacing of support bolts horizontally shall not exceed 1 m.
- Wherever M.S. clamps are required to be anchored directlyto brick walls, concrete slabs, beams or columns, nothing extra shall be payable forclampingarrangementand makinggood with cement concrete 1:2:4 mix (1 cement:2coarse sand :4 mm stone aggregate 20 mm nominal size)asdirected by the Engineer-in-Charge.
- For sleeves, anchor fasteners and clamp spacing chart shall be asfollows:

6.13.12 Floor Traps

Floor traps shall be siphon type full bore P or S type cast iron having a minimum 50mm deep seal.The trap and main waste pipes in toilets having 150mm sinking shall run below slab and shall be supported from the ceiling below. The trap and waste pipes in sunken area (where required) shall be set in cement concrete blocks firmly supported on the structural floor. The blocks shall bein1:2:4mix (1cement:2 coarses and:4 stone aggregate 20 mm nominal size) and extended to 40 mm below finished floor level. Contractor shall provide all necessary shuttering and centering for the blocks. Size of the block shall be 30x30 cms of the required depth.

Urinal traps

Urinal traps/horn shall be cast iron P or S traps with or without vent shall be fixed as specified for floor traps.

Floor trap inlet

Bath room traps and connections shall ensure free and silent flow of discharging water. Where specified, Contractor shall provide a special type inlet fitting fabricated from uPVC pipe without, with one, two or three inlet sockets fixed on side to connect the waste pipe. Joint between waste and hopper inlet socket of the trap shall be joined with solvent cement recommended by the manufacturer. Inlet shall be connected to a uPVC. Por S trap. Floor trap inlet hoppers and the traps if set in cement concrete blocks as specified in para above without extra charge. uPVC multi-inlet trap can be used where ever possible to be decided by the Engineer-in-Charge.

Trap & Seals

All traps shall be self cleaning design and the seal depth shall be as specified below wherever the traps are not integral with the appliances:

Appliance or ware	**Material**	**Trap Type**	**Seal depth (mm)**
Lavatory /wash basin	C.P.cast brass	32mm dia Bottle	75 mm
Sink	C.P.cast brass	40mm dia Bottle	75 mm
Kitchen floor drain of fabricated drain boxes	uPVC/C.I.	75/100 mmdia ‘P’ or‘S’	50 mm
Urinals	uPVC/C.I.	100 mmdia ‘P’ or ‘S’	50 mm

Floor Gratings

Floor and urinal traps shall be provided with 100-150mm square or round C.P./ Stainless steel grating, with rim of approved design and shape. Minimum thickness shall be 4 mm.

Jointing

Pipe to pipe and pipe to fitting (SWR) joint shall be with 'O' rubber ring as recommended by the manufacturer. Jointing with solvent cement shall be applied to uPVC waste pipes (confirming to I.S. 4985) and fittings or as recommended by the manufacturer's.

6.13.13 Clean out Plugs (On Soil Pipes)

uPVC Clean out pipe for Soil, Waste or Rainwater pipes laid under floors shall beprovided nearpipe junctions bends,tees,"Ys" and onstraight runs at such intervals as required as per site conditions. Cleanout pipe shall terminate flush with the floor levels.

Clean out on Drainage Pipes

Cleanout pipe shall be provided on starting point of each drain and in between at locations indicated on plans or directed by the Engineer-in- Charge Cleanout pipe shall be of size matching the full bore of the pipe but not exceeding 160 mm OD.

Cleanouts at ceiling level pipe shall be provided with a bend terminating at floor level above. The cap of the cleanout pipe shall have a cap flush with floor.

6.13.14 Waste pipe from appliances

General

a) Waste pipe from appliances e.g. wash basins, sinks and urinals shall be of uPVC pipes40, 50or 63mm OD conforming to IS:4985 class II (6 kg/cm2) shown on the drawings.

b) All pipes shall be fixeding radient towards the outfalls of drains. Pipes inside a toilet room shall be inchase unless otherwise shown on drawings. Where required pipes may be run at ceiling level in suitable gradient and supported on galvanized structural clamps. Spacing for clamps for such pipes shall be as per the pipe spacing chart given in section 1.

Encasing Pipe in Cement Concrete

C.I (Cast iron) soiland waste pipes and drainage under flooring sunken slabs and in wall chases (when cut speciallyforthe pipe)shall be encased in cement concrete 1:2:4 mix (1 cement :2 coarse sand : 4 stone aggregate 12 mm size) 75 mm in bed and all-

round. When pipes are running well above the structural slab, the encased pipes shall be supported with suitable cement concrete pillars of required height at intervals of one meter.

Testing

Testing procedure specified below apply to all soil, waste and vent pipes above ground including pipes laid along basement ceiling.

Entire drainage system shall be tested for water tightness during and after completion of the installation.No portion of the system shall remain untested. Contractor must have adequate number of expandable rubber/bellow plugs, manometers, smoke testingmachines, pipeand fitting work test benches and any other equipment necessary and required toconductthetests.All testing equipment / motorsetc.shall be certified for its calibration by an approved laboratory.

All materials obtained and used on site must have manufacturer'sHydraulic Test Certificate for each batch of materials used on the site.

Testing Soil, Waste and Rain water Pipes

A part from factory test all pipes and fittings shall be hydraulically tested for a head of 3 m preferably on a specially set up work bench. After applying pressure,strike the pipe with a wooden pallet and inspect forblow holes and cracks.Pressure may be applied for about 2 minutes.Rejectand remove all defective pipes.

After installation all connections from fixtures, vertical stacks andhorizontal drains including pipes along ceiling shall be tested to a hydraulic pressure not exceeding 3 m.Such tests shall be conducted for each floor separately by suitable plugs.

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

Contractor shall maintain a test register identifying date and time of each area.All tests shall be conducted in presence of Engineer-in-Charge and signed by both.

Excavation for Pipe Line

6.13.15 Excavation

The excavation for pipe works shall be open cutting unless the permission of the Engineer-in-Charge for the ground to be tunneled is obtained in writing. Where sewers have to be constructed along narrow passages, the Engineer-in-Charge may order the excavation to be made partly in tunnel and in such cases the excavated soil shall be brought back later on for refilling the trenches or tunnel.

6.13.16 Opening out Trenches

In excavation the trenches, etc. the solid road metal ling, pavement, curbing etc. and turf is to be placed on one side and preserved for reinstatement when the trenches or other excavation shall be filled up. Before any road metal is replaced, it shall be carefully shifted. The surface of all trenches and holes shall be restored and maintained to the satisfaction of the Engineer-in-Charge and of the Owners of the roads or other property traversed and the Contractor shall not cut out or break down any live fence of trees in the line of the proposed works but shall tunnel under them, unless the Engineer-in-Charge shall order to the contrary.

The Contractor shall grub up and clear the surface over the trenches and other excavations of all trees, stumps roots and all other encumbrances affecting execution of the work and shall remove the m from the site to the approval of the Engineer-in-Charge.

6.13.17 Obstruction of Roads

The Contractor shall not occupy or obstruct by his operation more than one half of the width of any road or street and sufficient spaces hall then be left for public and private transit, he shall remove the materials excavated and bring them back again when the trench is required to be refilled. The Contractor shall obtain the consent of the Engineer-in-Charge in writing before closing any road tovehicular traffic and the foot walks must beclear at all times.

6.13.18 Removal of Filth

All night soil, filth or any other offensive matter met with during the execution of the

works, immediately after it is taken out of any trench, sewer or cess pool, shall not be deposited on to the surface of any street or where it is likely to be a nuisance or passed into any sewer or drain but shall be at once put into the carts and removed to a suitable place to be provided by the Contractor.

6.13.19 Excavation to be taken to Proper Depths

The trenches shall be excavated to such a depth that the pipes shallrest on concrete or on firm bedding as described in t he several clauses relating to these so that the inverts may be at the levels given in the sections. In bad ground, the Engineer-in-Charge may order the Contractor to excavate to a greater depth than that shown on the drawings and to fill up the excavation to the level of these wers with concrete, broken stone,gravel or other materials. Nothing extra shall be paid for the same if the Contractor excavates the trench to a greater depth than is required without a specificorder to that effect in writing of the Engineer-in-Charge.The extra depth shall have to be filled up with concrete 1:5:10 mix (1 cement: 5 fine sand: 10 stone aggregate 40mm nominal size) at the Contractor's own costs and charges to the requirements and satisfactions of the Engineer-in-Charge.

6.13.20 Refilling

After the pipes or other work has been laid and proved to be water tight, the trench or other excavations shall be refilled. Utmost care shall be taken in doing this, so that no damage shall be caused to the sewer and other permanent work. The filling in the haunches and upto 75 cms above the crown of the sewer shall consist of the finest selected materials placed carefully in 15 cms layers and flooded and consolidated. Afterthis has been laid, the trench and other excavation shall be refilled carefully in 15 cms layers with materials taken from the excavation, each layer being watered to assist in the consolidation unless the Engineer-in-Charge shall otherwise direct.

6.13.21 Contractor to RestoreSettlement and Damages

The Contractor shall, at his own costs and charges, make good promptly during the whole period the works are in hand, any settlement that may occur in the surfaces of roads, beams, foot paths, gardens, open spaces etc. Whether public or private caused by histrenches or by his other excavations and he shall be liable for any accidents caused thereby. He shall also, at his own expenses and charges, repair and make

good and damage done to buildings and other property. If in the opinion of the Engineer-in-Charge he fails to make good such works with all practicable dispatch,the Engineer-in-Charge shallbe at liberty togetthe work done bythe Contractoror deducted from any money that maybe orbecome due to him or recovered from him in any other manner according to the law of the land.

6.13.22 Disposal of SurplusSoil

The Contractor shall at his own costs and charges provide places for disposal of all surplus materials not required to be used on the works. As each trench is refilled the surplus soil shall be immediately removed, the surface properly restored and roadways and sides left clear.

6.13.23 Timbering of Sewer and Trenches

The Contractorshall at all times support efficiently and effectively the sides of the sewer trenches and other excavations by suitable timbering, piling and sheeting and they shall be close, timbered in loose or sandy strata and below the surface of the sub soil water level.

All timbering, sheeting and piling with their waling and supports shall be of adequate dimensions and strength and fully braced and strutted so that no risk of collapse or subsidence of the walls of the trench shall take place.

The Contractor shall be held responsible and will be accountable for the sufficiency of all timbering, branches, sheeting and piling used as also forall damage to persons and property resulting from improper quality, strength, placing, maintaining or removing of the same.

6.13.24 Shoring of Buildings

The Contractor shall shore up all buildings, walls and other structures, the stability of which is liable to be endangered by the execution of the work and shall be fully responsible for all damages to persons or property resulting from any accident.

6.13.25 Removal of Water from Sewer,Trenche tc.

The Contractor shall at all times during the progress of the work keep the trenches and excavations free from water which shall be disposed off by him in a manner as will

neither cause injury to the public health nor to the public or private property nor to the work completed or in progress nor to the surfaceof any roadsorstreets, nor cause any interference with the use of the same by the public.

6.13.26 Width and Depth of Trench

The Engineer-in-Charge shall have power by giving an order in writing to the Contractor to increase the maximum widthin respectof whichpayment will be allowed for excavation in trenches for various classes of sewer, manholes,and other worksin certainlengths tobe specifically laid down by him, where on account of bad ground or other unusual conditions, he considers that such increased widths are necessary in view of the site conditions.

Water Supply System (Cold &Hot)

6.13.27 Scope of Work

Work under this section consists of furnishing all labor, materials equipment and appliances necessary and required to completely install the water supply system as required by the drawings & specified herein after.

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

a) Municipal water connection including water meter upto U.G.water tanks.
b) Piping from tube well to UGSR water tank.
c) Over HeadTank filling mains from hydro pneumatic system.
d) Distribution system from overhead tank to toilets and other wet area in the building.
e) Distribution mains from hydro pneumatic system to all fixtures and appliances for all buildings.
f) Excavation and refilling of pipe strenches.
g) Control valves, masonry chambers and other appurtenances.

- All water lines to different parts of building and making connection from source etc.
- Pipe protection and painting.

- Control valves, masonry chambers and other appurtenances.
- Connections to all toilets Snack bar, tanks and appliances.
- Excavation and refilling of pipe trenches, wherever necessary.
- Trenches for taking pipe lines for these services if required.

6.13.28 General Requirements

All materials shall be new of the best quality conforming to specifications. All works executed shall be to the satisfaction of the Engineer-in-Charge.

Pipes and Fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat work man like manner.

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

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

Pipes shall be fixed in a manners as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

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

As far as possible, all piping inside the buildings shall run either concealed or embedded. Outside the buildings the piping shall be installed at-least 60 cms below finished grade. All galvanized steel piping embedded either in trenches or in concrete and masonry work shall be tightly wrapped 1mm thick fiberglass tissue laid in bitumen.

Valves and other appurtenances shall be so located as to provide easy accessibility for operations, maintenance and repairs.

6.13.29 Scope of Work

Work under this section shall consist of furnishing all Labor, Materials, Equipments and Appliances necessary and required to completely finish Sewerage/Drainage system as specified hereinafter or given in theDrawing.

Without restricting to the generality of the foregoing, the sewerage system shall include:

- Internal/External sewer line.
- Excavations including refilling etc.
- Construction of Collection Chambers, Manholes and Drop Connections.
- Connection to Septic tank and Disposal of over flow water.
- Storm Water Drainage and Disposal.
- Construction of Desilting chamber & Rain water Harvesting tank
- Testing of pipe lines

6.13.30 General Requirements

All materials shall be new of the best quality conforming to specifications and subject to the approval of the Engineer-in-Charge.

Drainage lines shall be laid to the required gradients and profiles.

All piping shall be installed at depth greater than 80cms below finished ground level.

The piping system shall bevented suitably at the starting point of all branch drains, main drains, and the highest/lowest point of drain and at intervals as shown. All venting arrangement shall be un-obstructive and concealed.

All drainage work shall be done in accordance with the local Municipal bye- laws.

Wherever the sewerage pipes run above water supply lines, same shall be completely encased in cement concrete 1:2:4 all round with the prior approval of the Engineer-in-Charge.

Location of all manholes, catch basins etc., shall be got confirmed by the Contractor

from the Engineer-in-Charge before the actual execution ofwork at site.

All works shall be executed as directed by Engineer-in-Charge.

6.13.31 Alignment and Grade

The sewer pipes shall be laid to alignment and gradient shown on the drawings but subject to such modifications as shall be ordered by the Engineer-in-Charge from time to time to meet the requirements of the works. No deviations from the lines, depths of cutting or gradients of sewers shown on the plans and sections shall be permitted except by the express direction in writing of the Engineer-in-Charge.

6.13.32 Salt Glazed Stoneware Pipes

Stoneware pipes shall be of first class quality salt glazed and free from rough texture inside or outside and straight. All pipes shall have the manufacturers name marked on it and shall comply to IS: 651-1971 and shall be of approved makes.

The maximum permissible slope to the various diameters of pipes shall be as follows:

100mmpipe	……	1in40to1:50
150mmpipe	……	1in60to1:100
200mmpipe	……	1in801:120to1:200
250mmpipe	……	1in901:120to1:250

Where necessary,pipe shall be laid on abed of plain cement concrete1:3:6 and minimum 150 mm thick, and shall be projected by providing hunching up to half the diameter of the pipes. The width of the concrete bed for various diameters shall be as follows:

100 mm dia pipe	… …	380 mm wide			
150 mm dia pipe	… …	450 mm wide			
200 mm dia pipe	… …	600 mm wide			
250 mm dia	…	700 mm			

pipe … wide

Where the pipes are laid on a soft soil,with the maximum watert able level, lying at the invert level of the pipe, the pipe shall be bedded in concrete.

6.13.33 Laying of Pipes

Pipes are liable to be damaged in transit and not with standing tests that may have been made before dispatch each pipe shall be examined carefully on arrival at site. Each pipe shall be rung with a wooden hammer or mallet and those that do not ring true and clear shall be rejected. Sound pipes shall be carefully stacked to prevent damage. All defective pipes should be segregated, marked in a conspicuous manner and their use in the works prevented.

The pipes shall be laid with sockets leading uphill and should rest on solid and even foundations for the full length of the barrel. Socket holes shall be formed in the foundation sufficiently deep to allow the pipe jointer room to work right round the pipe and as short as practicable to admit the socket and allow the joint to be made.

Where pipes are not bedded on concrete the trench bottom shall be left slightly high and carefully bottomed up as pipe laying proceeds so that the pipe barrels rest on firm ground. If excavation has been carried too low it shall be made up with cement concrete 1:5:10 mix at the Contractor’s cost and charges.

If the bottom of the trench consists of rock or very hard ground that cannot be easily excavated to a smooth surface, the pipes shall be laid on cement concrete bed of 1:5:10 mix to ensure even bearing.

6.13.34 Jointing of Pipes

Tarred gaskin shall first be wrapped round the spigot of each pipe and the spigot shall then be placed into the socket of the pipe previously laid, the pipe shall then be adjusted and fixed in its correct position and the gaskin caulked tightly home so as to fill not more than one quarter of the total length of the socket.

The remainder of the socket shall be filled with stiff mix of cement mortar (1 cement: 1 clear sharp washed sand). When the socket is filled, a fillet should be formed round

the joint with a trowel forming an angle of 45 degrees with the barrel of the pipe. The mortar shall be beaten up andused after it has begun to set.

After the joint has been made any extraneous materials shall be removed from inside of the joint with asuitable scraper or“Badger”.The newly made joints shall be protected until set from the sun, drying winds, rain or dust. Sacking or other materials, which can be kept damp, shall be used. The joints shall be exposed and space left all rounds the pipes for inspection by the Engineer-in-Charge. The inside of the sewer must be left absolutely clearin bore and freefrom cement mortarorotherobstructions throughout its entire length, and shall efficiently drain and discharge.

- GullyTraps

Gully traps shall be of the same quality as described for stoneware pipes in Clause 5.

Gully traps shall be fixed in cement concrete 1:5:10 mix (1 cement: 5 coarse sand: 10 stone aggregate 40mm nominal size) and a brick masonry chamber 30x30 cms inside in cement mortar 1:3 with 10 x 10 cms grating inside and 30x30 cms C.I. sealed cover and frame weighting not less than 7.2 kg to be constructed as per standard drawing. Where necessary, sealed cover shall be replaced with C.I. grating of the same size.

6.13.35 Desilting Chamber & Rain Water Harvesting Tank

All Rainwater Collection Chamber shall be as per drawing or as instructions of Engineer-in- Charge.

Rain water harvesting pit is constructed preferably 5 to 10m from the permanent structure. The bore will be excavated manually or drilled by reverse direct rotary method up to the water level or as per instruction of Engineer-in-Charge.

The dia of Rain water harvesting pit shall be dia. 4500mm and clear water depth 4500mm. Pit shall be filled with boulders, gravel andcoarse sand.

Bore shall be 250mm dia and pipe shall be 160 OD uPVC 6 kg /cm^2. The pipe placed in the center of the shaft touching the lowest portion of the pit. The overflow pipe from the desalting chamber is directly connected to the rain water harvesting pit so that the rain water freely enters the pit for recharging.In addition to the inlet pipe from desalting

chamber an overflow pipe at the ground level so that any excess water that enters the pit is automatically drained away without damaging the pit.

Handing Over Procedure

6.13.36 Documents Submission

The Contractor shall before finally handing over the completed work in his scope to the Owner, submit the documents as per the Contract and as directed by the Engineer-in-Charge. Given below the checklist for the reference of the Engineer-in-Charge.

Packages/	**Sanitary Fixtures**	**Soil, waste &vent pipes**	**Water supply system**	**Sewerage/ drainage system**	**Water tanks**
Finalcleaning					
List of inventory					
Training Conducted on					
Operation Manual					
Maint.Manual					
As built P&I Diag/ SLD					
DefectsLiability Period/ Warranty					
Commissioning report					
Test reports/ Certificates					
List of essential spares					

Address/ Contact nos. of Vendors					
Remarks					

ELECTRICAL SYSTEM GENERAL AND PARTICULAR SPECIFICATIONS

1) General

The scope of work includes design, equipment selection, installation, inspection at Bidder's or his Sub-Bidder's works, supply, installation (including storing, unloading and transferring the material / equipment to Bidder's storage area, maintaining equipment / material in safe custody and assembling the elements of the equipment and installing at the place of work), testing and commissioning of the plant equipment/ electrical system on 'turnkey' basis. The Bidder shall submit their design calculations/ drawings based on 'Design criteria for electrical equipment/ system' for the indoor stadium to the WAPCOS's review and approval. These specification covers but not limited to, 11kV supply by HPSEB, LV switchboards, LV energy efficient motors, Motor starters, Phase Sequence Correctors, LV capacitors, HV, and LV power cables and control cables, DC supply system and any other allied equipment, etc. along with the specifications for workmanship, laying cables, lighting system, earthing systems, lightning protection etc. for the indoor stadium. It shall be the responsibility of the Bidder to design the electrical system based on the selection of the site requirements.

The Bidder shall make his own estimate of sizes, ratings and quantities for 11kV system, equipment if any as per load requirement, all plant items and miscellaneous systems such as earthing, lightning protection, lighting, etc. for the indoor stadium. However, facility for upgrade/ expansion of all equipment to cater any future requirements load shall have to be considered during design-engineering stage. It should be clearly understood that the Contract will be on 'turnkey' basis and no variation will be allowed for items of works not foreseen or omitted by the Bidder at the bidding stage, except where specifically indicated in the bid documents.

