THE PUNJAB AND HARYANA HIGH COURT BAR ASSOCIATION PROGRESSIVE LAWYER'S CO-OPERATIVE HOUSE BUILDING SOCIETY LTD.

TENDER NOTICE

Sealed Tenders are invited as per two bid system i.e. Technical Bid and Financial Bid on lumpsum per sqm rate basis up to 6.00 pm on or before 16/06/2025 at office of the society situated in chamber block Adjoining Diagnostic Center Punjab and Haryana High-court either personally/through messenger or by registered post for preparation of Architectural Drawings, structural Drawings and construction of 170 Number dwelling units (4bhk+Servant Room-110 Nos. Carpet area- minimum 2300 to 2400 sq ft .and 3 bhk + servant Room-60 Nos. Carpet Area- minimum 1700 to 1800 sq ft) on EPC/ Turnkey Basis for Multi -storied Group Housing Project at plot No. GH-1.(Area 2.5 Acres with dimensions East 188 '3"+ 237 '10.5". West 418 '9.5". North 272 '7". South 226 '5") Sector 8. Eco City Phase 2 Extension, Greater Mohali, Punjab from reputed Architects / firms/Contractors/Joint ventures / Individual(s) having at least 5 years 'experience and have executed at least two housing projects of cost 80% each or four projects of cost 50% each or minimum three no's of work done(complete work) value Rs 100 crores each(Building work Residential/nonresidential work) and having minimum turnover of minimum Rs 100 crores each for the last 3 years, as per audited Balance Sheet (FY. 22-23, FY 23-24, and FY 24-25). The tenderer will associate experienced architect at his own level. The project is to be executed by using Aluminum modular shuttering i.e. MIVAN Technology. Drawings, eligibility documents, list of executed/ongoing works in last 3 years along with list of technical staff and equipment must be attached with the tender application. The financial bid shall be enclosed in a separate Envelope. Bidders may refer to the already approved drawings and BOQ available on the society's website (www.plawyerssociety.org). If deemed beneficial to enhance quality and cost efficiency, they are encouraged to incorporate their own ideas or concepts. The desired bidders are requested to collect the tender form from the office of the society in High Court Premises or can contact the authorized person mentioned below.

Non-refundable fees of rupees 2**8,000** must be paid as processing fee at the time of submission of tender.

Note: -All those bidders who have already paid the abovementioned amount are not required to deposit the fee again. However, they shall submit fresh/revised tender documents as per above schedule. It is made clear that if fresh/revised tenders are not submitted then their previous bid if any shall be deemed to be 'not submitted.'

For any query call Ms. Anju Arora at 9417043303, Mr. Balraj Singh 9417419358, Mr. Baljeet Singh 9814154255, Mr. Saurabh Chaudhary at 9888155888

President

THE PUNJAB AND HARYANA HIGH COURT BAR ASSOCIATION PROGRESSIVE LAWYER'S CO-OPERATIVE HOUSE BUILDING SOCIETY LTD.

THEPUNJABANDHARYANAHIGHCOURTBARASSOCIATION PROGRESSIVELAWYER'SCO-OPERATIVEHOUSEBUILDINGSOCIETYLTD

PLOT NO.GH-1, SECTOR-8, ECOCITY PHASE 2 EXTENSION, GREATER MOHALI, CHANDIGARH

- NAME OF WORK Preparation of Architectural Drawings, Structural Design and Construction of Multi- storied Group Housing Project construction of 170 Nos (4bhk+Servant Room-110 Nos. Carpet area- minimum 2300 to 2400 sq ft .and 3 bhk + servant Room-60 Nos. Carpet Area- minimum 1700 to 1800 sq ft) on EPC/ Turnkey Basis at Plot No.GH-1, (Area2.5Acres with dimensions. East188' 3" +237' 10.5", West 418' 9.5", North 272' 7", South 226' 5") Sector-8, Eco City Phase 2 Extension, Greater Mohali, Punjab including Club House, Banquet Hall with capacity of at least 400 persons, all weather Swimming Pool with Children Swimming Pool, and Toddlers Splash Pool, Guest Rooms, dedicated common office space. Driver waiting area etc., Covered parking at least two parking slots of each flats, adequate Guest parking, complete in all respects on turnkey basis, including providing infrastructure facilities namely Plumbing, Internal and External Water Supply, Sewerage, Electrification, Storm Water Drainage, Roads, Boundary Wall with Gates + Guard Rooms, Fire detection and suppression services, Internal conduiting/wiring works, External Electrical Services, 24 hours Power Backup, Solar Geyser, Solar Power electronic security system, Parks and Horticulture Works, Roof Top Rain, Water Harvesting System, Gas Pipe Provisions and Broad Band optical fiber cable and intercom, including adequate passenger lifts and service lifts & and any other work/service contingent thereto, within the premises earmarked for above building blocks as Green Building with MIVAN technology/latest technology on turnkey basis.
- EARNEST: Approved bidder is required to submit Rs. 30.00 lacs Bank GuaranteeMONEYfrom scheduled bank as and when directed.
- **TIMELIMIT** : 36 months
 - :
- OFFICERIN
CHARGE: President, "The Punjab and Haryana High Court Bar Association
Progressive Lawyer's Co-operative House Building Society Ltd,"
ChandigarhINVITING
TENDERSChandigarh