All equipment offered shall comply with the requirements specified in the latest editions of applicable Indian/ International Standards and shall also comply with the good engineering practices.

The specifications are for general guidance of the Bidder only. Bidder shall design the electrical system on the basis of 'Design Criteria' and to be submitted for the indoor stadium to the WAPCOS for approval. Bidder shall incorporate any changes/ suggestions in the drawings to suit site conditions and design criteria and standard engineering practice and resubmit for approval to the WAPCOS.

The contractor or hired subcontractor shall possess/arrange the valid electrical contractor's license of appropriate class from the concerned statutory bodies governing the area of work place which they have to submit before starting the electrical work at project site. The contractor shall fully comply with the relevant statutory rules and regulations.

All type (as applicable), routine and acceptance tests shall be conducted in the presence of the department or their representative / Third Party Inspector on all the equipment as per latest applicable IS/IEC at no extra cost. Typical type test reports for other equipment shall be submitted by the Bidder for approval by the department or their representative.

All commissioning tests shall be carried out in the presence of the department or their representative and approval for the same shall be obtained before commissioning and installation. All test reports shall be properly maintained by the Bidder duly approved by the statutory bodies and shall be handed over to the the department or their representative after completion of the job. All instrument and accessories required for testing and commissioning of the equipment specified herein shall be provided by the Bidder at no extra cost to the department or their representative.

Liaison with HPSEB and other Government organization/ statutory bodies for electric load & Power supply/ other clearances shall be Bidder's scope. After completion of installation work, the Bidder shall arrange for inspection and obtain approval from the concerned statutory bodies. Any fees that are to be paid to such statutory bodies for testing, inspection or calibration shall be paid by the Bidder. Any modification / revision in the equipment / installation of equipment as required by the statutory bodies shall be carried out by the Bidder. All such costs / fees for revisions / modifications shall be deemed to be included in the prices of supply, installation, testing and commissioning of equipment as quoted by the Bidder.

If a standard is upgraded than the upgraded standard up to date shall be applicable even if old standard is mentioned in the tender document unless specifically asked for old standard. Approval of drawings by consultant and customer shall in no way relieve the contractor of contractual obligations or liabilities under the contract or his responsibilities for correctness of dimensions, material of construction, performance etc.

Wherever there is ambiguity in specifications, standards that are not specified in document or are not available in IS, NBC etc. than IEC 60364 & BS 7671 shall be applicable for system requirements and deratings as per ambient conditions prevailing in Chamba.

Contractor will have to use higher rated equipment as per DNIT even if item is approved of lower rating i.e. the rating can be increased to increase safety factor but cannot be decreased under any clause of terms and conditions.

All the works and material shall be covered by manufacturer's warranty clause. Material not covered by warranty/ guarantee clause or expired warranty clause shall be rejected without assigning any reason. The contractor shall get all the equipment tested or submit test Certificates for wires, cables, switchgear & lights etc. For small equipment in very small quantities contractor shall take inspection waiver before dispatch. Contractor shall file all the Test Certificates with the bill in which equipment is being billed. The contractor shall provide warranty cards and Test Reports of all equipment/machinery installed in the indoor stadium either by the contractor or by contractor's vendor.

Contractor shall submit all the guarantee/warranty certificates, one copy in original to be kept in administrative office of the building at the site accessible to contractor for maximum guarantee period of the equipment or completion of the work thereafter it shall be kept in the department. One copy each for client (one or as directed by the client), consultant and contractor. Guarantee/ warranty certificates should be with metering markings for cables, Sr. No. of equipment & any other product, batch & date specific markings which are used in plant.

All electrical works shall comply following statutory standards:

- Indian Electricity Act- 2003
- Indian Electricity Rules- 2005

- Central Electricity Authority Regulations with amendments up to date (Measures related to Safety and Electric Supply).
- Chief Electrical Inspector for work done as per standard of workmanship and safety norms for up gradation of connection.
- National Lighting Code- 2010

- National building Code
- Fire safety standards
- Or any other Act or Rule enacted by competent authority

All the indoor and outdoor electrical work shall be suitable to environmental conditions prevailing in Chamba area of Himachal Pradesh. The conditions can be chilly or extremely sunny. All the design and workmanship should be such that there is no dust deposition on equipment or it should be minimal, so that there is no hindrance in heat dissipation and lubrication.

All the work must be planned as following:

- Minimum Lux levels for each builing space have been mentioned in this document. however, any upgradation in hesaame as per the applicable design creiteria for the said applications shall be incorporated and got approved from WAAPCOS for both indoor and outdoor spaces.
- Type and rating of Electrical Equipment shall be got approved from WAPCOS.
- Electrical load of the each equipment based on the equipment selected be got approved from WAPCOS.
- Indoor stadium/ plant's complete load shall be calculated based on equipment load.
- SLD shall be prepared & got approved from WAPCOS based on equipment & operation philosophy.
- Approved indoor stadium SLD in minimum A 3 size sheet shall be framed with transparent glass shall always be hanged in Electrical room.
- Cable sizes and lengths should be calculated as per load current and fault level
- Type and rating of Electrical Equipment should be freezed as per function and fault level
- GA of electrical equipment may be finalised as per equipment and space available marked & shall be got approved
- LT panels can be designed with automatic operation and Marshaling boxes.

The contractor shall be fully and wholly responsible for receiving and utilising the electricity within the indoor stadium, as per CEA latest guideline up to date. The contractor

shall maintain power factor within the limits as given by HPSEB from time to time. Any penalty on account of Power factor shall not be payable by the department it shall be deduced form contractors payables. Any penalty on account of power factor and harmonics shall be to contractors account. **The power factor should not be less than 0.98 for whole period of contract.**

Hazard and Danger signs as per IS: 2551 : 1982 must be provided at all Electrical Installations, Substations, Buildings housing Electrical Panels, equipment carrying electric potential as per IS standards in English, Hindi and vernacular language warning of potential hazard.

Electric Shock chart with fire dosing equipment, rubber mats shall be provided in Sub Station. Rubber mats shall be provided for all Electrical Panels being installed in the the indoor stadium.

The contractor shall take approval for Pre-commissioning tests, to be performed on equipment installed at the Sewerage Treatment Plant from the consultant and the indoor stadium, before commissioning any or all the equipment.

The system shall have inbuilt feature of isolation when the selected short circuit protection device is switched off.

All electrical installation shall be fuse less type except for VFD feeders where semi-conductor fuses shall be installed to provide protection against fault level. Contractor shall always maintain spare fuse inventory as per ratings throughout the contract period, at no point of time semi- conductor fuses be by passed.

2) Power Supply Information

Available and proposed power supplies are as follows:

Introduction

This chapter details the specific requirements of electrical works provided for the plant. Operating Voltages and Frequencies

HV System

Voltage : 11 kV nominal, 12 kV highest

Frequency : 50 Hz

Connection : 3 phase, 3 wire

11 kV system minimum fault Level 500 MVA (26.2 kA at 11 kV)

LV System

Voltage : 433/ 415 V AC

nominal Frequency : 4 wire

System Earthing : Solidly earthed

415 V fault level : not less than 50 kA r.m.s. for 2000 KVA Transformer for higher ratings proportional increase in fault level shall be considered.

Control voltage – Instrumentation Power Supply, AC control, Lighting & space heating

	110 V	240 V
Voltage		
Phases	1	1
Frequency	50 Hz	50 Hz

DC control voltage (for 11KV switchgear and LV ACBs in Main LT Panel)

- Voltage 24 VDC/ 48VDC/110 V DC
- Wires/ Earthing 2 wire / unearthed

All equipment shall have rated withstand capacity based on above criteria..

3) Design Criteria for Electrical Equipment/ System

The Design Criteria described below covers the electrical equipment/system for the proposed works:

General Power Distribution Scheme

Estimation of Load

The following assumptions have been be made to arrive at the estimated load of the different sites.

a) Load Factor

i) Motor : not less than 0.9 (or more at actual)

ii) Auxiliary load, CCTV system, etc.: not less than 0.9 (or more at actual)

iii) Lighting load : not less than 0.5 (or a more at actual)

b) Diversity Factor

i) Motor : 1.0

ii) Auxiliary load, valve motors, etc. : 1.5

iii) Lighting load : 1.2 (or a more at actual)

c) Power factor of Motors: As per Manufacturer's Catalogue

d) Efficiency of Motors : As per manufacturer's Catalogue (Energy efficient IE-2/ IE3) (Energy efficient, high performance motors (IE-2/ IE3 category) shall be provided for optimum utilization of energy).

e) Protections

The following protections are proposed for various switchboards, transformers, motors and other plant feeders.

1) 11 kV Switch board

i) IDMT over current and earth fault protection for incomers

ii) IDMT and instantaneous over current and earth fault protection for outgoing transformer feeders

2) LV switchboard

i) Over current, short circuit and earth fault protection on ACBs/ MCCBs for incomers above 32A to 630A.

3) Motors

i) Temperature compensated Overload protection by thermal (bimetal/ Solid state) relays in all the three phases to trip with single phase preventer (SPP) and short circuit protection in all the three phases through motor protection circuit breakers/ MCCBs Above 29.5 KW, microprocessor based motor protection relay shall also be used.

ii) Thermal, locked rotor, short circuit, negative sequence, under voltage, over voltage and earth fault for each motor feeder of rating 90kW and above.

f) Metering

The following metering shall be provided.

1) 11 kV Switchboard

Discrete or Multifunction meter (for incomer) containing - i)

i) Ammeter

ii) Voltmeter

iii) kW meter

iv) Frequency meter

v) Power factor meter

vi) Kilowatthour meter

vii) kVAr meter

viii) kVA meter

ix) Harmonic analyser For outgoing feeders if any

i) Ammeter with selector switch

2) LV Incomers

(i) Ammeters with selector switch or Ammeter with 3 phase display

(ii) Voltmeter with selector switch or Voltmeter with 3 phase display iii)

(iii) kW meter

(iv) Power factor meter

(v) Kilowatt-hour meter

(vi) Frequency meter (DG incomers)

(vii) Harmonic analyser

3) LV Outgoing Feeders in Main LT Panel

i) Ammeter with ammeter selector switch above 4.5 KW below 4.5 KW direct acting ammeter can be provided.

g) Indicating Lamps

The following indications shall be provided:

1) 11kV Incomer, Bus Coupler and Outgoing feeders

i) Circuit breaker ON, OFF and TRIP, spring charged, control supply healthy and trip circuit healthy (Mains ON (R,Y,B) indication for incomer only)

2) LV Incomers

i) Mains available (red, yellow and blue)

3) Motor Feeders

i) Motor ON, OFF and Trip indication (Red, green and Amber)

ii) Motor ON, OFF and Trip indication (Red, green and Amber), control supply healthy and trip circuit healthy for breaker feeder.

4) Outgoing feeder

i) ON, OFF & Trip indication

h) **Emergency lighting**

Emergency lights with built in battery backup or separate emergency wiring shall be provided for indoor areas of the indoor stadium. The areas must be covered with emergency lighting are:

I) Reception cum wating areas
II) Corridoors
III) Main entrance
IV) Swimming pool hall
V) Other areas as directed by Engineer in Charge.

i) **Ambient temperature**

All electrical equipment will be rated for 50^0 C design ambient temperatures.

j) **Altitude**

All electrical equipment will be rated for altitude of the town and proper derating factor shall be considered before selecting any equipment.

k) **Voltage drop**

All power cables shall be sized based on continuous current capacity, permissible voltage drop and short circuit current rating. The voltage drop shall be limited to 2.5 % at rated equipment current rating.

The other rating factors for variation in ground temperature, variation in ambient air temperature, grouping of cables, depth of laying, etc. shall also be considered for cable sizing.

l) LED type indoor luminaries

LED type luminaries shall be used for office/ all indoor areas.

m) LED type street light

Street/ area lighting shall be controlled by time switch/ photocell for automatic switching of luminaries. Emergency light shall be provided for safe evacuation of the people in case

of fire or panic (blackout, total power failure, etc.) Emergency lighting shall be automatically switched ON when mains power supply fails.

n) Fault Level

The values of fault level for designing the electrical system shall be as per IS-13234 & based on transformer capacity, its impedance and system fault level. Fault clearing time for sizing of earth conductor will be taken as one second.

o) Earthing

The material of earthing conductor shall be hot dip Galvanized Steel. All connections between the earth conductors buried in earth/concrete and between earth conductor and earth leads shall be of welded type. While sizing the buried earth conductor, a corrosion allowance of at least 20% shall be taken. Earthing system shall be designed such that the overall earthing grid resistance is maximum one ohm.

Main earthing conductors outside and inside the building shall be planned in such a manner that various equipment is connected to earthing system by two connections in a reliable manner.

4) System Description and scope

It is not the intent to specify herein all the details pertaining to the design, selection of material/ equipment, procurement, manufacture installation, testing and commissioning, however, the same shall be of high standards of engineering and shall comply to all currently applicable standards, regulations and safety codes.

The scope also includes cabling, lighting, earthing and lightning protection installation for the plant. A complete electrical Load List comprising process loads and other loads shall be furnished by the Bidder along with his Bid. The contractor shall work out the details based on his equipment's power consumption. The execution should take care of I.E. rules, Electricity Board’s requirement and other local authorities and site condition.

It shall be the contractual responsibility of the contractor to obtain approval of drawings, design electrical installation and test certificates from Chief Electrical inspector to Government (CEIG) and any other statutory bodies. Necessary official procedural support as well as technical required in obtaining the approval shall be provided by the purchaser.

5) Detailed Specifications

5.1. 'Main LT Panel' for the Indoor Stadium

Main LT Panel or Main Power Control Centre for various loads, Allied loads including Auxiliaries in the indoor stadium shall have following but not limited to following material:

1	Material of Sheet	:	CRCA sheet
2	Sheet thickness	:	2 mm for Structural component partition, doors can
3	Bus Bar	:	Copper / Aluminum Electrolytic grade
4	Cable Entry	:	Top/Bottom (As per requirement)
5	Terminal Blocks	:	Terminal Blocks shall be used for termination of cables and wires.
6	Metering class CT	:	All metering class CT Bar Primary, resin cast Class-1 accuracy minimum 15 VA burden, Maximum load on CT shall be 66% of VA burden.
7	Metering Instruments	:	All meters shall be CE marked, double insulated type
8	LED Indicators	:	All LED lamps / indicators shall be glow
9	Functional equipment	:	All functional equipment shall be enclosed only pilot devices and Short Circuit Protection Device shall be accessible with door closed
10	Earth Wire	:	All doors cover & Hooks etc. shall be in continuation with Earth potential through sharp washers and through Yellow Green wire of minimum 2.5 sq mm.
11	CT wiring	:	All CT secondary wiring shall be minimum 2.5 sq mm FRLS wire.
12	CT shorting links	:	CT shorting links shall be provided
13	Main Bus Bad	:	Main Bus Bar shall be of full rated connected current after derating which is more than standards IEC 60439.
14	Earth Conductor	:	Earth Conductor shall be as per IEC 60439, IS 3403 and IEEE 80.
15	Fault Level	:	The KA rating of Bus Bar shall be minimum 35

16	Outgoing Feeders	:	-Outgoing feeders shall be MCCBs only for floors with spreader links, rotary handles complete. -Each floor outgoing feeder shall be provided with ammeter with amp selector switch and CTs of I/ 5 ratio. -Outgoing feeders like external lighting, PA system, Firefighting, EPABX, CCTV can be
17	Construction	:	Panel with modular with extensible both sides.Floor mounted/ Base mounted, Free standing, Back open with hinged door with Bolts cable entry bottom / top and front operated.
18	Panel Labels		Metal Engraved / moulded Plates of minimum 10 cm Panel name as approved shall affixed at front and back. Module Numbers shall be affixed on each module.
19	Operation Mode	:	Panel shall be Single front and front operated.
20	Auxiliary Transformer	:	Auxiliary Transformer shall double wound, Screened earth. Transformer shall be of VA rating double the full load VA

21 **MCCB:**

- Panel Incomer MCCB in "Main LT Panel' shall be minimum of 35KA four pole type as per IEC 60947-2/IS 13947-II.
- Out Going MCCBs of suitable KA but not less than 25 KA for different loads
- One no Dummy feeders shall be provided for 100A MCCB or Four Pole MCBs as per requirement.

22 Incomer MCCBs in the Panel shall be microprocessor based completely programmed at the time of commissioning other MCCBs can be either microprocessor based/ thermal Magnetic.

23 ACBs & MCCBs shall be set as per breaking capacity and location in the plant. All circuit breakers shall be installed, as per 'Main LT Panel' so that 1st to trip on fault is respective outgoing MCCB rather than main incomer of Main LT Panel.

24 **Contractor shall submit all General arrangement, Single line diagram, legend, Circuit diagrams and QAP with all other relevant details of panel before start of work.**

25 **QAP:** QAP as per IEC 60439 shall be adopted for quality control testing shall be submitted to Engineer-in-Charge for evaluation before start of work.

26 **Test Certificate:** Test Certificate shall be issued after performing all the tests as per IEC 60439. Testing of Panel feeders shall be 100%.

27 Contractor shall submitted three sets of drawing on A-1 sheets of as built drawings based on approved drawings, approved QAP, Inspection report if any. CDs of Soft copy of components can be provided if request is made.

28 Maintenance manuals and operating manuals shall be provided in separate module for

29 IEC standards shall be followed strictly, ratings can be provided as per NEMA standards

5.2. SPECIFICATIONS OF LT ELECTRICAL CONTROL PANEL FOR PUMPING SETS

The Control Panel suitable for LT supply i.e. 415VAC, 50Hz, 3Phase, 4 Wire system particularly suitable for uninterrupted operation even at -25% low voltage conditions of tropical and suitable for hilly environment, with RH up to 95%, 45 degree Celsius ambient temperature above with 1% de-rating upto 50^{O}C rise in ambient temperature and 2% de-rating per degree above 50^{O}C ambient temperature at sites in state of Himachal Pradesh.

Prerequisites before supply of Panel

i) Submission of drawings

a) General Arrangement Drawing as per IS:8623 1993
b) Single Line Diagram as per IS/ANSI codes and symbols
c) Bill of Quantities
d) Circuit diagram to be submitted in minimum A3 size sheet along with the LT Electrical Control Panel for Proper Operation and Protection of Submersible Pumping Set.
e) Specifications, makes and quantity of the main components to be specified.

ii) The approval of the drawings by the EIC shall in no way relieve the contractor of contractual obligations or liabilities under the contract or his responsibilities for correctness of dimensions, material of construction, performance etc.

iii) The contractor will have to use the higher rated equipment as per DNIT even if the drawing is approved of lower rating i.e. the rating can be increased to increase safety factor but cannot be decreased under any clause of terms and conditions.

iv) If there is further requirement for improvement after the each amendment than contractor shall submit the fresh documents drawings and ratings. No charges whatsoever will be paid for preparing drawings estimates etc.

v) The contractor shall inform 5 days prior to supply for inspection/inspections to be carried out.

vi) The contractor will strictly follow Indian Standards (IS: code). If for a particular code for any item is not available than relevant IEC code will be applicable subject to the note at the end of this chapter.

vii) All the material shall be covered by manufacturers warranty clause. The contractor shall provide the warranty card and test reports from the manufacturer for all the equipments/ machinery.

viii) The installation should comply following statutory standards:

a) Indian Electricity Act, 1910.
b) Indian Electricity Rules, 1956
c) National Electrical Code, 1985
d) The installation confirming to the instructions issued by the o/o Chief Electrical Inspector, Haryana & UHBVN/DHBVN with upto date amendments.

GENERAL REQUIREMENTS OF LT ELECTRICAL CONTROL PANEL FOR PUMPING SET

- Control Panel Board size shall be sufficient so as to accommodate all the equipment in one enclosure. An independent meter box for housing power & light meter shall be provided as per PWD requirement/specifications.
- Fabricated by cutting, bending, welding etc in neat, symmetrical, aesthetic manner, providing easy access for Repair & Maintenance in clean manner of not less than 14swg (2 mm) CRCA sheet steel epoxy based powder coated with RAL 7032/SG 7032 (Siemens Grey) shade as per IS: 5- 2007. All the equipments should be mounted on mounting plate of minimum 12 swg (3 mm) or more thickness with 15 mm bend on sides.
- The Panel should be dust and vermin proof wherever required & proper sponge neoprene/PU gasketing should be done.
- The Panel should be as per low voltage i.e. 415 V AC 50 Hz, 3 Phase 4 wire system switchgear and control gear assembly conforming to IS 8623:1993 with up to date amendments.
- The control panel board should comprise of rigid welded structural frames The control panel shall be complete with removable gland plates with provision of entry and exit of cable from glands duly fixed on the side plates of panel board.
- The mounting of panel shall be made on wall 1.00m from ground level to the bottom of panel.
- The board should be matt finished, covers should be rigid in construction wherever required door stiffeners should be used & free from flaws. It shall also be provided with discrete key lock system for every installation/panel.
- The panel board should have the flush mounted instruments of 96x96mm bezel or 22.5mm cut out for pilot devices.
- The LED type indicating lamps should be used as per IS: 13947-5 - 2004 for phases available RYB.
- The Copper (Cu) busbar should be of electrolytic grade Copper. The size for a rating should be according to the formula 1mm2 per 1.2A.
- The SCPD (Short Circuit Protection Device i.e. MCB/MCCB) should be on the incomer side of the Control Panel so that in case of fault/ fire/ exigency the starter

and subsequently pump could be isolated from Electricity board power supply by operator / attendant.

- Only SCPD should accessible from the front with door closed. All other devices like contractors, busbars, overload relays, soft starter if used, other protection relays and timers etc should not be accessible with door closed.
- In case the SCPD device is a 25KA, 3 Pole, MCCB suitable for motor duty, it will be fuse less and Cat. A type MCCB as per IS 13947-II:1993 or IEC 947/60947.
- All the controls, indications, metering devices/displays of the panel should be on the front side of the panel.
- All the Contactors should be air break type and AC3 duty as per IS13947-IV and of finger proof IP20 protection.
- The wiring shall be done by 1100V PVC wires as per IS 694:1990 FR type. The class of wire will be class 5 or class 6. The temperature range will be -15OC to 70OC.
- The wire rating will considered as 70% of the rated wire rating as designated by manufacturer.
- All the electrical equipment should be able to perform on Line voltage i.e. 415VAC. If any equipment is required to be used on 220VAC than separate step down control transformer be used of 415 to 220V AC.
- Over voltage protection relay for fluctuation of 20% and above should be incorporated.
- All the wires should be terminated, crimped with the due size of thimble. No wire should be terminated directly.
- All the wiring should have proper ferrules.
- Two earth studs one each on LHS and RHS should be provided.
- The door hinges should be strong enough to take the load of wiring, instrumentation etc.
- ELCB for current leakage protection.
- Output supply for flow meter shall be provided by providing with 2.5mm2 terminal blocks of Connect-well, Wago, Phoenix make.
- All the 220V AC machinery, equipment and instruments will be supplied through Neutral Isolation transformer only.

5.2.1 GENERAL REQUIREMENTS FOR CONTROL PANEL COMPONENTS

5.2.1.1 Moulded Case Circuit Breaker (MCCB)

- The MCCB (Moulded Case Circuit Breaker) shall conform to the latest IEC 947-2 & IEC 947-3 1989. The Service Short Circuit Breaking Capacity (ICS at 415V AC) should be as specified at the required level.

- The MCCB shall be Current Limiting type and comprise Of Quick Make – Break switching mechanism, preferably Quick Break Contact system, are extinguishing device and the Tripping unit, contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal & mechanical stresses. All MCCBs shall be capable of defined overload adjustment. All MCCB's rated 200A and above shall have required Magnetic short circuit pick up.

- The Trip command shall over ride all other commands. The MCCB shall employ maintenance free double break contact system to minimize the let thru' energies and capable of achievements Discrimination up to the full short circuit capacity of the downstream MCCB.

- In case of 4 Pole MCCB, the neutral shall be fully rated and capable of suffering protection. The MCCB shall have protection against Overload, Short Circuit & Earth Fault, minimum breaking capacity of MCCB will be 25 KA.

5.2.1.2 Starter

- Motors upto 37 KW HP shall be with Fully Automatic Star/ Delta starters. Starter shall conform to IS 1822-1967 category AC and shall be suitable for motor supplied.

5.2.1.3 Contactors

The contactors should comply with the latest IEC947-4 and the corresponding IS13947-4 standards. They shall have CPRI test Certificates. It should be manufactured by a company having got ISO 9001 approval. The contactor should be rated for AC3 duty at 415V and 50Hz. The Contactors shall be fast closing and fast opening type. The

making and breaking capacity values of the contactors should be as follows (as per IEC947-4) :-

For AC3 Duty

Making Capacity more than 10 Ie

Breaking Capacity more than 8 Ie

For AC4 Duty

Making Capacity more than 12 Ie

Breaking Capacity more than 10 Ie

The Contactors would be capable of frequent switching and should operate without de-rating at $55^{O}C$ for AC3 applications. They should be climate proof as standard. The coil of the Contactor would have class H insulation to support frequent switching.

The rated voltage of the contactor shall be equal or superior at 440V and rated insulation voltage will be 690-1000V. The rated impulse voltage of the contactor should be 8KV.

The contactor shall have 2 NO+2 NC Auxiliary Contact Block. The Contactor should be modular in design and would be suitable for the addition of auxiliary contacts and other electrical auxiliaries without any compromise on the performance or the operations of the contactors. The Contactors from 4KW to 400KW will be designed to accept the respective auxiliary contact block range.

The contactor upto 80 A should have a mechanical life of more than 10 million operations. Contactors from 95-550A should have mechanical durability of more than 10 million operations.

The thermal over load relay if used shall be direct/separate mounting over the contactor without any specific connections.

For Capacitor use, the Contactor should be suitable for Capacitor Duty i.e. AC-4 Category as per the required current ratings as per the Capacitor Banks.

5.2.1.4 Capacitor

The capacitor(s) will be with minimum 20%THD (Total Harmonic Distortion) in current with test certificates. The capacitors shall be switched on after the motor has attained the full speed. To attain this separate MCB, Contactor, and timer shall be used for pump capacitor.

The capacitors shall be heavy duty as per IS 13340 (Part 1):2012/IEC 60831-1:2002 & IS 13340 (Part 2):2012/IEC 60831-2:1995. The capacitor shall have safety features like pressure disconnection system, self-healing type and discharge resistors to discharge capacitor to safe 50V range in 1 minute from rated voltage after switching off.

Peak inrush current shall be upto 140 to 160 times the rated current. The capacitors shall be 440V rated, 110% tolerance in voltage. Three phase type, tolerance of only 5-10% of capacitance.

5.2.1.5 Over Load Relay

The overload relay should comply with the latest IEC 947-4 and the corresponding IS13947- 4 standard. They will be having CPRI certification. They will be manufactured in an organization in accordance with the requirements of ISO9001 standard.

The Relay would be direct contactor mounting type and should have the provision to be mounted separately also. The Over load Relay would be ambient compensated type and would be operable up to $55^{O}C$. It will be design ed for utilization category AC3. The Relay will be tripping as per the specified tripping curves given in the technical data. The overload Relay would have build in phase loss and phase unbalance protection as per IEC 947-4. The Over load Relay would be capable to withstand up rated currents and inrush currents. The overload relay would have the possibility to select manual / auto reset at site.

The rated operational voltage shall be greater than or equal to 690V. The rated impulse should be 6KV. All over load relays should have been subjected to variable ambient conditions.

The Selection of the overload relay should be such that up to 93A thermal bimetal over load relay would be used and beyond ratings of 90A only CT operated overload relay would be used.

The Relays shall have to assure protection of the connected equipment in case of overload and partial single phase as per the characteristics.

Correct operation of over load relay contacts shall be checked by pressing the test button on the relay. A trip indicator shall indicate the relay status. Reset following tripping would be automatic or manual. This is selected by the user by toggle switch on relay. For ratings greater than 45 KW reset will be manual & auto both.

The Over Load Relay shall have potential free contact for indication / alarm purpose. In combination with a contactor and a short circuit protective device the resulting motor starter shall be Type 1 or Type 2 co-ordinated conforming to IEC 947-4-1. Co-ordination shall be in accordance with tables tested and certified by the manufacturer of the respective switchgear.

5.2.1.6 Voltmeter and Ampere Meter with Selector Switch

96 mm square, Voltmeters (0-500V) and Ampere Meters of suitable range of high quality industrial 'A' grade conforming to latest relevant IS specifications. The Voltmeter and Ammeter should be of Panel type. Selector Switch shall be rotary type. Each pumping set shall be providing with a voltmeter with 3 ways and On/Off selector switch as per IS 1248.

5.2.1.7 Indicating Lamps

One set of indicators for each pump of red, yellow, blue phase indicating lamps with piano type switches and fuse for the incoming supplies for giving indication of respective incoming line feeder.

5.2.1.8 Bus-bar

The bus bar shall be of electrolytic grade (E91E) Copper as per IS specifications. The current carrying capacity should not be less than 1.2 A/mm^2. Neutral bus bar should be rated for 50% capacity. The bus bar shall be duly insulated with heat shrinkable colour coded sleeves in case of links and droppers. The Vendor should have a in-house conductivity test facility & primary current shall be conducted for temp. rise test.

The bus bar should be duly supported on fibre glass based finger type / pyramid type supports with minimum glass contents25mm.

5.2.1.9 Single Phase Preventer

Single Phase Preventor should be current sensing suitable for checking the Negative Sequence current having built-in time delay relay up to 40 Millisecond, so that this may not trip while starting at NO load , shall be provided. Rating of CT's, if required, may also be indicated.

5.2.1.10 Shop Tests required for Control Panel

The design of the Control Panels shall be type tested as per relevant IS standards and shall comprise the following:

- Verification of short time current withstand and peak current withstand of main and vertical bus-bars.
- Through fault withstand on power draw-out contacts with HRC fused in series.
- Through faults withstand of control draw-out contract with HRC fuses in series.
- Temperature rise tests on main busbars, vertical risers, power and control contacts.
- Routine tests shall be conducted on each panel as per IS: 8623 and shall comprise the following:
- Inspection of panel including inspection of wiring and electrical operational tests where necessary.
- Insulation resistance test.
- High voltage test of bus bars, power and control wiring.
- Any other tests and checks

5.2.1.11 Earthing:

- All the electrical equipment such as LT panel etc. shall be provided with double loop earthing with thimble connection. All lighting equipment shall be provided with single loop earthing. All connection shall be by means of soldered thimbles of approved quality. The earthing shall be done in accordance with para 7 of IS-732-1968 and IS

3043-1996 (code in practice in earthing) all connections of the earthing system shall be visible for periodical inspection and testing.

- It is absolutely essential that the entire earthing system should be designed with regard to likely earth fault and Current based on the rating of equipments installed. All wiring and earthing shall be as per I.E. 1956 rules and shall be got approved from Electrical Inspector, HP.

5.2.1.12 Automatic Power Factor Control

Power factor shall be controlled in automatic mode by Intelligent Power factor controller (IPFC). The IPFC shall maintain the power factor in desirable range of 0.98 or better. The IPFC shall be minimum 8 step relay and the number of steps used shall depend on load and incoming power factor.

Contractual agency is advised to install the capacitor panel either integral to mian panel or as a separate unit of capcity based on transformer feeding the stadium instead of running load of the installation. It is important as the load outside the stadium on same transformer feeding the stadium may be small loads and without capacitors.

The agency is also required to add steps after installation if the power factor falls below 0.98 to improve pf to desired level. So, while designing the panel shall have space and 1 or 2 steps free in IPFC relay for switching ON & OFF of the capcitor.

5.2.1.13 **TESTS**:

The tests shall be conducted on each panel as per IS: 8623 on the panel board during the inspection at the manufacturer place at the cost of contractor.

1. Inspection of panel including inspection of wiring and electrical operational tests where necessary.
2. High voltage test upto 2 KV for 1 min for Busbar, Power & Control Wiring to determine any leakage or internal cracks in the insulation. While performing this test any electronic component may be disconnected.
3. No load operational test by energizing the panel.

5.3. SPECIFICATIONS OF HORIZONTAL SPLIT CASING PUMPS

Codes and standards

The design, manufacture and performance of the pumps specified herein shall comply with the requirements of the applicable Codes and Standards, as follows, but not limited to:

No.	Standard	Title
1	IS: 6595 (PART ii)	Horizontal centrifugal pumps for clear, cold and fresh water
2	IS: 9137	Code for acceptance tests for Centrifugal, Mixed flow and Axial pumps
3	IS : 13537	Technical specification for centrifugal pumps - Class 2
4	ISO 5199	Standards of the Hydraulic Institute of USA.
5	ISO 2373	Balancing of impeller
6	IS 5120	Performance test of pumps
7	IS 11732	Mechanical Balancing

Features of construction

Impeller

The impeller shall be an enclosed impeller, made in one piece and securely keyed on the shaft. The installation will include means to prevent loosening of the impeller during operation, including rotating in the reverse direction. The impeller shall be statically and dynamically balanced to prevent vibration, as per ISO 2373.

Casing rings

The pump shall be provided with a renewable type casing ring, to offer wearing resistance. Hardness of the casing ring shall be 50 BHN (Brinnel Hardness Number units), lower than the impeller.

Shaft

Single integral shaft, be designed to withstand the torque loads throughout the whole range of operating conditions, for the selected particular impeller diameter as well as all

the impeller diameters covered between minimum and maximum impeller diameters when coupled to the motor shaft through flexible coupling.

The shaft shall also include the possibility of running the pump with an electric motor of higher power rating meant for future expansion with increased impeller diameters.

Shaft Sleeves

Replaceable shaft sleeves shall be provided to protect the shaft where it passes through stuffing boxes. The end of the shaft sleeve assembly shall extend through the packing gland. Shaft sleeves shall be securely locked or keyed to the shaft to prevent loosening. Shaft and shaft sleeve assembly shall ensure concentric rotation.

Stuffing boxes

Stuffing boxes at driving end and non driving end shall be of such design that they can be repacked, without removing any part, other then the gland and lantern ring. An axially split gland should be used to facilitate changing the gland packing. Sufficient space shall be available for maintenance purpose.

Air release valves

Pump shall be provided with arrangement of valve to vent air which may get accumulated in the pump.

Sealing

Self sealing water connections should be provided.

Flanges

Flanges shall be machined flat, with flange faces vertical and at right angles to the pump mounting surface. Cast iron flange drilling and thickness shall conform to IS 1538, (part IV and VI) for ID upto 1500mm and to IS 6392 for ID greater than 1500mm.

Bearings

Bearing shall be either grease or oil lubricated and should absorb the radial and axial thrust, under all operating conditions. Anti-friction bearing shall be of standard type and shall be selected to give 20,000 hours continuous operation at rated operating conditions. The rise in bearing oil/grease temperature with continuous running of the pump shall be within the allowable limits which shall not exceed 20°C for grease and 30°C for oil

lubricated bearings above ambient temperature. Cooling arrangements shall be provided if required. The bush bearing shall not be acceptable.

Base Plate

The common base plate for pump and motor shall be fabricated from mild steel section and have sufficient rigidity to resist vibration and distortion. Suitable holes shall be provided for grouting and they shall be so located that the base will be able to be grouted in place, without disturbing the pump and motor. All pumps and motors shall be properly and accurately aligned, bolted and doweled to the base plate. An adequate space shall be provided between pump drainage connections and base plate for installation of minimum 20mm diameter drain pipe. Foundation bolts shall be complete with nuts and flat and shake proof washers.

Coupling

A flexible pin bush type coupling shall be provided, duly bored and keyed to the pump and motor shafts. The coupling and the pump shafts have to be designed that the breaking load of the coupling system is slightly below that of the shaft.

Accessories

ll specified accessories and any other standard accessories required for correct and safe operation of the pump shall be furnished with the pumps. All incidental piping (including valves) required for sealing, lubrication and cooling of stuffing box packing and / or pump bearing shall be furnished by the Bidder. A mild steel lubricated coupling guard shall be provided to provide a safe guard against the open rotating parts of the pump and motor.

Eye bolts (as many per pump as required for safety), shall be provided for ease of lifting and installation.

TECHNICAL PARTICULARS OF PUMPS

FEATURES AND MATERIALS OF CONSTRUCTION

1.	Casing	Horizontal Split Casing
2.	Drive	Direct
3.	Flange Drilling	IS 1538
4.	Prime mover	Electric Motor (refer electrical section)
5.	Casing	Cast Iron IS : 210-Gr FG 260

6.	Impeller	S.S (CF8M)
7.	Shaft	Carbon Steel (C 40) or EN 24/EN 19/ BS 970
8.	Shaft Sleeve	S.S.(AISI 410)
9.	Casing rings	SS (CF8M, CA15)
10.	Glands	Bronze grade LTB2 of IS 318
11.	Gland Packing	Graphite Asbestos
12.	Lantern Rings	CI
13.	Gaskets	Manufacturers Standards durable
14.	Fasteners (bolts)	Forged Steel for pressure parts and carbon steel for non pressure parts

DRIVE DATA

1	Motor	415 V motor (TEFC) Squirrel cage induction motors FOR details refer to Motor Specifications

ACESSORIES AND SERVICES REQUIRED TO BE SUPPLIED BY THE BIDDER WITH PUMP

The bidder is supposed to provide at least the following accessories :

- Base Plate
- Foundation Bolts
- Coupling
- Coupling Guard

DRAWINGS AND INFORMATION TO BE PROVIDED

During detailed engineering the Bidder shall submit the following:

- General arrangement, cross-sectional and dimensional drawings/data pertaining to selected model.
- Complete performance curve with
  - H - Q curves for complete range of impellers between minimum and maximum size of impellers and efficiency curves super imposed on them, highlighting selected impeller diameter.
  - Shaft power – Q curves for complete range of impellers.
  - Efficiency – Q curves for maximum impeller diameter and selected impeller diameter.

- NPSHR- - Q curves for maximum, minimum and selected impeller diameter.

- Torque speed curve of pump superimposed on motor corresponding to 80 %, 90%, 100% voltage.
- Test reports, performances curves and other particulars, as required by the applicable clauses of these specifications.

Instruction Manuals:

- Instruction manual for Erection
- Instruction for pre-commissioning check up, operation, abnormal conditions, maintenance and repair
- Write up on Controls and interlocks provided
- Recommended inspection points and periods of inspection
- Schedule of preventive maintenance
- Ordering information for all replaceable parts
- Recommendations for types of lubricants, lubricating points, frequency of lubrication and lubricant changing schedule

Delivery & Suction Pipes – Design Considerations

The sizes of manifold pipes will not be less than that mentioned in the scope of work. The column pipes, suction pipe and delivery pipes for pumps shall be sized to limit the velocity of flow in respective pipes, below 2 m/sec. The velocity in the suction pipe shall not exceed 1.8 m/s and velocity in delivery pipe shall not be more than 2.0 m/s.

Specifications for Back wash pumps

S.N.	Particular	Required Specifications
1.	Make	As per approved list of Makes
2.	Type	Split casing/monoblock centrifugal
3.	Quantity	As per Scope of Work
4.	Duty Condition	As per Scope
5.	Combined Efficiency	60%. For smaller pumps as per IS
6.	Speed	Suitable for 2900/1440 rpm synchronous speed motors
7.	Pump Casing	CI IS: 210 Gr FG-260
8.	Shaft Sleev	Bronze Grade LTB-2 of IS 318

S.N.	Particular	Required Specifications
9.	Gland	CI
10.	Impeller	CI IS: 210 Gr FG-260
11.	Liquid Handled	Potable Water
12.	Temperature	Ambient 45 Deg C (Range 40 to 50 Deg C)

PRESSURE GAUGES

a) Pressure gauges and vacuum gauges shall comply with IS 3624 / BS 1780. Glycerin filled dial shall be provided where the gauge is subjected to pressure pulsation and / or vibrations. The internal parts of pressure gauge shall be stainless steel.

b) Pressure gauges shall be provided on discharge and on suction of each pump. Pressure gauges shall be bourdon type and calibrated for the required range. The gauge shall be supplied complete with impulse tubing, two valve manifold with drain cock, fittings etc.

c) The minimum diameter for pressure gauges shall be 150 mm. However, where the pressure gauge forms part of an equipment, the equipment manufacurer's standard sizes will be acceptable.

1	Accuracy	+ 1% of full scale
2	Dial size	150mm
3	Glass	Shatter proof
4	Over range Protection	125% of maximum pressure
5	Housing Material	Die Cast Aluminium
6	Material of sensor and other wetted parts	SS316
7	Accessories	2-valve manifold with drain cock, impulse tubing, snubbers and all installation hardware

5.4. Specifications for Submersible Pumping Sets

5.4.1 General

5.4.1.1 Submersible Pumping Set for Tubewell

Electric driven Submersible pumping set for pumping clear water conforming to IS 8034-2002 with latest amendment/ relevant ISO Standard, capable of delivering adequate quantity of water against required head at duty point, suitable for installation within housing pipe of tubewell with sufficient clearance. Both pump and motor shall run at 2900 RPM at rated frequency and voltage. It should also be capable of operating at various other specific normal operating conditions.

5.4.1.2 Pump

The unit shall consist of a submersible pump and a submersible motor with shafts connected by a sleeve and operates from beneath the surface of water. Maintenance-free pump set should be suspended vertically with column pipe which is further fixed by suitable clamp. The individual casting part of pump as a whole in assembled condition should be able to withstand a hydrostatic pressure of 1.5 times the maximum discharge pressure.

5.4.1.3 Impellers: The pumps shall be multistage with radial or mixed flow impellers. The pump should **be fitted with dynamically balance enclosed type impeller. Each impeller shall be balanced dynamically to grade of G 6.3 (6.3mm/s).**

5.4.1.4 **Suction Casing**: to be located between pump and motor

5.4.1.5 Seal: Radial seal shall be provided to avoid mixing of well water with the filled water.

5.4.1.6 **Shaft:** The pump shaft shall be guided by bearing provided in each stage bowl & in the suction gland discharge casing. The surface finish of shaft or of the protecting sleeves should be 0.75 micron Ra Max.