President, The Punjab and Haryana High Court Bar Association Progressive Lawyer's Co-operative House Building Society Ltd

INDEX

SECTION	DESCRIPTION	PAGENO.
SECTION-1	DETAIL NOTICE INVITING TENDER	5-9
SECTION-2	INTRODUCTION AND INSTRUCTIONS TO THE BIDDER	10-16
SECTION-3	FINANCIAL BID/OFFER	17-19
SECTION-4	PAYMENT TERMS	20-22
SECTION-5	CONDITIONS OF CONTRACT	24-43
SECTION-6	SPECIAL CONDITIONS OF CONTRACT	44-64
SECTION-7	SCOPEOFWORKANDSPECTIONS FOR CIVIL, ESTATE SERVICES, ROADS, INTERNAL WATER SUPPLY, INTERNAL PLUMBING WORKS, INTERNAL SEWERAGE WORKS, STORM WATER WORKS, INTERNAL ELECTRICAL WORKS, EXTERNAL ELECTRICAL WORKS, FIRE FIGHTING, EARTHING, D.G. SETS, LIFTS, LIGHTENING PROTECTION WORKS, HORTICULTURE WORKS, & RAIN WATER HARVESTING	65-283
SECTION-8	BRIEF SPECIFICATIONAN LIST OF APPROVED MAKES	284-303

(SECTION-1)

DETAILED

NOTICE INVITING TENDER

THE PUNJABAND HARYANAHIGH COURTBAR ASSOCIATION PROGRESSIVE LAWYER'S CO-OPERATIVE HOUSE BUILDING SOCIETYLTD, PLOTNO.GH-1, SECTOR-8, ECOCITYPHASE2 EXTENSION, GREATER MOHALI, CHANDIGARH

Sealed Tenders are invited as per two bid system i.e. Technical Bid and Financial Bid on lump sum rate basis up to 6.00 pm on or before 16/06/2025 at office of the society situated in chamber block Adjoining Diagnostic Center Punjab and Haryana High-court for any query call Ms. Anju Arora at 9417043303, Mr. Balraj Singh 9417419358, Mr. Baljeet Singh 9814154255, Mr. Saurabh Chaudhary at 9888155888. either personally / through messenger or by registered post, for preparation of Architectural Drawings, Structural Design and Construction for Multi-storied Group Housing Project construction of minimum 170 **Nos dwelling units** (4bhk+Servant Room-110 Nos. Carpet area- minimum 2300 to 2400 sq ft and 3 bhk + servant Room-60 Nos. Carpet Area- minimum 1700 to 1800 sq ft) on EPC/ Turnkey Basis atPlotNo.GH-1,(Area2.5Acreswithdimensions.East188' 3"+237' 10.5", West 418' 9.5", North 272' 7", South 226' 5") Sector-8, Eco City Phase 2 Extension, Greater Mohali, Punjab from reputed Architects/firms/ contractors/Joint Ventures/individual(s) having at least 5years' experience and have executed at least two group housing/Multi story Building projects of cost 80% each or four projects of cost 50% each and having minimum annual turnover of Rs. 100.00 crore each for the last 3 years, on behalf of the Society. The tenderer will associate experienced architect at his own level. The project is to be executed by using Aluminum modular shuttering i.e. MIVAN technology. Drawings, eligibility documents, list of executed works in last 3 years along with list of technical staff and equipment's must be attached with the tender application. Non-refundable fees of rupees 28,000 has to paid as processing fee before submission of tender. All those bidders who have already paid the abovementioned amount are not required to deposit the fee again. However, they shall submit fresh/revised tender documents as per above schedule. It is made clear that if fresh/revised tenders are not submitted then their previous bid if any shall be deemed to be 'not submitted.'

Earnest money of Rs.30.00 Lacs in the shape of bank guarantee in the name of the society shall also be deposited by the bidders as and when directed.