5.4.1.7 **Suction Casing:** The inlet passage of the suction casing shall be stream lined to avoid eddies. The suction case shall be fitted with a strainer of corrosion resistant material.

5.4.1.8 **Sand Guard:** Suitable sand guard shall be provided just above the suction case bearing to prevent the entry of foreign material into suction case.

5.4.1.9 **Non-Return Valve:** The pump should be provided with a spring loaded non-return valve above the pump discharge case with standard flanged connection.

5.4.1.10 **Direction of Rotation:** The direction of rotation shall be clearly indicated either by incorporating an arrow in the casing or a separate metal plate arrow security fitted on pump set.

5.4.1.11 **Bearings:** The pump may be equipped with replaceable bearings wherever provided.

5.4.1.12 **Cable and Cable Guards**: The outer periphery of the pump casing shall have provision for securing the cable and cable guards over the cable, so as to prevent damage to the cable. The cable clamp of adequate size be supplied for fixing submersible cables to the rising main pipes.

5.4.2. Motor

Submersible Motor shall be directly coupled with the pump. Submersible motor should be water filled, water lubricated squirrel cage type. The submersible motor shall be squirrel cage induction motor conforming to IS 9283-1995 or latest of continuous duty (type S-1). The KW of motor shall be minimum 15% in the excess of maximum KW required under all heads of working. The motor shall be made of corrosion resisting material or suitable materials to resist corrosion under normal conditions of mechanical performance continuously under water. The motor shall not have any element, which may induce contaminant of any type to water being handled. It shall be capable of delivering rated output with.

- The terminal voltage differing from rated voltage of 415V by +6% and – 15%
- The frequency differing from its rated value of 50 Hz by not more than $\pm$ 3 %
- Any combination of (a) and (b)

The motor shall be suitable for operating in submerged and corrosive atmosphere within Tubewell Housing Pipe. A maximum ambient temperature of 50^{o}C and a

maximum altitude of 1000 meter above mean sea level may be considered. The motors shall be designed for a maximum 5 starts per hour.

The supply shall be completed with Star/Delta Starter upto a capacity of 37 KW. For higher capacities, Auto Transformer Starters shall be provided.

Cooling: The motor winding and the bearing bushes of the rotary shaft shall be cooled/ lubricated by pure water in the motor before erecting the pump set.

Thrust Bearings: The water lubricated thrust bearing should be of adequate size to withstand the weight of all rotating parts as well as the imposed hydraulic thrust. The thrust bearing housing shall be provided with a drain plug to empty the pure water filled into the thrust bearing housing/ motor. The axial thrust generated by the pump is absorbed by thrust bearing fitted at the bottom of the motor.

Diaphragm: The motor shall be provided with breathing attachment like bellows, diaphragm etc. to compensate the volumetric variation due to change in the temperature. The diaphragm below the thrust bearing should be provided to absorb the over pressure which will result by thermal expansion of water filled or when the temperature of the winding rises, this will save the burning/ jamming of motor.

Cable Glands, Rubber Seals: The motor shall be protected by means of cable glands; rubber seals etc. from ingress of bore well water sand, another foreign material.

Rotor: The rotor shall be provided with shaft protecting sleeves having a surface finish of 0.75 micron Ra Max. The rotor shall be provided with suitable epoxy paint to protect it from corrosion under water. The rotor shall be dynamically balanced as per grade 6.3 of IS 11723 (Part – I): 1992.

Bearing Housing: The thrust bearing housing shall be provided with a drain plug to empty the water filled into thrust bearing housing/ motor.

Winding: The motor winding should be a non edging water proof dense PVC insulated which should also be resisted to chemical effects having an extremely high precision strength.

Submersible Cable: The submersible cable shall be PVC insulated and PVC sheathed flexible 3 cores copper conductor type conforming to IS 694.showing the current drawl and required cable size in addition to voltage drop during summer season and length of cable from starter to pump set should also be kept in mind. The size of the conductor shall be adequate and suitable for continuous use under water and in air. The size of conductor and length of cable should be suitably selected so that the voltage drop at motor terminal does not exceed three percent of the rated voltage.

5.4.2. Pump Performance

5.4.2.1. Efficiency of submersible pump shall be guaranteed to specified point of rating i.e. duty point may be guaranteed to cover the performance of the pump under conditions varying therefrom for a sustained performance for any period of time. The pump discharge may be guaranteed for the range of head between – 25% & + 10% of the rated head when the rated head is 30 meters or above. If the rated head is below 30 meters the limits of operation shall be from – 25% to + 25% or + 3 meters whichever is less. Performance guarantees shall be based on laboratory tests corrected for field performance so as to ensure that rated current of the motor does not exceed 1.5 times the motor HP at standard voltage i.e. 415V AC.

5.4.2.2. The pump should be at least 2m below the maximum expected drawdown at operating discharge level to compensate for drawdown and change in water tables as the same will go down after continuous running of the same.

5.4.2.3. The noise level shall be within the permissible limits as specified in the Indian Standards and latest Pollution Control acts and stipulations.

5.4.2.4. The motor working in the voltage range of 415 (+) 6% and – 15%, the starting current shall be limited to 3 times the full load current.

5.4.2.5. **Special Tools:** - The supply shall be completed with 2 sets of special tools required for maintenance.

5.4.2.6. A name plate as required under IS:325 shall be provided on each motor.

5.4.2.7. The motor shall be tested in accordance with IS 325 and IS: 4029 and test certificates shall accompany the supply.

5.4.2.8. Material of construction for various parts of submersible tubewell - pump sets are summarized in the following **Table.**

Table: Material Specification for Various Components of Submersible Pumps

S. No.	Component	Material	Specifications
1.	Impeller	Lead Tin Bronze of Stainless Steel	LTB 2 of IS 318-1981 or latest or Stainless Steel Grade X 12 Cr 12 of IS 6911 or IS 6603
2..	Pump shaft	Stainless steel	Stainless steel grade X 04 Cr 12,X 12 Cr 12 or X 20 Cr 13 of IS 6603
3.	Bearing Sleeve	Stainless Steel or Cr Steel or Bronze	12 percent chromium steel grade X 04 Cr 12, X 12 Cr 12 and X 20Cr 13 conforming to IS 6911 or IS 6603 Or Bronze Grade LTB 2, 3, 4 or 5 of IS 318-1981 or latest.
4.	Suction Casing	Cast Iron	FG 200 of IS : 210-1993 or latest
5.	Casing wear ring	Bronze	LTB 3, 4 or 5 of IS 5 318-1981 or latest.
6.	Discharge casing	Cast Iron	Grade FG200 of IS 210 of IS 1993 are latest.
7.	Pump bowl/ diffuser	Cast Iron	Grade FG200 of IS 210 of IS 1993 are latest.
8.	Wearing Ring (Mixed Flow)	Bronze	LTB 4 of IS 318-1981 or latest
9.	Valve Body	Cast Iron	FG 200 of IS 210-1993 or latest
10.	Valve Seat	Cast Iron	FG 200 of IS 210-1993 or latest
11.	Valve Spring	Spring Steel	IS 4454 – 2001
12.	Valve Dish	Cast Iron	FG 200 of IS 210-1993 or latest
13.	Adaptor	Cast Iron	FG 200 of IS 210-1993 or latest
14.	Stage Sleeve	Cr. Steel/ Bronze	AISI 410 of A276/LTB2 of IS 318
	Keys	Chromium Steel	ASI – 410 A of ASTM A – 276
16.	Stator casing	Steel	AISI-304 as per ASTM A 240

S. No.	Component	Material	Specifications
17.	Rotor Shaft	Chromium Steel	AISI 410H of ASTM A 276
18.	Motor Bearing bush	LeadedTin ronze/ resin moulded carbon metal/ Rubber/ rubber lined	LTB 3, 4 or 5 of IS 318-1981 or latest.
19.	Diaphragm	Nitrile Rubber	Non toxic, with stable polymers synthetic aging minimum 10 years without replacement of NB-60 grade.
20.	Thrust bearing plate	C.I. + Carbon Above 6" / Steel + Carbon up to 6"	FG 200 of IS 210/ AISI 410 of ASTM A 276
21.	Coupling Sleeve	Chromium Steel	As per relevant IS/AISI;
22.	Thrust bearing housing	Cast Iron	FG 200 of IS 210 – 1993 or latest
23.	Thrustbearing segments	Cr. Steel	CA 40 A of ASTM A 743
24.	Counter thrust bearing Plate	Bronze	As per relevant IS/AISI;
25.	Sand Guard	Bronze	LTB 2 of IS 318 – 1981 of latest
26.	Bearing Segment Carrier	Cast Iron	FG 200 of IS 210-1993 or latest
27.	Submersible Cable a) Conductor b) Insulation	Electro grade copper PVC or with polymer and/ or sheathing	IS 694 – 1990 or latest

S. No.	Component	Material	Specifications
28.	Rotor a) Laminations b) Conductor core Stator c) Lamination b)Winding wire Conductor Insulation	Electro sheet steel Electro grade copper Electrical sheet steel Electro grade copper PVC or with polymer	IS 648:1994 or latest IS 613:2000 or latest IS 648:2006 or latest IS 613: 2000 or latest IS 8783-1995 or latest

5.4.2.9. Performance Test Report: The performance test report as per relevant IS-Code or latest from the manufacturer that the pump satisfies of required duties shall be submitted at the time of inspection. A test report from the manufacturer that the motor conforms to relevant I.S. shall be also submitted at the time of inspection.

Following information to be provided by the Bidder for pump performance

	Duty Head (in m)	**+10% of Duty Head (in m)**	**-12.5% Duty Head (in m)**	**-25% Duty Head (in m)**
Discharge in m^3/hr				
Power consumption in kW				

Minimum 5 head points in meters shall be considered to draw the tested performance curve.

The motor should never be overloaded throughout the entire pump operating range as shown in the performance curve. The pump performance must be stable from zero discharge to run out condition.

The design, manufacture and performance of the pumps specified herein shall comply with the requirements of the applicable Codes and Standards, as follows, but not limited to.

The Tenderer must furnish complete information as required under Clause 13 of IS 8034-2002 with latest amendments while quoting the rates.

5.4.2.10. Delivery & Suction Pipes – Design Considerations

The sizes of manifold pipes will not be less than that mentioned in the scope of work. The column pipes, suction pipe and delivery pipes for pumps shall be sized to limit the velocity of flow in respective pipes, below 2 m/sec. The velocity in the suction pipe shall not exceed 1.8 m/s and velocity in delivery pipe shall not be more than 2.0 m/s.

5.5. LED INDOOR AND OUTDOOR LIGHTING

5.5.1 INDOOR LIGHTING

Indoor lighting shall be as per National lighting code, pleasant kelvin rating in 3000 to 5700K, shall not have stroboscopic effect by wiring alternate phases, easy to control to avoid wastage with less maintenance with 5 years warranty.

Surface mounted downlighters/ LED fitting shall be used for areas that are to be mounted directly on roof.

Recess mounted downlighters/ LED fittings shall be used for areas that are to be mounted in false ceiling.

All lighting shall be LED type for long life and maintenance free life. The lights shall have good CRI, 0.95 p.f.,

a) Reception cum waiting area
b) Battens for Swimming pool Hall
c) LED lights for Gymnasium
d) LED light for Table Tennis Hall
e) Flood lights
f) Post top lamp for gates
g) Street light

h) Emergency lights with built in battery backup or separate emergency wiring shall be provided for indoor areas of the indoor stadium. The areas must be covered with emergency lighting are:
    a. Reception cum wating areas
    b. Corridoors
    c. Main entrance
    d. Swimming pool hall
    e. Other areas as directed by Engineer in Charge.

5.5.1 Lux Level

Lux levels in indoor stadium shall be as per NBC and SAI norms. The lux levels in halls shall be higher among the NBC or SAI norms. If any upward revision of the lux levels or any of the parameter or parameters thereof are made by the competitive authority or authorities then better/ higher & stringent shall be applicable at no extra cost. Lowering of the lux levels than stipulated in this document shall not be allowed, unless lux levels are specifically limited for the sport by the competitive sports authority guidelines.

Minimum lux levels is given below for compliance:

I. 300 lux or higher as per SAI norms in sports halls of the indoor stadium like badminton, table tennis, swimming pool, gymnasium & wrestling/ boxing hall
II. 300 lux in all the offices & other rooms
III. 200 lux at reception, waiting areas, snack bar & guard room etc.
IV. 150 lux in utility areas like panel room & meter room etc.
V. 100 lux in all indoor verandahs, pathways passages & staircases etc.
VI. 100 lux in rest rooms
VII. 20 lux in outdoor areas inside boundary wall
VIII. For areas not covered above NBC & SAI norms shall be applicable to the complete satisfaction of the Engineer in charge.

MINIMUM TECHNICAL PARAMETERS FOR LIGHTING FIXTURES

5.5.1.1 15 W Down lighter

LED downlighter in 15 W +/- 1 W or as per lux level & manufacturer's design for the location LED Surface Mounted Downlighter Round Shape with minimum system

lumen efficacy of 100 lm/W and system lumen 1500 lm with Pressure Die cast Aluminium Housing and HET diffuser and P.F.>0.95 ,THD<10% ,CCT 5700K, CRI 80, IP20 optical compartment. The LED with Useful life of 50000 Hrs at L70.. The Input voltage range shall be 150V to 270V .Fixture have Surge Protection 2kV .Driver .Make: Philips, Wipro, Havells, Panasonic, Osram, LT.

5.5.1.2 18 W Down lighter

LED downlighter in 18 W +/- 1 W or as per lux level & manufacturer's design for the location LED Recess Mounted Downlighter Round Shape with minimum system lumen efficacy of 100 lm/W and system lumen 1800 lm with Pressure Die cast Aluminium Housing and HET diffuser and P.F.>0.95, THD<10%, CCT 5700K, CRI 80, IP20 optical compartment. The LED with Useful life of 50000 Hrs at L70. The Input voltage range shall be 150V to 270V Fixture have Surge Protection 2kV .Driver Make: Philips, Wipro, Havells, Panasonic, Osram, LT.

5.5.1.3 40W LED FIXTURE (4 feet Batten)

IP40 Led fixture 40 W+/- 1W or as per lux level & manufacturer's design for the location with Surface Mounted 4 Feet with Polycarbonate diffuser with aluminium housing having minimum system lumen efficacy of 110 lm/W with minimum system lumen output 4400 lumens with P.F.>0.95 with THD<10% ,CCT 5700K, CRI 80,Surge Protection 3 Kv .The LEDs with minimum life of 75000 burning hours. The Input voltage range shall be 150V to 270V. Make: : Philips, Wipro, Havells, Panasonic, Osram, LT.

5.5.1.4 100W LED FIXTURE (4 feet Batten)

IP54 Led fixture 100W+/- 1W or as per lux level & manufacturer's design for the location with Surface Mounted 4 Feet Linear Highbay Polycarbonate diffuser withCRCA Housing having minimum system lumen efficacy of 120 lm/W with minimum system lumen output 12000 lumens with P.F.>0.95 with THD<10% ,CCT 5700K, CRI 80,Surge Protection 3 Kv .The LEDs with minimum life of 75000 burning hours. The Input voltage range shall be 150V to 270V. Make: Philips, Wipro, Havellls, Panasonic, Osram, LT.

5.5.1.5 10W LED FIXTURE (2 feet Batten)

IP20 Led fixture 2FT 10 W+/- 1W or as per lux level & manufacturer's design for the location with Surface Mounted 4 Feet with aluminium housing and Polycarbonate diffuser, minimum system efficacy of 100lm/W with P.F.>0.90 with THD<20%

,CCT6500 K,CRI 80,Surge Protection 2 Kv, IP20.The LED with Useful life of 50000 Hrs at L70. The Input voltage range shall be 150V to 270V. Make: Philips, Wipro, Havellls, Panasonic, Osram, LT.

5.5.1.6 Led fixture 600mmX600mm decorative

Led fixture 600mmX600mm decorative type 33 W+/- 1W or as per lux level & manufacturer's design for the location Recess or Suspension Mounted Fixture having system efficacy of minimum 90 lm/W Light Light engine and diffuser only on the edges and hollow in between with Drop Down HET PMMA diffuser with extruded aluminium housing. with P.F.>0.95 with THD<10% ,CRI 80,CCT 5700 K .The LED with Useful life of 50000 Hrs at L70. Make: Philips, Wipro, Havellls, Panasonic, Osram, LT.

5.5.1.7 IP66- 80 Watt LED Highbay

IP66- 80 Watt +/- 1 W LED Highbay at entrance to mounted at top Suspended. Mounted with minimum system lumen efficacy of 140 lm/W with Pressure Die Cast Aluminum housing, and P.F.>0.95 with THD<10% ,CRI 80.The LED shall be tested with LM80-08 standard with Useful life of 100000Hrs at L70. The LEDs used in the luminaire shall have CCT of 5700 K only with CRI of minimum 70.The Input voltage range shall be 140V to 280V with 2.5 kV Surge. Make: Philips, Wipro, Havellls, Panasonic, Osram, LT.

5.5.1.8 200 W Integral LED Floodlight

200 W +/ - 1 W or as per lux level & manufacturer's design for the location Integral LED Floodlight luminaire, cradle mounted, Al Pressure Die cast Housing having minimum system lumen efficacy of 125 lm/W with minimum system lumen output of 25000 lumens. The luminaire shall have IP66 protection with Beam angle of 60 degree, CCT of 5700K and CRI 80. The LED shall be compliant with Useful L70 life of >50000 Hrs. Driver efficiency should be 85%, THD<10%, PF>0.95 in input voltage range of 140V to 300V (nominal rated voltage – 240V) with 5 KV internal surge

protection and 10KV External protection. Make: Philips, Wipro, Havellls, Panasonic, Osram, LT.

5.5.1.9 CEILING FANS

Adequate numbers of ceiling fans 1200 mm / 1400 mm sweep in offices complete with down rods, canopy and speed regulator as approved by the Engineer shall be provided. All ceiling fans shall be of double ball-bearing type, class-I and conforming to IS 374.

5.5.1.10 EXHAUST FANS

Adequate numbers of exhaust fan of required CFM or air changes per hour max 450 mm sweep with louvers in the pump house, sub-station rooms, toilets as approved by the Engineer shall be provided.

(a) Impeller shall be with blades of an aerofoil design. Blades shall be mounted on stream lined hub. Impeller shall be mounted directly on the motor shaft.

(b) Casing shall be of heavy gauge construction properly reinforced for rigidity. It shall be provided with suitable supports.

(c) In case of cane axial fans, guide vanes shall be provided on the discharge side.

(d) Materials of construction

Casing : Mild Steel

Impeller : Mild Steel / Cast Aluminium

Inlet / Outlet : Mild Steel

(e) Exhaust fan shall be provided with louver shutter made of MS sheet/ Aluminium, which opens, by fan draft and close by gravity when the fan is switched off.

5.5.2 MINIMUM TECHNICAL PARAMETERS FOR OUTDOOR LIGHTING

Outdoor lighting shall be as per National lighting code, to maintain safe environment for outdoor area of the indoor stadium easy to control to avoid electricity wastage with less maintenance with 5 years warranty.

The design shall be such to that there shall be no dark spots in the indoor sports stadium.

Post tops shall be provided at main entrance of the indoor stadium. Pleasant outward appearance shall be maintained by proper lighting design as approved by the WAPCOS. Proper illumination shall be designed to maintain proper illumination without excessive lighting or dark areas. Contractor is free to use solar LED lights.

5.5.2.1 45 Watt LED IP 66 POST TOP

Minimum 45 Watt LED IP 66 Post top shall be provided on each side at main entry gate & small gate. The post tops shall be made of pressure die cast aluminum housing, system efficacy 100 Lumen Per Watt, luminaire should be dry sky certified, CCT 5700 K, Diffuser is fresenl lens for symmetric light distribution. Luminaire is dark sky certified. Make: Philips, Wipro, Havellls, Panasonic, Osram, LT.

5.5.2.2 IP65 Bulkhead LED fixture

IP65 Bulkhead led fixture 10 W +/- 1 W or as per lux level & manufacturer's design for the location wall Mounted with minimum system lumen efficacy of 100 lm/W with Pressure Die Cast Aluminum housing, Polycarbonate Opal Diffuser and P.F.>0.95 with THD<10% ,CRI 80.The LED shall be tested with LM80-08 standard with Useful life of 50000 Hrs at L70. The LEDs used in the luminaire shall have CCT of ANSI Bin 5000K-5700 K only with CRI of minimum 80.The Input voltage range shall be 140V to 280V with 2.5 kV Surge Protection. Make: Philips, Wipro, Havellls, Panasonic, Osram, LT.

5.5.2.3 115 mm Dia 2700K Bush Light with Integral driver

115 mm Dia 2700K or as per lux level & manufacturer's design for the location bush Light with Integral driver & completely made in India luminaire. The luminaire's shall be made of Die cast aluminum with Pure polyester powder coated housing. Optical compartment is sealed Reflector with toughened glass using Silicon gasket ensuring IP67 & IK07 protection and lifelong performance.The LEDs shall have minimum CRI =80 (White LED) & shall have SDCM=5. The luminaire shall have wattage 8W and shall deliver 640 lumens. Beam angle of the Luminaire shall be 36 deg .Fixture shall operating temperature range of 0°C to 45°C. Input Voltage Range of 100 - 270V AC. 2 stage Constant current driver with Inbuilt 3kV surge protection. The luminaire shall have

declared life of 50,000 burning hours at L70. Luminaire and Driver must be made in India with same brand. Luminaire manufacturer must have In-house NABL accredited lab to conduct LM79. The successful bidder must submit the NABL accreditation certificate for Luminaire manufacturer along with technical bid. LM80 , RoHS compliance issued by LED luminaire manufacturer, BIS certificate for LED Luminaire. Brand name shall be embossed / engraved on each an every light fixtures. Luminaire and Driver should be Made in India. Luminaire, Driver and controller should be with same make. Wipro make - LF05-600-036-27-XX. Make: Philips, Wipro, Havells, Panasonic, Osram, LT.

5.5.2.4 Street light suitable for pole mounting/ building/ boundary wall mounting

Street light shall be as per designed height of luminaire mounted on pole/ boundary wall or the buiding of the indoor stadium. Proper bracket upto 1.5 m length shall be provided for the street light luminaire to be mounted.

60 W/ selected rating luminaire, Pole mounted IP66 Street Light with System efficacy of 120 lm/ W. or as per lux level & manufacturer's design for the location LED Street Light shall be made up of Die cast Aluminium Housing for better heat decapitation. L70 life of 50000 Hrs. P.F.>0.95 with THD<10% ,CCT 5700 K,CRI 80, Surge Protection 4 KV upto 45 watt, 6 Kv 50 watt to 60 watt or 10 KV external SPD above 60 watt. Input voltage range of 150V to 270V.

5.5.2.5 20 Watt LED Linear Washer 500 MM Long

20 Watt or as per lux level & manufacturer's design for the location LED Linear Washer 500 MM Long IP66, IK06 Protection with Toughend Glass protection, Extruded aluminum housing & PDC End cap duly pure polyester powder coated in dark grey (RAL7021), Beam angles – Symmetric & Asymmetric. CCT 4000 K.

5.5.2.6 All in One solar LED streetlight

IP 65 rated All in One solar LED streetlight with MPPT charge controller having > 95% efficiency. The system wattage of All In One Streetlight should be minimum 30W±10% W with Minimum 4500 lumens system output (After all losses) or as per lux level & manufacturer's design for the location ,60Wp High Efficiency Monocrystalline Silicon Panel, CCT – 5700K ±500K, CRI >70, 30Ah/ 12.8V LiFePO4 Battery. High Efficiency

Battery with higher life of >2000 cycles at 80% of Depth of Discharge (DOD). The cell used should have relevant BIS certificate. Full Power up to 10Hrs when the Battery is fully charged. Automatic Dusk to Dawn feature should be available in the product through voltage sensing from the panel. The product should have option of dimming possibility as well as dimming.

5.5.2.7 Earthing of streetlight

All street light metallic poles and lights shall be earthed. Without earthing of street light with earth wire the life of the street light luminaire is reduced drastically.

Either each metallic pole is earthed for protection or not more than 5 poles are connected to the earth connection in the indoor stadium.

If the lights are mounted on the boundary wall than body earth of the light shall be barbed wire.

5.6. MINIMUM TECHNICAL PARAMETERS FOR PA system

PA system is proposed or making announcements in the indoor stadium, Chamba.

2 types of PA system are proposed 2 channel for hall and 5 channel to cover common areas like corridors in the stadium.

5.6.1. Technical Specifications

6.1.1 2 – Channel PA Amplifier

S. No.	Parameter	Minimum Specifications
1.	Input Channel	1 or more 1.0 mV / 4.7 kΩ or better
2.	Aux Channel	1 or more 100 mV / 470 kΩ or better
3.	Frequency Response	150 to 10,000 Hz ± 3 dB or better
4.	Signal to Noise Ratio	60 dB or better
5.	Power Output	Upto 30W or better as per hall
6.	Tone Control	-10 dB at 10 kHz or better
7.	Speaker Output	4 Ω/ 8 Ω/ 16 Ω/ 100V or better
8.	Power Supply	AC : 220 – 240 V 60 / 60 Hz OR DC 12 V

9.	Power Consumption	AC : 80 VA OR DC : 1.2 A or better
10.	Operating Temp. Range	0°C to 50°C or better

6.1.2. 5 – Channel PA Amplifier

S. No.	Parameter	Minimum Specifications
1.	Input Channel	5 or more 0.65 mV / 4.7 kΩ or better
2.	Aux Channel	1 or more 50 / 150 mV / 470 kΩ or better
3.	Frequency Response	50 to 15,000 Hz ± 3 dB or better
4.	Signal to Noise Ratio	60 dB or better
5.	Power Output	Upto 130W or better
6.	Tone Control	Bass : ±10 dB at 100 Hz, Treble : ±10 dB at 10 kHz
7.	Speaker Output	4 Ω/ 8 Ω/16 Ω / 70V / 100V or better
8.	Power Supply	AC : 220 – 240 V 60 / 60 Hz OR DC 24 V
9.	Power Consumption	AC : 220 VA OR DC : 3 A or better
10.	Operating Temp. Range	0°C to 50°C or better

3. Conference Mic (Wired)

S. No.	Parameter	Minimum Specifications
1.	Frequency Response	50 to 10,000 Hz or better
2.	Sensitivity	2 mV/Pa
3.	Impedance	600 Ω or better
4.	Gooseneck	Flexible 300 mm high quality unidirectional
5.	Indicators	LED Indicators
6.	Operating Temp. Range	0°C to 50°C or better

4. Speaker

S. No.	Parameter	Minimum Specifications
1.	Power Rating	Upto 50 W

2.	Frequency Response	55 Hz to 16,000 Hz
3.	Configuration	One Way
4.	Impedance	16 Ω or better
5.	Input Connector	Two Terminal Strips in Parallel
6.	Sound Pressure Level (SPL)	96 dB at 1W/1m or better
7.	Maximum Rated SPL	113 dB or better
8.	Operating Temp. Range	0°C to 50°C or better

5. Speaker Wall Stand

S. No.	Parameter	Minimum Specifications
1.	Material	Iron / Aluminium
2.	Dimension	As per dimension of speaker supplied

6. Wire – 2 Core

S. No.	Parameter	Minimum Specifications
1.	Type	Flexible pair of tinned, annealed copper conductor
2.	Insulation	PVC / Rubber minimizing electrical interference
3.	Sheath	PVC
4.	Pairing	Parallel Pair or Twisted Pair
5.	Strands	16 or more strands per conductor
6.	Strand Diameter	0.1 mm or more
7.	Nominal Outer Diameter	Upto 8 mm
8.	Insulation Thickness	< 0.80 mm

5.7. MINIMUM TECHNICAL PARAMETERS FOR CCTV System

Supply, installation, testing and commissioning of CCTV surveillance system with minimum 5 TB or minimum 60 days storage complete in all respects to the satisfaction of the Engineer in Charge.

The CCTV system shall be provided with UPS providing minimum 6 hours back calculated 1 year after installation. A minimum 32” LED monitor to live stream feed from various cameras to the monitor shall be provided.

All necessary managed/ unmanaged switches, racks, chords, joy stick for PTZ camera, NVR, DVR etc., power & LAN or Cat 6 or POE cables etc. of required length & latest specifications to the satisfaction of the Engineer in charge shall be provided.

Storage Camera - PTZ Camera 1 Nos. (tentative), 36 IR, Dome cameras , Indoor and outdoor cameras: To cover all the outdoor and indoor units in the stadium.

- Suggestive guidelines for the cameras to be installed are as given hereunder. Final selection shall be as per resolution and range of the cameras offered to cover and record the events.
- Minimum two indoor cameras at the reception/ entrance/ waiting hall
- Minimum 6 no. in each, Gymnasium, TT Hall and Badminton Hall & swimming pool hall
- minimum 3 no. each in each floor corridors
- Minimum PTZ camera on front side of the building
- Minimum one camera each on left hand side, right hand side and back side of the building.

Table- CCTV

Camera	
Sensor	1/2.7” HD progressive scan CMOS
Lens	C/CS mount lens
Auto Iris Type	DC drive or software
Illumination (low light sensitivity)	• Color: 0.2 lux at F1.2
	• B/W: 0.05 lux at F1.2
Pan and Tilt	Pan Range: 0 to 360°, Tilt Range: -90 to 40°
White Balance	ATW/AWB (range: 3200 to 10000°K)
Dynamic Range	• Color: 100 dB
	• B/W: 110 dB
Auto Electronic Shutter	1/30 to 1/25000 sec.
S/N Ratio	50 dB (Gamma, Aperture, AGC OFF; DNR ON)

ICR Control	Auto (light sensor control) or DI control
DNR	Built-in DNR
WDR	Level 1-8/Off
AGC control	2X, 4X, 8X, 16X, 32X, 64X
Flickerless Control	Indoor/Outdoor mode
Black Level Control	High/Medium/Low
Auto Exposure	Level ±5
Image Rotation	Flip, Mirror, and 180° rotation
Image Setting	Manual tuning with saturation, sharpness, and contrast
• Video	
Video Compression	H.264 (ISO/IEC 14496-10) or MJPEG
Video Outputs	Ethernet
Video Streams	Up to 3 video streams (2 x H.264 and 1 x MJPEG) • Stream 1: H.264, 1280 x 800 resolution (max.) • Stream 2: H.264, 720 x 480 resolution (max.) • Stream 3: MJPEG, 720 x 480 resolution (max.)
Video Resolution and FPS (frames per second)	Not less than 20 FPS in NTSC or PAL
• Network	
Protocols	TCP, UDP, HTTP, SMTP, FTP, Telnet, NTP, DNS, DHCP, UPnP, RTP, RTSP, ICMP, IGMPv3, QoS, SNMPv1/v2c/v3, DDNS, Modbus/TCP, 802.1X, SSH/SSL
Ethernet	1 10/100BaseT(X) Ethernet port, RJ45 connector
• Serial Interface	
RS-485	1 half-duplex RS-485
• GPIO	
Digital Input	1, max. 8 mA • High: +13 V to +30 V • Low: -30 V to +3 V
Relay Output	1, max. 24 VDC @ 1A
• LED Indicators	
STAT	Indicates if the system is booted properly or not
Network	10 Mbps or 100 Mbps
Power	Power on/off
• Local Storage	
SD Socket	Standard SD socket (SDHC)
• Power Requirements	

Input	Power Consumption: As per requirement
	• provision for Redundant power inputs
	• 12/24 VDC, 24 VAC, or Power-over-Ethernet (IEEE 802.3af)
• Physical Characteristics	
Camera Body Housing	Metal, IP65 protection or better. In case camera body has lower IP rating, external housing providing IP65 rating or better should be used.
Installation	Wall mounting, pole mounting, corner mounting
Note	External housing and mounting accessories for PAN
• Security	
Password	User level password protection
Filtering	By IP address wherever applicable
Authentication	802.1X
Encryption	HTTPS, SSH
• Alarms	
Video	Camera tamper, virtual fence, alert zone, missing object, unattended object
Video Motion Detection	3 independently configurable motion areas
Scheduling	Daily repeat timing schedule
Imaging	JPEG snapshots for pre/trigger/post alarm images
Video Recording	Event recording and stored in the SD card
Email/FTP Messaging	Automatic transfer of stored images via email or FTP as event-triggered actions
Custom Alarms	HTTP event servers for setting customized alarm actions
Pre-alarm Buffer	24 MB video buffer for JPEG snapshot images
• Environmental Limits	
Operating Temperature	0 to 60°C (32 to 140°F)
Storage Temperature	0 to 60°C (32 to 140°F)
Ambient Relative Humidity	5 to 95% (non-condensing)
Environment	Hilly environment at approximately greater than 1000 m altitude

5.7. Wring and cabling

5.7.1. Internal Wiring

Internal wiring shall be as per Indian Electricity Rules, MBC norms and good engineering practices. All the work shall be as per PWD standards to fulfill the norms

of the sport. Stringent rules and standard shall apply. Minimum sizes and ratings in this document shall be adhered to while designing the installation.

Wiring shall be in PVC conduits for modular switches for light points, Fan boxes, electronic regulators, plug & sockets for small gadgets and power wiring etc.

The wiring shall be in PVC insulated copper conductor single core FR cable (ISI marked), 1100volts grade to be laid in heavy gauge, PVC, fire retardant conduit pipe 20mm/25mm dia. (2mm thick) ISI Marked and shall comply with I.E.E. regulations for nonmetallic conduit as per IS 9537/1983, recessed in wall etc., complete with powder coated/anodized concealed metal boxes required for suitable number of modules, for having:

i) electronic fan regulators,
ii) bell push,
iii) electronic buzzer,
iv) 3pin 6Amp., 3pin 16/20Amp. Sockets
v) 6Amp./16/20Amp. Switches
vi) AC boxes/ points etc.

The modular switches & accessories etc., shall be provided and covered with Frame Plate etc., & including the cost of required number of modular switches/sockets, step type electronic fan regulator 100watts, PVC connector (For Fan Box and Electronic Buzzer), Steel Hooks, Circular Inspection Box (Recessed Type and Deep Type) PVC conduit pipe & copper wire and other petty material etc. including cutting and filling up of chases.

The wiring shall be done using 1100V grade, 99.9% pure copper conductor, multistrand wires, PVC as per IS 694:1990 FRLS type. The class of wire shall be class 5 or class 6. The temperature range will be -15^{O}C to 70^{O}C.

Wiring for power plug shall be with minimum of 2 x 4 sq. mm FRLS PVC insulated copper conductor single core cable in recessed PVC conduit along with 1 No 4 sq. mm PVC FRLS wire.

PVC insulated copper conductor single core cable for loop earthing with length as required.

Recessed wires shall not be loaded more than 60% of sum of rated current of all the equipment in circuit including spare equipment.

There shall be a minimum 40% vacant area inside the conduit.

All sections of conduit and relevant boxes shall be properly cleaned and glued by epoxy resin glue & the proper connecting pieces like conduit fittings.

Separate mains shall be run in separate conduits. Conduits concealed in the ceiling slab shall run parallel to walls and beams and conduit concealed in the walls shall run vertical and horizontal. No wires shall run loose in false ceiling.

Each of the mains at every floor feeding the circuit shall be protected by a RCCB or RCBO of minimum 30mA or 100mA. 3 phase RCCB or RCBO of 300mA may be used if required for large mains of load.

No wiring shall be without earth leakage protection system to protect from electrocution or shock.

Earth wire shall be yellow green as per IS 3403 with stripe of yellow in green wire or vice versa.

All the metallic parts in the indoor stadium that are part of the stadium construction shall be connected to earth potential at all times.

All the wring shall be, before handover, tested for insulation resistance by megger.

Continuity, polarity test and earth continuity test shall be conducted and tabulated results shall be prepared and got approved from the Engineer in charge. Any discrepancy found in testing shall be made good before handover.

8.1.2 Control of Air Conditioning Unit/equipment

Wiring for AC point shall be as per tonnage of the ACs shall be with a minimum of 2 x 4 sq. mm FRLS PVC insulated copper conductor single core cable in recessed PVC conduit along with 1 no. of 4 sq. mm PVC FRLS wire.

A 16/20 Amp switched socket outlet shall be provided for room air-conditioners (window type) to connect units only with cooling capacity up to 18000 Btu/hour. Double pole switch, of appropriate rating, with flex outlet mounted adjacent to the unit shall be provided for control of other room air-conditioning units. Each room air-conditioning unit shall be connected to a separate final sub circuit, from the distribution board. A maximum of two air-conditioning units (window type) are permitted to connect on a single phase supply. Where three or more units are installed they shall be balanced as nearly as possible over a three phase supply. Breaker rating and wire size for the air conditioning unit is to be selected as per the connected load of the appliance, subject to minimum 20 Amps with 4 sq. mm circuit wires.

5.8. Cabling

5.8.1. LT Cables

5.8.1.1. Standards

No.	Standard	Description
1.	IS 1554	PVC insulated electric Cables.
2.	IS 8130	Conductors for insulated electric cables.
3.	IS 5831	PVC insulation and sheath of electric cables.
4.	IS 3975	Mild steel wires, strips and tapes for armouring of cables.
5.	IS 1753	Aluminium conductors for insulated cables.

5.8.1.2. Other Considerations

Power cable shall be of Al conductor, whereas control and lighting cables shall be of Cu conductor. The minimum size of Al conductor cable shall be 4 mm2 and Cu conductor cable of 2.5 mm2 for other puroses other than lighting.

Power cable sizing shall be based on the various de-rating factors recommended by cable manufacturer, rated current, temperature rise of conductor and voltage drop.

Control cables of CTs shall be based on the VA burden of CT and relays, meters.

5.8.1.3. Technical parameters

LT Cables	PVC insulated, taped PVC inner sheath and outer sheath 650/1100 V grade, with multi-stranded aluminium/copper conductor, armoured
Cable selection	Cable shall be selected considering following points Current rating of the load De-rating due to grouping of cables. Voltage drop up to 3% in cable due to cable resistance De-rating factor due to ambient temperature. De-rating due to depth in case of buried cables
Spare cores for control cables	Up to 4 cores - nil 5 cores to 9 cores - 1 core 10 cores to 20 cores - 2 core 21 cores to 30 cores - 3 core More than 30 cores - 4 core

5.8.1.4. Drawing and documents required

- Cable catalogue

5.8.2. HT Cables

5.8.2.1.1.1. Standards

No.	Indian standard	Description
1.	IS 7098	XLPE insulated electric Cables.
2.	IS 5831	PVC insulation and sheath of electric cables.
3.	IS 3975	Mild steel wires, strips and tapes for armouring of cables.
4.	IS 1753	Aluminium conductors for installation cables.

5.8.2.1.1.2. Other Considerations

The HT Cable sizing shall be passed on 100 MVA at 3.3 KV. The short circuit withstand duration shall be 1.0 sec for all breaker feeders and 0.7 sec for HRC fuse control feeders.

HT cable shall be of 3.3 KV, on earth grade.

5.8.2.1.1.3. Technical Parameters

HT Cables	3 core, Aluminium conductor, XLPE insulated, armoured.
Cable Size	As per design

5.8.2.1.1.4. Drawing and documents required

- Cable catalogue

5.8.3. Cabling System

5.8.3.1.1. Installation

The cables shall be laid in trenches, trays or conduits or shall be buried in ground. Cable routings shall be checked at site to avoid interference with structures already provided in the pump house, piping and ducting. All cables shall be carefully measured and cut to the required length, leaving sufficient length for final connections to the equipment on both ends.

The Bidder shall ascertain the exact requirement of cable, for a particular feeder, by measuring at site along the actual finalised route.

Cables shall be laid in complete uncut lengths from one item of equipment to another.

Cables shall be neatly arranged in the trenches, trays in such a manner, that criss-crossing is avoided and final take off to the motor, switchgear is facilitated. LT Cables shall be laid a maximum two layers in each tray for cables up to 3 ½ C x 95 mm2. Arrangement of cables within the trench, tray shall be the responsibility of the Bidder.

Power and control cables shall be laid on different trays in one trench. 1.1 kV grade cable may be laid on one tray.

All cables shall be identified close to their termination point by cable numbers. Cable numbers will be punched on aluminium straps, (2 mm thick), securely fastened to the cable and wrapped around it.

Underground cables shall be provided with cable markers. These cable marker posts shall be located at every 50 metres and every corner or change of direction.

All temporary ends of cables shall be protected against dust and moisture to prevent damage to the insulation. While laying cables, the ends shall be taped with PVC tape.

Cables shall be handled carefully during installation to prevent mechanical injury to the cables. Ends of cables leaving trenches shall be coiled and provided with protective cover until the final termination to the equipment is completed.

Directly buried cable shall be laid underground in excavated cable trenches wherever required. The trenches shall be suitably designed for accommodating all the cables. Before cables are placed, the trench bottom shall be filled with a layer of sand. This

sand shall be levelled and cables laid over it. The cable shall be covered with 150 mm of sand over the top of the largest dia. cable and sand shall be lightly pressed. A protective covering of RCC tiles shall then be laid on top in case of HT cable and ordinary brick in case of LT cables. The balance trench area shall then be back filled with soil, rammed and levelled.

As each cable is laid in the trench, it shall be subjected to an insulation test in the presence of the Engineer in Charge before covering. Any cable which proves defective shall be replaced at no additional cost.

All wall openings shall be effectively sealed after installation of cables.

Where cables rise from trenches to motors, control stations, lighting panels etc., they shall be taken up in GI pipes (rigid, flexible) for mechanical protection up to a minimum of 600 mm above grade level. The diameter of the GI pipe shall be at least 3 times the diameter of the cable.

Cable shall be carefully pulled through conduits to prevent damage.

Wherever cables are taken in conduits, pipe, the Bidder shall ensure that the area of conduit, pipe is at least 100 % more than the cable area.

If pipe sleeves installed are inadequate due to a greater number of cables being laid, then additional pipe sleeves shall be laid. After the cables are installed and all testing is complete, conduit ends above grade level shall be plugged with suitable weatherproof plastic compound.

Where cables pass through foundation walls or other underground structures, the necessary ducts or openings will be provided in advance for the same.

At road crossings and other places where cables enter pipe sleeves an adequate bed of sand shall be given.