The Financial bid shall been closed in a separate Envelope. **Technical Bid and financial bid shall be opened 06/07/2025 at High Court premises**. Bidders may refer to the already approved drawings and BOQ available on the society's website (http: // <u>www.plawyerssociety.org</u>). If deemed beneficial to enhance quality and cost efficiency, they are encouraged to incorporate their own ideas or concepts.

1. Preparation of Architectural Drawings, Structural Design and Construction of Multi- storied Group Housing Project **construction of minimum 170 Nos dwelling units** (4bhk+Servant Room-110 Nos. Carpet area- minimum 2300 to 2400 sq ft and 3 bhk + servant Room-60 Nos. Carpet Area- minimum 1700 to 1800 sq ft) **on EPC/ Turnkey Basis** at Plot No. GH-1,(Area2.5 Acres with dimensions. East188' 3" +237' 10.5", West 418' 9.5", North 272' 7", South 226' 5") Sector-8, Eco City Phase 2 Extension, Greater Mohali, Punjab including Club House with capacity of at least 500-600 persons, all weather Swimming Pool with Children Swimming Pool, and Toddlers Splash Pool, Guest Rooms, dedicated common office space. Driver waiting area etc., Covered parking at least two parking slots of each flats, adequate Guest parking, complete in all respects on turnkey basis, including providing infrastructure facilities namely Plumbing, Internal and External Water Supply, Sewerage, Electrification, Storm Water Drainage, Roads, Boundary Wall with Gates + Guard Rooms, Fire detection and suppression services, Internal conduiting/wiring works, External Electrical Services, Power Backup(3kW), electronic security system, Parks and Horticulture Works, Roof Top Rain Water Harvesting System, Gas Pipe Provisions and Broad Band optical fiber cable and intercom, including Passenger Lift & Passenger Hospital Elevators and any other work/service contingent thereto, within the premises earmarked for above building blocks as Green Building with MIVAN technology/latest technology on turnkey basis. Drawings submitted by the tenderers would become the exclusive property of the Society and the Society would have a right to call a limited bid from the qualified tenderers in case any drawing finds acceptability with the members of Management committee.

- 2. The dwelling units shall be constructed after finally been Approved Drawings of "The Punjab and Haryana High Court Bar Association Progressive Lawyer's Co-operative House Building Society Ltd". The building blocks shall be suitably got executed by the firms /contractors as Green Building with MIVAN technology. The Architectural Drawings, Structure design & drawings are to be approved by "The Management committee of the Society", as prepared and submitted by the firm in technical bid which will be capable for withstanding deadload, live loads, wind load, earthquake forces and other likely loads in most severe combination. However, Agency will get the said Architectural Drawing sanctioned from GMADA and the said Structure Design & Drawings checked and vetted from IIT,Ropar/ PEC, Chandigarh, Thapar university or Any other Reputed Structural Consultant, before starting of work & the same will have to be incorporated & executed at site by the firm without demanding any additional cost. The society will only be liable to bear the statutory/official fees, where as it will be the sole responsibility of the successful agency to bear all the logistic expenses if any, beyond the statutory/official fees. The Architectural details e.g. layout plans, building plans/ blocks, individual dwelling units plan, elevations and sections shall be provided by firm in technical bid.
- 3. Successful agency will have to construct and finish the building blocks/dwelling units, and every dwelling unit should receive adequate sun light as per provision of national building code and other relevant I.S. Codes and as per specifications fixed. The scope of work also includes infrastructure services e.g. Water Supply including construction of underground & overhead water tanks as per requirements, sewerage, storm water drainage, roads, parking, fire detection & fire alarm and suppression services, provision of gas pipe line and Broad Band optical fiber cables and intercom, solar power plant, boundary wall, external electrical services, electric sub-station, 3KW power back up for each flat, electronic security system, all electric panels, lightning arrester, street lights and parks & other horticulture work, roof top rain water harvesting system, lift within the premises earmarked for the above building block i.e. Within boundary wall. However, scope of work does not include source generation e.g. Source of water supply, electric power supply, disposal facilities i.e. sewage treatment & its disposal and storm water disposal beyond the said premises i.e. Outside the boundary wall except water supply connection, sewerage connection, storm water connection and electric connection beyond boundary wall but includes water supply storage and pumping including for fire-fighting all inside the boundary wall. All external services inside the complex will be in the scope of this work. All internal & external public health services will be designed as per latest CPHEEO norms with minimum sizes.
- 4. Lump sum financial bid should be quoted as rates per square meter/ft. by the Architects/Firms/Contractors/Joint Ventures/Individual(s)for Preparation of Architectural

Drawings, Structural Design and Construction of project including services mentioned above, the same shall be passed on to the Society.