Cables installed above grade level shall be run in trays, exposed on walls, ceilings or structures and shall be run parallel to, or at right angles to, beams, walls or columns. The cables shall be so routed that they will not be subjected to heat.

Cables running along with structures will be clamped by means of GI saddles and saddle bars at a spacing of 300 mm.

Cable carrier systems i.e. site fabricated ladder type cable trays and supporting steel shall be painted before laying of cables. Painting shall have two coats of red oxide and one coat of Aluminium paint.

For all outdoor buried cables a 3 metre diameter loop shall be provided at both ends before termination.

Termination

All HT XLPE insulated cables shall be terminated using HT termination kit only

All PVC cables shall be terminated at the equipment/panel by means of double compression type brass glands and tinned copper lugs.

Power cable cores shall be identified with red, yellow and blue PVC tapes.

In case of control cables, all cores shall be identified at both ends by their terminal numbers by means of PVC ferrules. Wire numbers shall be as per inter-connection diagrams, to be furnished to the Bidder.

The cable shall be taken through an adequate size gland inside the panel or any other electrical equipment.

Cable leads shall be terminated at the equipment terminals by means of crimped type solderless connectors.

Crimping shall be done by hand crimping/hydraulically-operated tool and conducting jelly shall be applied on the conductor. Insulation of the leads should be removed immediately before the crimping.

Testing of cables

Before energizing, the insulation resistance shall be measured from phase to phase and phase to ground.

5.8.4. Wiring of fire alarm & other low voltage circuits

Low voltage wiring like for fire alarm shall be in separate conduits minimum 500mm apart from power circuits.

The cables shall be laid in areas where Electromagnetic interference is kept at its minimum. The wires and cables shall be with grounded metal sheath for cancellation of interference and attenuation.

Medium duty PVC conduits shall be used for wiring of the the alrm and detection systems.

5.9. Lifts

Conformity with Indian Electricity Act and Rules

All electrical work in connection with installation of the lifts and moving walks shall be carried out in accordance with the provisions of The Indian Electricity' Act, 2003 as amended up-to-date along with the rules and regulations framed thereunder and shall also comply with the other provisions of Part 8 'Building Services, Section 2 Electrical and Allied Installations' of National building Code.

Needless to mention that the Lift shall operate in fail safe mode and a talk back system shall be provided so that in case of an emergency lift occupants can communicate with rescue staff.

The installation shall be generally carried out in conformity with relevant Act and Rules wherever they are in force.

Following standards shall be followed for supplying & installion the lifts

IS 14665 (Part- 1, 2, 3, 4 & 5): 2000 or latest

IS: 8216 steel wire rope

ISO 22201-1:2017

EN 115-1: 2008 Safety of escalators and moving walks — Part 1: Construction and installation IBC 2015 International Building Code, International Code Council, Washington, USA JIS A 4302 : 2006 Inspection standard of elevator, escalator and dumbwaiter CIBSE Guide D: Transportation Systems in Buildings, 2015, The Chartered Institution of Building Services Engineers, London, U.K.

The installation shall be carried out in conformity with Part 4 'Fire and Life Safety' of National Building Code and the states' fire acts/local fire regulations, wherever they are in force.

All standards, whether given herein above or cross-referred to in the main text of this Subsection, are subject to revision. The parties to agreement based on this Subsection are encouraged to investigate the possibility of applying the most recent editions of the standards.

Following principles shall be followed in installation of the lifts for reducing power consumption by using energy efficient equipment and behavioural changes:

a) Reducing energy consumption by the use of variable voltage variable frequency (VVVF) drives, which provide very smooth, almost imperceptible speed transitions.

b) Energy saving LED lamps for lighting in place of conventional lamps.

c) Improvement in total power factor of the factor at the isolator connecting equipment to the building's electrical supply circuit.

d) Adoption of materials and practices that are environmental friendly and sustainable shall be preferred.

5.10. Specifications Fire Detection and Alarm System

I. Supplying, installation, testing & commissioning of heat detector operating at 54°C/57°C with rate of rise cum fixed temprature (dual thermistor) type with mounting base complete with all connection etc. 12 nos. minimum or as required.

II. Supplying, installation, testing & commissioning of smoke detector with built in LED and mounting base complete with all connection etc. 30 nos. minimum or as required.

III. Supplying, installation, testing & commissioning of manual call boxes of MS construction in surface/recess with stainless steel chain & hammer assembly complete with glass and push button etc. as required.

IV. Supplying, installation, testing & commissioning of manual call box of ABC type in surface/recess with stainless steel chain & hammer assembly complete with glass and push button etc. minimum 3 no. on each floor or as required.

V. Supplying, installation, testing & commissioning response indicator on surface/recess MS box having two LEDs metallic cover complete wirth all connections etc. 3 nos. minimum or as required.

VI. Supplying, installation, testing & commissioning fire alarm sounder with facility to make announcement, mounted in M.S. box (16 SWG) with hinged cover plate & suitable for operation with amplifier i/c line matching transformer etc. complete 2 nos. minimum or as required.

VII. Supplying, installation, testing & commissioning talk back slave station in surface/recess suitable for operation on simplex mode complete with P.T.I. knob & speaker / microphone enclosed in a M.S. (16 SWG)/ ABS box with break glass in front etc. complete 2 nos. minimum or as required.

VIII. Supplying, installation, testing & commissioning sector panel suitable for 6 Zone, complete with visual indications for short circuit fault, open circuit fault, fire condition and all other standard facilities as per IS:2189 with mimic diagram for all area/zone covered, complete with all connections, interconnections 1 nos. minimum or as required.

IX. **Supplying, Installation, Testing & Commissioning of Main Control and Indicating Panel**:

Main control and indicating panel made out of 16 SWG MS sheet to accommodate the following items duly powder coated in approved colour with louvers for ventilation, locking arrangement, audio and visual indication for fire alarm and public address system, monitoring system including connections, inerconnections etc complete as required. 6 zone panel for fire alarm system

I. 60 watt amplifier racks suitable for operation on 230V Ac/24V DC supply conforming to IEC-268-3 complete with all accessories as required -2 Nos.(one to act as standby).

II. Talk back master station with LED PTT (press to talk) push button for operation on 230V AC/24V DC supply conforming to IEC-268 for simplex mode of operation/communication suitable for 20 Nos. talk back unit-1 set.

III. Announcement control desk suitable for selection of different zones selectively and ON ALL CALL switch with visual indication etc., complete as required - 1 set.

IV. Amplifier change over switch for inter changing amplifier-1 monitor panel for loudspeaker complete output selector ON/OFF switch, fuse visual indication etc. complete as required

a. Gooseneck microphone with stand and ON/OFF switch -1 mains
b. ON/OFF switch, fuse indication lamps, DC and AC voltmeters & ammeters terminal blocks etc. complete as required-1 set.

c. Battery charger trickle cum boost to take compete load of fire alarm & PA system complete with all accessories including
d. providing & fixing of 2 Nos. 12 volt, 30 AH no. sealed maintenance free batteries -1 set.

X. Supplying, installation, testing & commissioning of 1.5/3/6W metal box speaker complete 10 nos. minimum or as required.

XII. Supplying, installation, testing & commissioning of exit point directional sound speaker with voice and integral audio amplifier with selectable sound pulse pattern complete 20 nos. minimum or as required.

XIII. Supplying & lying of 2x1.5 sqmm fire alarm armoured cable, 600/1000V rated with annealed copper conductor having XLPE insulation, steeel wire armouring & FRLS outer sheath complete 185 m minimum or as required.

XIV. Speaker cable Single pair, 2-crore, 1.5 sqmm 40 m minimum or as required.

XV. 1.5 sqmm fire rated FRLS Cable 240 m minimum or as required.

5.11. Firefighting system

The firefighting system shall be designed as per the stadium building design, dimensions and rules and regulations applicable & enacted or amended by competent authorities from time to time.

5.11.1. Fire Fighting System

5.12. CODES AND STANDARDS

Latest Codes for Firefighting system shall be applicable

5.11.2.0. FIRE FIG HTING EQUIPMENT S

All the equipment shall be as per latest IS and other codes.

5.11.2.1. EX TERNAL FIRE HYDRANTS

External Yard Hydrants shall be of ‘Stand Post’ type conforming to IS-:908-1975 and comprise of stand post for single outlet, duck foot bend, flanged riser and single headed SS/ brass/ gunmetal valve conforming to type A of IS. 5290-1977.

The stand post column shall be cast iron, cast in one piece, conforming to Grade 20 of IS:210-1970. The internal diameter at the top shall be at least 80mm.

5.11.2.2. GROOVED COUPLING JOINTS

Pipes and fittings for MS piping larger then 50mm may be required to be joined using factory galvanized mechanical roll grooved fittings and mechanical joints suitable for fire protection services as desired by client /consultant without any extra financial implications. Fittings, gaskets and mechanical couplings shall be UL listed and FM approved.

Flexible grooved coupling joints as per NFPA-13 shall be provided at building expansion joints.

5.11.2.3. HOSE CABINETS

Hose cabinet shall be fabricated from 16 gauge MS powder coated sheet of fully welded construction with hinged single/double door partially glazed door with suitable locking arrangement, stove enameled fire red paint with 'Fire Hose' written on it prominently. Glass panes shall be 4 mm thick.

The hydrant cabinet shall hold double headed hydrant, 2 nos. Hoses and 1 no. branch pipe.

The cabinet shall have two pipe studs of 200 mm dia in MS with base which shall be fixed to the back of the cabinet and shall be used to hold the RRL hose.

5.11.2.4. HYDRANT VALVE

Stainless steel/ brass/ gun metal hydrant valve shall be of oblique pattern provided as per IS: 5290 complete with hand wheel, quick coupling connection, spring and blank cap and chain.

The double headed hydrant shall have flanged inlet of 100 mm dia and single headed hydrant shall have flanged inlet of 80 mm dia and 63 mm female instantaneous type outlet. The hydrant shall have a rubber plug with chain fixed to the main body of the Hydrant.

5.11.2.5. RRL HOSES

The hoses for the internal and external hydrant system should be rubber impregnated woven jacketed type conforming to IS:636 Type-B. Each fire hose shall be provided with quick coupling, branch pipes, nozzles, spanners etc.

Hose pipes of all types shall be capable of withstanding an internal water pressure of not less than 35 Kg/Sq.cm without bursting. It must also withstand a pressure of 21 Kg/Sq.cm without undue leakage or sweating.

Each hose shall be fitted with instantaneous spring lock type couplings at both ends. Hose shall be fixed to the coupling ends by copper rivets and the joint shall be reinforced by 1.5 mm galvanised mild steel wires and leather bands.

5.11.2.6. BRANCH PIPES AND NOZZLE

Stainless steel Standard Branch Pipe shall be used conforming to IS : 903 with Stainless steel nozzle of 16mm dia to fit standard instantaneous type 63mm dia hose coupling. Suitable spanners of approved design shall be provided in adequate numbers for easy assembly and dismantling of various components like branch pipes, nozzles, quick coupling ends.

5.11.2.7. 2.3.9. AIR VESSEL

Air vessel shall be provided to compensate for slight loss of pressure in the system and to provide an air cushion for counter acting pressure surges whenever the pumping set comes into operation. It shall be normally partly full of water, the remaining being filled with air, which will be under compression when the system is in normal operation.

Air vessel shall be fabricated from MS plate conforming to IS : 2002 grade 2A having 10mm thickness shell with 12 mm thick dished ends and suitable supporting legs. It shall be provided with a 80 mm dia/100 mm dia flanged connections from pump, one 25 mm drain with ball valve and 15 mm sockets for pressure gauge and pressure switches. The air vessel shall be hydraulically tested to 30 kg/cm2 pressure for 30 minutes.

The pressure vessel shall be provided for hydrant system. The pressure switches shall be mounted on the header of air vessel. The air vessel shall also be provided with safety valve mounted at the top.

5.11.2.8. FIRE BRIGADE CONNECTION AND TANK FILLING

5.11.2.9. FIRE BRIGADE INLET TO HYDRANT RING

Stainless Steel (SS 304 grade) four way fire brigade inlet connection having 63 mm dia instantaneous type inlet and 150 mm dia flange outlet conforming to IS : 904 with blank cap and chain with necessary 150 mm dia MS (heavy duty pipe) and flanges, nuts and bolts etc.

The inlet assembly shall be in glass fronted wall box and size of wall box shall be adequate to allow hose to be connected to the inlets, even if the door cannot be opened and the glass has to be broken.

Each box shall have fall of 25 mm toward the front at its base and shall be glassed with wired grass with “FIRE SUPPLY TO RING MAIN” painted on the inner face of the glass in 50 mm size block letter.

Each such box shall be provided with a steel hammer with chain for breaking the glass. The inlets shall be provided with ABS quality plastic blank caps with chain.

5.11.2.10. FIRE BRIGADE TANK FILLING CONNECT ION

Stainless Steel (SS 304 grade) four way fire brigade tank filling connection having 63 mm dia instantaneous type inlet and 150 mm dia flange outlet conforming to IS : 904 with blank cap and chain with necessary 150 mm dia MS (heavy duty pipe) and flanges, nuts and bolts etc.

The inlet assembly shall be in glass fronted wall box and size of wall box shall be adequate to allow hose to be connected to the inlets, even if the door cannot be opened and the glass has to be broken.

Each box shall have fall of 25 mm toward the front at its base and shall be glassed with wired grass with “FIRE SUPPLY TO TANK” painted on the inner face of the glass in 50 mm size block letter.

Each such box shall be provided with a steel hammer with chain for breaking the glass.

5.11.2.11. DIESEL ENGINE PUMPS

The engine rating shall be decided considering the de-rating factors which are based on Site conditions as per BS : 5514.

The diesel engine shall be of multi cylinder type four/six stroke cycle with mechanical (airless) injection, cold starting type.

The Engine shall be direct injection type, capable of being started without use of wicks, cartridge, heater plugs at an engine room temperature of 7oC and shall accept full load within 15 second from the receipt of the signal to start.

The Engine shall be turbo-charged and water cooled.

The Engine shall be capable of operating continuously on full load at the site elevation for a period of 8 hours and no major overloads before 300 hours of operation.

The Engine shall be provided with an adjustable governor to control the Engine speed within

10% of its rated speed under any condition of load upto the full load rating. The governor shall be set to maintain rated pump speed at maximum pump load.

The Engine shall be provided with an in-built tachometer to indicate R.P.M. of the Engine.

Engine, after correction for altitude and ambient temperature, shall have bare engine horse power rating equivalent to the higher of the following two values :- 20% in excess of the maximum brake horse-power required to drive the pump at its duty point.

The brake horse power required to drive the pump at 150% of its rated discharge.

The coupling between the Engine and pump shall allow each unit to be removed without disturbing the other.

The engine shall be designed with regard to ease of maintenance, repair, cleaning and inspection.

All parts susceptible to temperature changes shall have tolerance for expansion and contraction without resulting in leakage, misalignment of parts or injury to parts.

The engine shall be capable of both automatic and manual start. Generally the engine shall start automatically, but in case of the auto-start system failure the engine shall be capable of manual start.

Provision shall be made for two separate methods of Engine starting viz.

Automatic starting by means of a battery powered high torque D.C. electric starter motor incorporating the axial displacement type of pinion, having automatic repeat start facilities initiated by a fall in pressure in the water supply pipe to the hydrant installation.

Manual starting by Electric Starter motor. The starter motor used for automatic starting may also be used for manual starting provided there are separate batteries for manual starting.

Engine shall be able to start without any preliminary heating of combustion chamber; manual cranking mechanism shall also be provided. All controls/mechanisms, which have to be operated in the starting process, shall be within easy reach of the operator.

The high torque D.C motor charged by battery shall initiate automatic start of diesel engine. The battery shall hold adequate retainable charge to provide the starting of the diesel engine. Starting power will be supplied from storage batteries. The battery capacity shall be adequate for ten consecutive starts without recharging with a cold engine under full compression. Battery shall be lead acid type of 12 V, 180 Ah capacity.

The battery banks shall be used for no other purpose other than starting of the engine and shall be fully charged at all times with provision for trickle & boost

chargers. After start of the engine the charger shall be disconnected. The battery being fed from the engine alternator.

5.11.2.11.1. GOVERNING SYSTEM

The engine shall have a speed control device, which will control the speed under all conditions of load. The governor shall be suitable for operation without external power supply. The Governor shall offer following features:

An adjustable governor to regulate engine speed within a range of 10% between shut-off and maximum load conditions of the pumps. The governor shall be set to maintain rated pump speed at maximum pump load.

An over speed shutdown device to shut down the engine at speed approximately 20% above rated engine speed with manual reset, so that the automatic engine controller will indicate an over speed signal until the device is manually reset to normal operating position.

The Engine fuel oil shall be of quality and grade specified by the Engine manufacturer.

The diesel engine shall be suitable to run on High Speed Diesel (HSD), the tank provided being enough to hold the volume required for 8 hours (minimum) continuous operation. The tank shall be of MS sheet of 3.0 mm thickness.

The fuel tank shall be of welded steel construction to relevant Indian Standard. The tank shall be mounted above the Engine fuel pump to give gravity feed otherwise recommended by the manufacturer. The tank shall be fitted with an indicator showing the level of the fuel in the tank.

5.11.2.11.2. COOLING SYSTEM:

The engine shall be water cooled with cooling water drawn from the discharge side of the pump and with pressure reducing valve, strainer and all necessary accessories.

A heat exchanger, the raw water being supplied from the fire pump discharge (taken off prior to the pump discharge valve) via a pressure reducing device, if

necessary, to limit the applied pressure to a safe value as specified by the engine manufacturer. The raw water outlet connection shall be so designed that the discharged water can be readily observed. The water in the closed circuit shall be circulated by means of an auxillary pump driver from the engine and the capacity of the closed circuit shall not be less than that recommended by the engine manufacturer. If the auxiliary pump is belt driven there shall be multiple belts so that should half of the belts break, the remaining belts shall be capable of driving the pump.

5.11.2.11.3. TACHOMETER

A tachometer shall be provided to indicate revolutions per minute of the engine.

5.11.2.11.4. OIL PRESS URE GAUG E

The engine shall be provided with oil pressure gauges indicating lubricating oil pressure.

5.11.2.11.5. TEMPERATURE GAUGE

The engine shall be provided with a temperature gauge to indicate cooling water temperature.

All connecting wires for automatic controllers shall be harnessed or flexibly enclosed, mounted on the engine and connected in an engine junction box to terminals numbered to correspond with numbered terminals in the controller, for ready wiring in the field between the two/sets of terminals.

5.11.2.11.6. SIGNAL FOR ENGINE RUNNING AND CRANK TERM INATION

The engine shall be provided with a speed sensitive switch to signal engine running and crank termination. Power for these signals shall be taken from a source other than the engine generator.

5.11.2.11.7. ENGINE EXHAUST PIPES

The exhaust pipe shall be galvanized steel pipe and sized in accordance with the manufacturer's recommendations. The exhaust pipe shall be insulated with 50 mm of fiber glass with aluminum jacket for its entire length.

A stainless steel flexible connection shall be provided between the engine exhaust outlet and the exhaust pipe. An exhaust silencer shall be provided as required to satisfy the acoustic requirements.

5.11.2.11.8. BAT TERY CHARGING

The means of charging the batteries shall be by a 2-rate trickle charger with manual selection of boost charge and the batteries shall be charged in position. Where separate batteries are provided for automatic and manual starting, the charging equipment shall be capable of trickling charging both the batteries simultaneously. Equipment shall be provided to enable the state of charge of the batteries to be determined.

5.11.2.11.9. INSTALLATION

Installation of the Diesel Engine shall be carried out exactly as per manufacturer recommendation.

5.11.2.11.10. FOUNDATION AND ANTI VIBRATION MOUNTING

The foundation shall be constructed as per the requirement of Diesel Engine Manufacturer. Anti-Vibration Mounting: Suitable vibration mounting duly approved by the authorized representative shall be employed for mounting the unit so as to minimize transmission of vibration to the structure. The isolation efficiency achievable shall be clearly indicated.

5.11.2.11.11. ACCES SO RIES

The engine shall be mounted on a base plate of fabricated steel construction. Adequate access shall be provided to the big end and main bearing, camshaft and governor drives, water jackets etc.The engine shall be provided with inlet filter and silencer, outlet muffler, expansion joints, dampers etc. as necessary for efficient operation. Intake air shall be taken from inside the building in which the engine is

located, but the exhaust shall be discharged into the air at location as desired by the employer.

The contractor shall provide all accessories, fittings and fixtures necessary and required for a complete operating engine set.

5.11.2.11.12. INSTRUMENTATION

The diesel engine shall be provided with instrumentation as under:- Engine Starting System:

It shall be with lead acid batteries heavy duty of minimum 180 AH capacity, higher if so required by the engine manufacturer, 2 Nos. and self-starter switch.

Engine Instruments and Standard Control Panel:

It shall be complete with required connections and comprising of following items:

Inlet and outlet water temperature gauge (dial type) with key.

Lubrication oil pressure gauge. Lubrication oil temperature gauge.

Automatic start stop device (push button type).

Auto /Manual Selector switch shall also be provided.

Manual: the Engine can be manually operated by means of Push Buttons. Start Stop and failure control device.

Start key for manual starting.

Stop Push Button for manual stopping of engine. Starting failure indication by lamp and horn unit.

Engine temperature control with failure indication by red lamp indication.

Engine temperature ‘very high’ indication by audio alarm and automatic stopping of engine. Engine set is ‘running’ and ‘in operation’ indication by green lamp.

Mains supply available indicated by yellow lamp.

Push Button for Audio Alarm reset.

Push Button Failure indication by lamps.

The Panel shall also have an auto/manual/test/off selector switch.

5.11.2.11.13. JOCKE Y PUMPS

The jockey pump capacity and pressure shall be as per design.

Pump shall be 2900 rpm vertical inline multistage, electric, and complete with pressure relief valve.

Pump controller shall be factory pre-wired and tested. Pressure switch shall sense low pressure in the fire pump system. Set cut-in pressure and cut-out pressure shall be as per design. Provide minimum run timer to operate the pump for a minimum of 3 minutes.

Control panel to contain a fusible 3-pole disconnect switch, magnetic motor contactor and thermal overload relays with external reset. Enclosure to be wall mounted with hinged door.

5.11.2.11.14. Terrace pump

Supply erection testing and commissioning of electric driven terrace pump suitable for automatic operation and consisting of following, complete in all respects, as required:

- Horizontal type, multistage/ single stage. Centrifugal, split case pump of cast iron body & bronze impellar with stainless shaft, mechanical confirming to IS:1520
- Suitable HP squirrel cage induction motor TEFC type suitable for operation on 415 volts, 3 phase, 50Hz, A C supply with IP55 calss of protection for enclosure, horizontal foot mounted type with class –‘F’ insulation, conforming to IS-325.
- M.S. fabricated common base plate, coupling guard, foundation bolts etc. as required.
- Suitable cement concrete foundation duly plastered and with anti-vibration pads.
- Suitable canopy / sun barrier for the pump set.

5.11.2.11.15. COMMISSIONING & TESTING

All the tests shall be performed, documented and got approved from the competent authority to get the NOC and approval for the indoor stadium.

Designing, supply, installation, testing and commissioning of system controller for operation of main electric fire pump, diesel pump, pressurization pump, terrace pump in sequence as specification consisting of relays, timers, sensors, annunciation window for fault indication, complete as per specification.

5.11.2.11.16. FIRE BRIGADE TANK FILLING CONNECT ION

Pressurize the fire hydrant system by running the main fire pump and after attaining the required pressure in different pressure zones under check shut off the pump.

Open bye pass valve and allow the pressure to drop in the system. Check that the jockey pump cuts-in and cuts out at the pre-set pressures. If necessary, adjust the pressure switch for the jockey pump. Close bye-pass valve.

Open hydrant valve and allow the water to flow into the fire water tank in order to avoid wastage of water. The main fire pump should cut-in at the pre-set pressure and should not cutout automatically on reaching the normal line pressure. The main fire pump should stop only by manual push button. However, the jockey pump should cut-out as soon as the main pump starts.

Switch off the main fire pump and test check the diesel engine driven pump in the same manner as the electrically driven pump.

When the fire pumps have been checked for satisfactory working on automatic controls, open fire hydrant valves simultaneously and allow the hose pipes to discharge water into the fire tank to avoid wastage. The electrically driven pump should run continuously for eight hours so that its performance can be checked.

Check each landing valve, male and female couplings and branch pipes for compatibility with each other. Any fitting which is found to be incompatible and does not fit into the other properly shall be replaced by the contractor. Landing valves shall also be checked by opening and closing under pressure.

5.11.2.12. CIVIL WORKS

All the civil work shall be carried out in accordance with civil and structural specifications provided in tender and latest CPWD specifications.

5.11.2.13. TESTING AND COMMISSIONING OF PRESSURIZED NETWORKS

Testing and commissioning of pipeline and other associated structures should be carried out as per applicable standards and IS codes. Testing and commissioning shall be coordinated with the Engineer.

HORTICULTURE WORKS

SPECIFICATION FOR HORTICULTURE WORKS

1. The work will be carried out in accordance with the concept landscape drawing and plantation detail attached with this document and as per CPWD Specifications with upto date correction slips.
2. All liabilities of the labour is the responsibility of the contractor.
3. The contractor shall arrange his own T&P required for development as well as maintenance.
4. The payment of all operations and material is inclusive in this contract.
5. The existing trees/plants should be preserved and felling of tress/transplantation of tress should be done as per Forest Act/ Laws as per direction of officer in charge.
6. Cleaning jungle including uprooting rank vegetation, grass etc, removal and disposal of rubbish with all leads and lifts.
7. Trenching of area up to depth of 60 cm including removal and disposal of rubbish with all leads and lifts.
8. Earth work in excavation by mechanical means (hydraulic excavator) / manual means over areas (exceeding 30cm in depth, 1.5m in width as well as 10sq. mt on plan) including disposal of excavated earth with all leadsand lifts.
9. Supplying and stacking of good earth at site including royalty and carriage upto all leads and lifts and spreading it in required thickness and for preparation of mounds also on required places.
10. Supplying and stacking of cattle dung manure at site including royalty and

carriage upto all leadsand lifts and spreading it over the surface and mixing it.

11. Preparation of beds for hedging, edeging, herbs, shrubs, seasonal flowers etc.byexcavating60cmdeep andtrenchingtheexcavatedbasetoafurther depth of 30cm, refilling the excavated earth afterbreaking clods and mixing with manure in the ratio of 2:1 (2 part of stacked volume of earth after reduction by 20%: 1 part of stacked volume of manure after reduction by 8%) flooding with water, filling with earth – if necessary, watering and finally dressing, leveling etc.Including stacking and disposal of materials declared unserviceable and surplus earth by spreading and leveling as directed with all leads and lifts.
12. Digging holes in ordinary soil and refilling the same with the excavated earth mixed with manure or sludge in the ratio 2:1 by volume (2 part of stacked volume of earth after reduction by 20%: 1 part of stacked volume of cattle dung manure after reduction by 8%) flooding withwater, dressing including removal of rubbish and surplus earth, if any with all leads and lifts (cost of manure/extra good earth, if needed is to be provided without any extra cost).
    (i) Pits1.2mdia.and1.2mdeep.(ForTrees)
    (ii) Pits60cmdia.and60cmdeep.(ForShrubs)
13. Providing and planting best quality of wellgrown healthy plants in pots /bagsofrequired heightand species as specified inthe enclosed list.All plants to be got approved by the Officer In-Charge before planting.
14. Supplying and applying chemical emulsion of approved quality in sealed containers for termites 50ml. per sqm.Including delivery as specified.

ACCEPTABLE MAKES OF MATERIALS

Acceptable makes of materials to be used in the work are enclosed. In case of non-availability of these makes, after the approval of WAPCOS, the Contractor can use the alternative makes only BIS marked materials. Non BIS marked materials may be permitted by the WAPCOS only when BIS marked materials are not manufactured.

List of acceptable makes for civil works

Sr. no.	Item	Approved Manufacturer's Name
	Civil and Interior Works	
1.	Grey Cement (PPC43Grade)	ACC,Ultratech,Ambuja Birla Cement
2.	White Cement	J.K.Cement,Birla or equivalent
3.	Reinforcement Steel(TMTbars)	SAIL, TISCO, RINL, JSW LTD (Neo brand), JINDAL STEEL & POWER(Panther)
4.	Structural Steel sections	Tata, Sail, RINL Vizag, Locally approved Structural Steel Section Manufacture.
5.	Concrete Additives	Fosroc,Choksey,SikKa
6.	Antitermite Chemical	a) Central Insecticide Board approved Chemical b) Specialisedagencyshouldbememberof IPCA.PestControlIndiaLtd.,PestCon India, or Equivalent
7.	Tilegrouts,JointFiller	Laticrete,BalEndura,GEBayerSilicon
8.	PolysulphideSealant	Fosroc,Choksey,Pidilite
9.	SiliconeSealant	GEBayerSilicone,DowCorning,Wacker.
10.	Epoxy	Fosroc,Sika,Choksey,BASF
11.	Water Proofing Membrane – Bitumen Based	Sikka,Fosroc,BASF,ShalimarTarProducts Ltd.,Tikki Tar Industries
12.	Admixture	Choksey, BASF, Fosroc
13.	Form work ReleaseAgent	Choksey,MBT,BASF
14.	Non Shrinkgrouts	Fosroc,Sikka
15.	Non Metallic Floor Hardeners	Fosroc,Choksey,BASF

16.	Bitumen	Shalimartarproducts,Mathuraoilrefinery
17.	Synthetic Enamel Paints, Interior & Exterior Paints	Berger Paints, Nerolac Paints, Asian Paints, ICI Dulux Paints or any approved equivalent make.
18.	OilBoundDistemper	Berger,Nerolac,Asian,ICI Dulux
19.	CementPaint	SnowcemPlus,Berger,Nerolac,Ultratech
20.	Plastic EmulsionPaint	Berger,ICI,Nerolac,Asian
21.	Other Paints & Primer	ICIDulux,Asian,Berger,Nerolac
22.	Textured Coating/Paint	Heritage,Unitile,Spectrum,Ultratech
23.	Melamine	ICI Dulux,Timber stone Melamine Coating
24.	Polyurethane Paint	MRF,Nerolac,Texfin
25.	Silicon Water Repellent Solution	GEBayerSilicon, Choksy chemicals, Bal Endura, BASF
26.	Ceramic Tiles (Glazed,Matt, Others)	Kajaria,RAK,NITCO,OrientBell,somany,Johnson

VitrifiedTiles	Kajaria,RAK,NITCO,OrientBell,somany,johnson
Heat resistant tiles	Thermatek/OrientBell
Laminated Wooden flooring	Orientbell, ActionTesa or any approved equivalent make.
PVC/Vinyl Flooring	Polyflor,GerFloor,Wonderfloor
TerrazzoTile	NITCO,Unistone,Hindustan
Interlock Tiles, Grass Paver Block	NimcoPrefab,KKManhole,Hindustan
Cement Concrete Tiles, Designer Tiles	Unistone,Dazzle, Eurocorn.
Laminates &veneers	CenturyPly, Kitply, Merino,Archidply, Greenply,Formica,Greenlam,Timex,syragold,virgo
MDF Grade-I as per IS-12406&Ecomark	Century, Merino ,Archidply, Novapan, Nuwood,Bhutan Board,Greenply
Adhesive for wood work	Dunlop,Fevicol,Famcol
PreLaminatedParticleBoard	Century,Merino,Archidply

Plywood, Block Board, Soft Board	Century,Merino,Archidply
PavingStones	Unistone, NimcoPrefab, KK Hindustan Manhole,
WaxPolish	Mansion,Reckitt&Colman
PolyethaneSealant	MBT,Choksey,Fosroc,Pidilite
Polyethylene Board,BackUpRod	SupremeIndustriesorEquivalent
StainlessSteelHinges	Hettich,Doorset,Godrej,Dorma
Mirror&FloatGlass	Modi Float Glass, Asahi Glass, Saint Gobain
DoorHardware	Godrej, Dorset, Dorma, Hettich.
Furniture hardware	Hettich,Blum
Water Stopper	Fixopan,Caliplast or equivalent
Aluminium Composite Panel	Alucobond, Alstrong, Aludecor, Viva
Asphalt Emulsion	STP, Karnak Chemical Corporation.
ExpansionFastener	Hilti,Fischer,Canon
Stainless Steel	Salem,Jindal,Cavelier
Anchor Fastener,AnchorBolts	Hilti,Fischer,Canon
Gypsum Partition & Gypsum Ceiling with frame	SaintGobin, skrni or equivalent
Impregnated Fibre Board	STP or equivalent
Joint Fille rand Bitumen Products	STP or equivalent
Electrodes	Advani-Overlikon, ESAB, Dwekam
Mineral Fibre Ceiling System	Aura, AMF, USGBoral, Armstrong
H.T.Bolts	Unbrakoor equivalent
Steel Doors(Generalpurpose)	Shakti Met-Dor, SenHarvic, Welcome Doors, AGEW, Multiwin or equivalent
Steel Doors(Firerated)	Global Fire Protection Company, Radiant safe Fire Doors, Godrej, Navair, Shakti Met-Dor, Abaqs
Fire Door (Wooden)	Navair,Kidlee,Ozone
Aluminium Sections	Jindal, Hindalco, Indal, chetak or equivalent
RollingShutter	Shivam, Milestones, Rama, Prakash

Pre-coatedRoofSheeting	Multicolor,BHP, Bluescope, Japan Metal Systems, Lloyds, CRIL
Glass wool and related products, Mineral wool	UP-Twiga, Owens Corning, Lloyds
Polycarbonate sheets	GE Plastics, Danpalon, Polygal, LEXAN

1.	Self drilling Screws	Hilti, Builtex or equivalent
2.	Logo,Signs,Nameplates	D-Line, Sign Sutra, Sameer
3.	Pre-Engineered Building	Kirby Building,Tiger Steel or equivalent
4.	Flush Doors	Merino,Century,Archidply, Kitply,
5.	MS Sliding Motorized Door	Shivam Associates-BenincaRI524K System or equivalent
6.	Wate proofing compound	Pidilite, Cico, Fosroc, Choksey, Mapei
7.	Fasteners	Gun, Atul, Hilti, Canon
8.	Aluminium fittings	Crown, Nulite, Mccoy, Hardwyn,
9.	Extruded vitrified clay tile	Unistone, Pioneer, Marbito, RAK
10.	POP	JK , Skrini, Prince or equivalent
11.	Outdoor furniture(sitting bench, dustbin)	Arihant or equivalent
12.	Modular furniture	Godrej,HNI,Featherlite
13.	Chairs and Sofas	Godrej,HNI,Featherlite
14.	Acoustical paneling	Absound overseas, Anutone, Armstrong. Bose
15.	ModularToilets	Merino, Dorma,Trespa
16.	Mosaictiles	Nitco, surya, Laxmi
17.	Acoustical False Ceiling	Absoundoverseas, Anutone, Armstrong
18.	Exteriortiles	Duvtex, Unistone, Pioneer
19.	PatchFitting/SpiderFitting	D-Line, Hettich, Dorma
20.	UPVC Door &Window	Fenesta, Aluplast,vega or equivalent
21.	Acid and alkali resistant tiles	Kajaria, NITCO, Durato, orientbell or equivalent
22.	Ceramic Rain screen ventilated faced tile/ Terracotta	Terrial, Soladrilho

23.	Roller Blinds	Hunter Douglas/Mac/Vista
24.	GRCJali	Unistone,Birla GRC, Grasim
25.	MetalCeiling	Aura,Unimet, Hunter Douglas
26.	Decking Sheet	Tata Blue scope Corus or equivalent
27.	Glassbricks/Blocks	Solaris,Sevesor Equivalent
28.	Aluminium standing Seam roofing	Kalzip/Bemo/Sanko/Kingspan
29.	FoamConcrete	Valifoaalifoam/AEFoam
30.	Expansion Joints	3RJoints & seals, sandfield, vexcolt
31.	Raised/False Access Flooring	Unifloor,Tate,Kingspan
32.	Lifts	Kone, Otis, Mitsubishi, Schinder, johnson, thyssunkrup
33.	CalciumSilicateFalseCeiling	Aerolite, Armstrong (Mylar/Newtone), Ramco (Hilux)
34.	“T”GridFor calcium Silicate FalseCeiling	RK Grid System, Gridline
35.	Curing compound	Fosroc,Sika,Cico
36.	Inherent Fire Retardant Fabric	Trevira C S fabric of RSWMLtd.Or equivalent
37.	Fire retardant paint	Nullifier/Signum/Godrej
38.	Fire rated vision Panels	Pilkington,Schott, Ferilite, Saint Gobain
39.	Fire rated hardware	Dorma/Becker FS/Assaabloy
40.	Skylight–Thermo form	Mccoy Architectural System, Vergola, Abucob
41.	Aluminium Coating/Anodizing	National Coater/National Colours/Prince Coater

TABLE - ELECTRICAL		
A.	**ELECTRICAL ENERGY STORAGE & ALTERNATE POWER SUPPLY EQUIPMENT**	
1	UPS SYSTEM	APC/ SOCOMEC/ EMERSON/ AAL
2	INVERTER	LUMINOUS/ MICROTEK/ SU-KAM
B.	**ELECTRICAL LT DISTRIBUTION SYSTEM WITH PANELS ETC.**	
1.	ACB (Air Circuit Breaker) microprocessor based	LAURITZ & KNUDSEN (L&T)/ ABB/ SCHNEIDER/ SIEMENS/ LEGRAND/ TERASAKI
2.	MCCB (Moulded Case Circuit Breaker)	LAURITZ & KNUDSEN (L&T)/ ABB/ SCHNEIDER/ SIEMENS/ LEGRAND/ TERASAKI
3.	MINIATURE CIRCUIT BREAKER (MCB)	HAGER/ SCHNEIDER ELECTRIC/ SIEMENS/ ABB/ HAVELLS/ LAURITZ & KNUDSEN (L&T)
4.	METALCLAD SOCKET	SIEMENS/ LEGRAND/ HAGGER/ BCH
5.	RISINGMAINS/ BUSDUCT	ABB/ SIEMENS/ SCHNEIDER/ C&S/ LEGRAND/ LAURITZ & KNUDSEN (L&T)
6.	LED LUMINAIRES & LED FITTINGS	PHILIPS/ WIPRO/ HAVELLLS/ TRILUX/ PANASONIC/ OSRAM/ TRANSRAIL
7.	MOTOR PROTECTION CIRCUIT BREAKER FOR MOTORS	LEGRAND/ SIEMENS/ SCHNEIDER/ ABB/ LAURITZ & KNUDSEN (L&T)
8.	CHANGE OVER SWITCH	HH-ELCON/ SOCOMAC/ HPL/ LAURITZ & KNUDSEN (L&T)/ C&S
9.	AIR BREAK CONTACTOR	LAURITZ & KNUDSEN (L&T)/ ABB/ SCHNEIDER/ LEGRAND/ SIEMENS/ BCH
10.	THERMAL OVERLOAD RELAY	LAURITZ & KNUDSEN (L&T)/ ABB/ SCHNEIDER/ LEGRAND/ SIEMENS/ BCH
11.	STAR DELTA TIMER	LAURITZ & KNUDSEN (L&T)/ ABB/ SCHNEIDER/ LEGRAND/ SIEMENS/ BCH
12.	TIME DELAY RELAY	LAURITZ & KNUDSEN (L&T)/ SCHNEIDER ELECTRIC/ SIEMENS/ BCH
13.	TIMER	BCH/ LAURITZ & KNUDSEN (L&T)/ SIEMENS/
14.	TIME SWITCH	LAURITZ & KNUDSEN (L&T)/ ABB/ GIC/ SCHNEIDER/ LEGRAND/ SIEMENS/ BCH
15.	SINGLE PHASE PREVENTOR	LAURITZ & KNUDSEN (L&T)/ ABB/ SCHNEIDER/ LEGRAND/ SIEMENS/ BCH/ MINILEC/ CROUZET
16.	VARIABLE SPEED DRIVES	ABB/ SIEMENS/ YASKAWA/ LAURITZ & KNUDSEN (L&T)/ SCHNEIDER
17.	CURRENT TRANSFORMER	GILBERT & MAXWELL/ PRAGATI/ AUTOMATIC ELECTRIC
18.	DOL AND FASD STARTER (temporary installation only)	LAURITZ & KNUDSEN (L&T)/ BCH/ SIEMENS/ KALYANI SWITCHGEARS ENGINEERING ENTERPRISES/

		TRICOLITE
19.	FLUSH MOUNTNG 96mm x 96mm METERS – DIGITALTYPE	AE/ LAURITZ & KNUDSEN (L&T)/ RISHAB/ SCHNEIDER ELECTRIC/ FLUKE
20.	IPFC (Intelligent Power Factor Control Relay)	SCHNEIDER/ SIEMENS/ LAURITZ & KNUDSEN (L&T)/ BCH/ ABB/ DUCATI
21.	PROTECTIVE RELAY	ASLTOM/ SCHNEIDER/ SIEMENS/ LAURITZ & KNUDSEN (L&T)/ ABB
22.	CT's/PT's-DRYTYPE-EPOXY	AE/ KAPPA/ MATRIX/ C&S
23.	22.5 mm Ø LED INDICATING LAMP/	LAURITZ & KNUDSEN (L&T)/ SIEMENS/ BCH/ Schneider/ ABB/ VAISHNO
24.	22.5 mm Ø PUSH BUTTON ACTUATORS	LAURITZ & KNUDSEN (L&T)/ SIEMENS/ BCH/ Schneider/ ABB/ VAISHNO
25.	ROTARYSWITCHES	LAURITZ & KNUDSEN (L&T)/ KAYCEE/ BCH
26.	SELECTOR SWITCH, TOGGLE SWITCH	LAURITZ & KNUDSEN (L&T)/ KAYCEE
27.	CHANGE OVER SWITCH	LAURITZ & KNUDSEN (L&T)/ HPL-SOCOMEC/ C&S
28.	PHASE SEQUENCE CORECTOR	HAVELLS/ LAURITZ & KNUDSEN (L&T)/ ENGINEERING ENTERPRISES/ CMKL/ KALYANI SWTCHGEAR/ C&S/ ELECTRO CONTROL SYSTEMS
29.	TERMINALBLOCK	ELEMEX/ WAGO/ PHOENIX/ CONNECTWELL
30.	LT PANELS/ SYNCRONISING PANELS/ CAPACITOR PANEL/ SUB LT OR AUXILLIARY PANELS	ADLEC / LAURITZ & KNUDSEN (L&T)/ SIEMENS/ ABB/ RITTAL/ CMKL/ KALYANI/ TRICOLITE
31.	LIGHTENING ARRESTER	NUTECH / MAHAVIR INDUSTRIAL CORPORATION/ Earthtech or equivalent
32.	LT Capacitors	ABB/ EPCOS/ SCHNEIDER/ LAURITZ & KNUDSEN (L&T)/ DUCATI
C .	**CABLES/ WIRE/ TERMINATIONS/ ACCESSORIES**	
1	LUGS/ THIMBLE/ CABLE ENDS	DOWELLS/ COMMET/ MULTI/ SCHNEIDER
2	CABLE GLANDS	COMMET/ BELIGA/ PEECO/ GRIPWELL/ LAPP KABEL

3	XLPE/ PVC INSULATED ALUMINIUM/ COPPER CONDUCTOR, ARMOURED LT CABLE (1100 VAC GRADE)	FINOLEX/ POLYCAB/ HAVELLS
4	PVC COPPER CONTROL CABLE (COPPER)	LAPP/ RR KABLE/ NICCO/ POLYCAB/ HAVELLS/ RALLISON/ VGUARD/ PARAFLEX KLJ/ POLYCAB
5	COPPER PVC WIRES FRLS (WIRING)	LAPP/ RR KABLE/ NICCO/ POLYCAB/ HAVELLS/ RALLISON/ VGUARD/ PARAFLEX KLJ/ POLYCAB
6	H.T.CABLE END TERMINATION	BIRLA3M/REYCHEM/FRONTEC
7	FIRE SURVIVAL CABLE	AFW/ FRTEK/ PRYSMIAN/ INDIA IMPEX
D.	**CONDUITING & WIRING ACCESSORIES**	
1	MS CONDUIT WITH ACCESSORIES/ GI CONDUIT (ISI MARKED)	BEC/ ATUL/ RMCON/ AKG
2	PVC CONDUIT WITH ACCESSORIES (ISI MARKED)	BEC/ AKG/ ATUL/ PRECISION /INDEANA/ DIPLAST
3	PVC INSULATED COPPER CONDUCTOR FRLS WIRE	LAPP/ RR KABLE/ NICCO/ POLYCAB/ HAVELLS/ RALLISON/ VGUARD/ PARAFLEX KLJ/ POLYCAB
4	MODULAR TYPE- SWITCHES/ SOCKETS/ TV & TELEPHONE SOCKETS AND ALL OTHER WIRING ACCESSORIES	M.K/ LEGRAND/ ANCHOR-ROMA/ SCHNEIDER/ GOLD MEDAL/ PANASONIC/ HAVELLS/ CLIPSAL
6	PVC INSULATION TAPE	STEEL GRIP/ ANCHOR
7	PHENOL LAMINATED SHEET	HYLAM/ FORMICA
8	RACEWAYS & CABLE TRAY	MEM/ CTM ENGG/ SWIFT/ OBO BEHERMAN
E.	**LIGHTINGDBs&MCBs**	
1	MCB ‘B’ CURVE & ‘C’ CURVE	ABB/ HAGER/ SCHNEIDER/ LEGRAND/ LAURITZ & KNUDSEN (L&T)/ HAVELLS/ C&S/ SIEMENS
2	RCCB/ RCBO	ABB/ HAGER/ SCHNEIDER/ LEGRAND/ LAURITZ & KNUDSEN (L&T)/ HAVELLS / SIEMENS
3	DOULBLE DOOR DISTRIBUTION BOARD	ABB/ HAGER/ SCHNEIDER/ LEGRAND/ LAURITZ & KNUDSEN (L&T)/ HAVELLS/ SIEMENS
F.	**LIGHTING FIXTURES & FANS ETC.**	
1	LIGHTING FIXTURES	PHILIPS, WIPRO, HAVELLS, PANASONIC,

		OSRAM, TRILUX, TRANSRAIL
2	SOLAR LIGHTING FIXTURES	PHILIPS, WIPRO, HAVELLS, SE, PANASONIC, OSRAM, TRANSRAIL
3	STREET LIGHT/ FLOOD LIGHTS	WIPRO, HAVELLS, PANASONIC, OSRAM, TRILUX, TRANSRAIL
4	EXHAUST FANS/ CEILING FAN/ WALL MOUNTED FAN	CROMPTON/ POLAR/ HAVELLS/ KHAITAN/ BAJAJ/ GEC
5	LIGHTING CONTROL SYSTEM	SCHNEIDER/ PHILIPS/ LUTRON/ WIPRO
G.	**ELV- TELEPHONE/ CCTV/ DOOR ACCESS/ FIRE ALARM/ PUBLIC ADDRES SYSTEM & MISC. SYSTEMS**	
1	SMOKE DETECTORS	ESSER HONEYWELL/ TYCO/ SIEMENS CERBERUS-PRO/ SHRACK/ HONEYWELL

2	HEAT DETECTORS	ESSER HONEYWELL/ TYCO/ SIEMENS CERBERUS-PRO/ SHRACK/ HONEYWELL
3	MANUAL CALL BOX	ESSER HONEYWELL/ TYCO/ SIEMENS CERBERUS-PRO/ SHRACK/ HONEYWELL
4	HOOTER/ SOUNDER	ESSER HONEYWELL/ TYCO/ SIEMENS CERBERUS-PRO/ SHRACK/ HONEYWELL
5	RESPONSE INDICATOR	ESSER HONEYWELL/ TYCO/ SIEMENS CERBERUS-PRO/ SHRACK/ HONEYWELL
6	FIRE PANEL	ESSER HONEYWELL/ TYCO/ SIEMENS CERBERUS-PRO/ SHRACK/ HONEYWELL
7	PA AMPLIFIER	HONEYWELL/ BOSCH/ HEINRICH/ BOSE/ AHUJA
8	PASPEAKERS	HONEYWELL/ BOSCH/ HEINRICH/ BOSE/ AHUJA
9	LINE MATCHING TRANSFORMER	HONEYWELL/ BOSCH/ HEINRICH/ BOSE/ AHUJA
10	GOOSE NECK MIKE	HONEYWELL/ BOSCH/ HEINRICH/ BOSE/ AHUJA/ SHURE
12	CAMERA WITH ALL ACCESSORIES	AXIS/ INPULSE/ IDIS/ BOSCH
13	ROAD BARRIER	NICE/ MAGNETICS/ GODREJ/ GE
14	CARD READER	SENSORMATIC-USA/ MOTOROLA/ HONEYWELL(XLS-3000)
15	MONITOR	LG/ SAMSUNG/ SONY/ PANASONIC
16	MULTIPLEXER	SENSOR MATIC OR EQUIVALENT
17	SEQUENCER	ALBA/ VANTAGE
18	PROXIMITY CARD	MOTOROLA/ HUGHES/ HONEY WELL/ GE/ SIEMENS
19	TELEPHONE TAG BLOCK	CTM ENGG/ SYSTIMAX/ SCHNEIDER/ PANDU IT
20	TELEPHONECABLES	DELTON/SKYTONE/CLIPSAL
21	CO-AXIAL CABLES	FINOLEX/ DELTON/ SKYTONE
22	EPABX	ALKATEL/ SIEMENS/ NEC/ AVAYA
23	CCTVSYSTEM	HIKVISION/ CPPLUS /KES

24	ACCESS CONTROL SYSTEM	HONEYWELL/ SIEMENS/ SYRIS
H.	**MISCELLANEOUS SYSTEMS**	
1	BATTERIES	EXIDE/ SF/ Rocket/ Quanta
2	BATTERY CHARGER	KELTRON/ NELCO/ EXIDE/ HBLNIFE
3	EARTHING (ALLTYPE)	NUTECH / MAHAVIR INDUSTRIAL CORPORATION/ Earthtech.
I	**VCB PANEL/ TRANSFORMER**	
1.	11KV HT VCB PANELS	ABB/ CROMPTON/ SIEMENS/ LAURITZ & KNUDSEN (L&T)/ EATON/ SCHNIEDER
2.	250KVA ONWARDS COPPER WOUND TRANSFORMER	VOLTAMP/ ABB/ SCHNEIDER/ KIRLOSKER/ CROMPTON/ NGEF
3.	UPTO 200KVA COPPER/ ALUMINIUM WOUND TRANSFORMER	ISI MARKED HPSEB APPROVED
4.	UNITISED / COMPACT SUB-STATION	ABB/ SIEMENS/ SCHNIEDER ELECTRIC/ C&S/ CROMPTON
5.	PROTECTION RELAY	
	B. NUMERIC TYPE	ABB/ AREVA/ LAURITZ & KNUDSEN (L&T)/ SIEMENS/ SCHNEIDER/ SIEMENS
	C. ELECTRO MAGNETIC TYPE	ABB/ AREVA/ LAURITZ & KNUDSEN (L&T)

PLUMBING-LIST OF APPROVED MAKES

S. No.	Details of Materials / Equipment	Manufacturer'sName
1.	VITREOUS CHINA SANITARY WARE	HINDWARE/ JAGUAR/KOHLER
2.	WC PAN CONNECTOR	SUPREME/PRINCE/FINOLEX
3.	BATH FITTINGS	HINDWARE/ JAGUAR/KOHLER
4.	STAINLESS STEEL SINK	NILKANTH or equivalent
5.	AUTO URINAL FLUSH SYSTEM	HINDWARE/ JAGUAR/KOHLER
6.	HAND DRIER	EURONICS/CMR/KOPAL
7.	CISTERN	HINDWARE/ JAGUAR/KOHLER
8.	CP BRASS FITTINGS	HINDWARE/ JAGUAR/KOHLER
9.	GEYSER	RACOLD/BAJAJ/HAVELLS
10.	FLOOR DRAIN FIXTURE RAIN WATER OUTLETS	VIEGA/GMGR/GEBRIT
11.	CP GRATING FOR FLOOR TRAP	VIEGA/GMGR/NEER
12.	CASTIRON PIPES& FITTINGS MANHOLE COVER & FRAME	
13.	A. AS PER IS:3989(PIPES & FITTINGS)OFCASTIRONPIPES&FITTINGS	NECO/BIC/SKF
14.	B. AS PER IS:1729(PIPES & FITTINGS) CAST IRON PIPES &FITTINGS	NECO/BIC/RAJIRONFOUNDARYAGRA
15.	C.ASPERIS:1536(PIPES& FITTINGS) (CI CLASS LA PIPES)	NECO/IISCO/KESORAMCALCUTTA
16.	D.DIMANHOLECOVERS &FRAMES	KARTARVALVESFITTINGS/NECO/BIC
17.	CI LA FITTINGS	KARTARVALVES7FITTINGS/NECO/BIC
18.	SUSPENDED MANHOLE &GULLY TRAP	SUPREME/PRINCE/FINOLEX

19.	DRIP SEAL	ACQUA BOND/BINOD CEMEN COMPANEY/MEGGASEAL
20.	GI / MS PIPE (IS : 1239 and IS : 3589)	TATASTEEL/JINDAL
21.	GI PIPE FITTINGS	NVR/MAC/ZOLOTOM/UNIK
22.	GI PIPE SEALENT	HENKEL-LOCTITE55
23.	PIPE CLAMP & SUPPORT	CHILLYEUROCLAMP/KANWAL
24.	D.I PIPES	ELECTRO STEEL/JINDAL/LANCOKALAHASTHI
25.	UPVC PIPE	SUPREME/PRINCE/FINOLEX
26.	CPVC PIPES	SUPREME/PRINCE/FINOLEX
27.	RCC PIPE	LOCAL ISI APPROVED
28.	STONEWARE PIPE,GULLEYTRAP	LOCAL ISI APPROVED
29.	GM/FORGED BRASS BAL VALVES	DANFOS/KITZ/UTAM
30.	SLUICE VALVE	AUDCO/LEADER/VTM/UTAM
31.	BUTTER FLY VALVE	AUDCO/LEADER//VTM/UTAM
32.	CHECKVALVE-WAFERTYPE	ADVANCE/AUDCO/VTM/UTAM
33.	CHEC KVALVE-DUALPLATE	ADVANCE/AUDCO/VTM/UTAM
34.	CHECK VALVE -FORGEDSCREWED	ADVANCE/AUDCO/VTM/UTAM
35.	PRESSURE REDUCING VALVE	HONEYWELL/WATTS/UTAM
36.	SOLENOIDVALVE	DANFOS/HONEYWELL
37.	THERMO STATIC VALVE	OVENTROP
38.	AIR RELEASE VALVE	ADVANCE/ZOLOTO/AIP/LEADER
39.	BALL FLOAT VALVE	ZOLOTO/VTM/UTAM
40.	NRV-BALL TYPE-SEWAGE APPLICATION	DANFOS/SILVERSPARK/NORMEX/UTAM
41.	YS TRAINER CI	AUDCO/KITZ/VTM
42.	HYDRO PNEUMATIC SYSTEM	GRUNDFOS/XYLEM/WILLO-MATHER&PLAT

43.	STORMWATER DRAINAGE & SEWAGE SUMP PUMPS	GRUNDFOS/ XYLEM/ WILLO - MATHER & PLAT/ KISHOR
44.	TRANSFER PUMPS	GRUNDFOS/ XYLEM/ WILLO-MATHER & PLAT/ FLYGT/ XYLEM/ KIRLOSKAR/ KSB
45.	SELF PRIMING PUMP	JOHNSON/ KIRLOSKAR/ GRUNDFOSS/ KSB
46.	MECHANICAL SEAL	BURGMANN/ SEALOL
47.	COUPLINGS	LOVEJOY
48.	ANTYVIBRATION MOUNTING & FLEXIBLE CONNECTION	DUNLOP/KANWAL INDUSTRIES/RESISTOFLEX
49.	PRESSURE GAUGE	HGURU /FIEBIG/ EMERALD
50.	WATER METER (MECHANICAL TYPE)	KRANTI/ ACTARIS/ KENT/ CAPSTAN
51.	ELECTRONIC FLOWMETER	KROHNE/ SIEMENS/ ABB/ ENDRESS & HAUSER
52.	LEVEL CONTROLLER & INDICATOR WATER	ELEGENT CONTROLL/ ENGINEERING ENTERPRISES/ TECHNIKA/ TECHTROL
53.	PAINTS	ASIANPAINTS/BERGER
54.	MH/WATER TANK PLASTICS TEP	KGM/PATEL/PRANALIINDUSTRIES
55.	INSULATION FOR HOT WATER PIPE	ARMACELL-ARMAFLEX/K-FLEX/THERMAFLE
56.	THREE WAY MOTORISED VALVE	DANFOSS/HONEYWELL/SIEMENS/AIP
57.	GREASE TRAP	ACO/WADE
58.	WELDING RODS	ADOR/ESSAB
59.	FASTENER	FISHER/HILTI
60.	FIRESEALANT	BIRLA3M/HILTI
61.	MANHOLE(PREFABRICATED)	OKPLAT/CRESCENTFOUNDARY
62.	TEMPERATURE SENSOR/GAUGE	FORBES MARSHALL/ WIKA/ YOKOGAWA/ BAUMER
63.	DOSING PUMPS	LMI/ PULSER FEEDER/ TOSCHON
64.	FLANGES	CLASS 150 TABLE H
65.	U.VSTERLIZER	ALFA/ EUREKA

66.	FLOW CONTROL DEVICES	AQUA PLUS/ JAQUAR/ RST
67.	SOLAR PANNEL	SOLARHARD/RACOLD/HONEYWEL
68.	STAINLES STEEL PIPES	JINDAL/VEIGA/ALFA

LIST OF APPROVED MAKES FOR EQUIPMENT & MATERIALS FIRE FIGHTING SYSTEM

S. No.	Details of Materials/ Equipment	Manufacturer's Name
1.	C.I. MANHOLES FRAME& COVER	NECO/ BIC/ SKF
2.	BUTTERFLYVALVE	AUDCO/ ZOLOTO/ CRANE/ KITZ/ VTM/ UTAM HAWLE/ KRAMMER
3.	GATEVALVE	LEADER/ ZOLOTO/ TYCO/ UTAM/ L&T/ VTM/ HAWLE/ KRAMMER
4.	NON RETURN VALVE	ADVANCE/ ZOLOTO/ AUDCO/ VTM/ UTAM/ HAWLE/ KRAMMER
5.	BALL VALVE	UTAM/ ZOLOTO/ DANFOSS/ VTM
6.	M. S. FORGED FITTINGS	V.S/JOHNSON
7.	DASH FASTENERS	HILTI/ FISHER
8.	AUTOMATIC AIR VENT	CIM/AIP/ZOLOTO
9.	PIPE HANGERS/ CLAMPS/ SUPPORT	EUROCLAMP/CHILLY/GRIPPLE
10.	PAINT	BERGER/ NEROLAC/ ASIAN
11.	FIREHOSE	CEASEFIER/ OMEX/ UTAM
12.	FIRE HYDRANT VALVE	CEASEFIER/ OMEX/ UTAM/ HAWLE
13.	FIRST AID HOSE REEL DRUM & TUBING	CEASEFIER/ OMEX/UTAM
14.	BRANCH PIPE	CEASEFIER/ OMEX/UTAM
15.	DOUBLE/ SINGLE HEADED LANDING VALVES	CEASEFIER/ OMEX/UTAM
16.	FIRE MAN AXE	CEASEFIER/ OMEX/ UTAM
17.	FIRE BRIGADE INLET CONNECTION	CEASEFIER/ OMEX/ UTAM

18.	FIRE /SPRINKLER MAIN PUMP/JOCKEY PUMPS	KIRLOSKAR/ WILLO-MATHER & PLATT/ KSB/ FLYGT/ GRUNDFOSS
19.	DIESEL ENGINE	CUMMINS/ GREAVES/ KIRLOSKAR
20.	MOTOR	ABB/ KIRLOSKAR/ CROMPTON/ BHARAT BILEE/ SIEMENS/ MARATHON
21.	BATTERY	AMCO/ EXIDE/ AMRON
22.	BATTERY CHARGER	BCH/ HBL/ KINETIC
23.	MS PIPE	TATA STEEL/ JINDAL HISSAR
24.	SPRINKLER HEAD	TYCO/ VIKING/ NEWAGE/ OMEX
25.	ALARM CONTROL VALVE	TYCO/ VIKING/ SAFEX/ EVERSAFE
26.	FLOWS SWITCH	SYSTEM SENSOR/ HONEY WELL/ POTTER/ DANFOSS/ PUNE TECHTROL
27.	WELDING ROD	ESAB/ADOR/ SUPERON OERLIKON
28.	PRESSURESWITCH	SYSTEM SENSOR/ HONEYWELL/ DANFOSS/ POTTER
29.	CONTROLS	HONEYWELL/ SIEMENS/ DANFOSS
30.	VIBRATION ELIMINATOR	RESISTOFLEX/ KANWEL
31.	G.I FITTINGS	UNIK/ ZOLOTO
32.	HOOTER	HONEYWELL/ SIEMENS/ DANFOSS
33.	SLUICE VALVE	HAWLE/ KSB/ KIRLOSKAR/ KRAMMER/ VAG/ AVK
34.	Y STRAINER	KITZ/AUDCO/VTM/UTAM
35.	DELUGE VALVE	VIKING/ TYCO/ HD
36.	WATER CURTAIN NOZZLE	VIKING/ TYCO/ HD
37.	FIRE EXTINGUISHERS	NEWAGE/ EXFLAME/ KANNEX/ MINIMAX/ OMEX
38.	FLEXIBLEDROPCONNECTION	NEWAGE/SEFEX/EVERSAFE/OMEX
39.	ELECTRICAL PANEL DETECTION & SUPPERESSION SYSTEM	AVECI NDIA/ FIRE TERRACE/ SVS BUILDWEL
40.	PIPE PROTECTION WRAPPING	PIPEKOTE/ COATEK
41.	INSPECTOR TEST ASSEMBLY	EVER SAFE/VIKING/VICTAULIC

42.	FIREBUCKETS	NEWAGE/SEFEX/MINIMAX/OMEX
43.	FOOTVALVE	KIRLOSKAR/NORMEX/VTM/UTAM
44.	MECHANICALSEAL	BURGMANN/ SEALOL
45.	PRESSUREGAUGE	HGURU/ EMERALD/ FIEBIG

Water heating system System –List of Approved Makes of Equipment

S. NO.	DESCRIPTION		MAKE
1.	HOT WATER GENERATORS	:	THERMAX/MXIMA/OLYMPIA
2.	PLATE TYPE HEAT EXCHANGER	:	ALFALEVEL/GEAECOFLEX/FISCHOR
3.	PRESSURE REDUCING VALVES	:	OR/SIM
4.	GI AN DMS PIPES	:	TATA/JINDAL(HISSAR)
5.	BUTTER FLY VALVES	:	AUDCO/INTERVALVE
6.	FLANGES	:	CLASS150
7.	INSULATION MATERIAL	:	THERMAFLEX/LLOYD/ROCKWOOL
8.	STRAINERS	:	LEADER/SHENCO
9.	PUMPS	:	DP, GRUNDFOS, SALMSON, ITT