- 5. Eligibility criteria & Earnest Money: Preparation of Architectural Drawings, Structural Design and Construction for Multi- storied Group Housing Project construction of minimum 170 Nos dwelling units (4bhk+Servant Room-110 Nos. Carpet area- minimum 2300 to 2400 sq ft .and 3 bhk + servant Room-60 Nos. Carpet Area- minimum 1700 to 1800 sq ft) on EPC/ Turnkey Basis State of Art Multi-storied Group Housing Project at S.A.S Nagar, Mohali from reputed Architects/firms/contractors/JointVentures/individual(s)havingatleast 3 years' experience and who have: -
 - A) Executed at least two grouphousingprojectofcost80%eachor four projects of cost 50% each of the total construction value.
 - B) Minimum annual turnover of Rs. 100.00 Crore in eachoflast3years as per audited Balance Sheet.
 - C) Additional qualifying criteria
 - Bidder should have successfully completed at least one Building (s) work containing minimum (G+5 stories).
 - The bidder should have successfully completed/ongoing one work having double basement in Residential/Non-Residential Building.
- Similar nature of work means a multi storied MIVAN Technology/ RCC framed structure for residential/institutional use or housing projects. The cost of work executed by the applicant shall be updated @ 10% per annum.
- For annual turnover, financial status duly audited by chartered accountant will be submitted for last three years.
- Tenderer should have necessary licenses for carrying out sanitary and electrical works etc. or should have necessary experience in the field.
- Any company/firm while submitting tender can use the work experience of its subsidiary/Joint ventured company. And the companies/firms which intend to get qualified based on experience of the parental company/ group company/ joint ventured company own works, shall also be considered. Further, the financial parameters of the subsidiary or Parental Company can be used by the other one for qualification.
- For solvency, the applicant will have to produce the bankers' certificate which should not be More than three months sold.
- Completionperiodwillbe36months. The time period also includes the approvals and permission from concerned authority.
- 1 Envelope A, super scribed as "Technical bid", will contain details Architectural Drawings, proof in support of eligibility, organization structure, financial information including turnover of last three years with balance sheet duly audited and self-attested, detail of similar works/ buildings completed in last 3 years, on-going projects (under execution or awarded),performance report of works, details of technical and administrative personnel to be employed for the work, detail of construction plan and proof of equipment and machinery to be used in carrying out the works of multistoried buildings. Technical bid shall be rejected if the bidder fails to attach above documents. Earnest money will also be enclosed in Envelope-A. The Technical Bids and Financial bid shall be **opened on** 06/07/2025 at High Court Premises at Chandigarh at 11.00 am. Opened Envelope B, superscribed as "Financial bid" will contain financial bid/offer and will only be opened for

the Technical Qualified Bidders.

- 1.1 The Architectural Drawing, Qualification document will be evaluated first. Financial bids of eligible and responsive applicants will be opened after evaluation of technical bids. The tenderer should come prepared for a short presentation of their project on the day of opening of tender.
- 1.2 Earnest money of Rs.30.00 Lacs will be in the form of DD or Deposit at call or Bank Guarantee by scheduled bank to be made in favor of *'The Punjab and Haryana High Court Bar Association Progressive Lawyer's Co-operative Society Ltd.* The earnest money is to be as and when directed.
- 1.3 The managing committee reserves the right to verify all the statements in respect of applicants to establish their capability/capacity for construction of works. Tenderer must provide the contact address. The committee shall have the right to relax any condition of tender at any time.
- 1.4 The managing committee reserves its right to reject any or all offers / proposals without assigning any reason. Nothing will be payable to the agency if any offer is rejected by the Society, even if any agency has incurred any expenditure for preparation of documents.
- 1.5 Performance Guarantee: Successful tenderer will deposit 3% performance Guarantee. Earnest money will be released after submission of bank guarantee.
- 1.6 Mobilization advances 2% at the time of Signing of contract+3% after getting of all statutory clearances for start of construction work i.e. total 2%+3%= 5% will be given to the successful bidder upon furnishing of above-mentioned performance Bank Guarantee (PBG) On commencement of construction and submission of running bills 10% would be adjusted out of mobilization advance.

President, The Punjab, and Haryana High Court Bar Association Progressive Lawyer's Co-operative House Building Society Ltd.



INTRODUCTION AND

INSTRUCTIONSTOBIDDERS

INTRODUCTION&INSTRUCTIONSTOBIDDERS

1. **GENERALDESCRIPTION:**

1.1 This invitation of bid is open to all the bidders who fulfil the eligibility criteria as laid down in this Tender Document. The work involves Preparation of Architectural Drawings, Structural Design and Construction of Multi- storied Group Housing Project construction of minimum 170 Nos dwelling units (4bhk+Servant Room-110 Nos. Built up area- minimum 2300 to 2400 sq ft .and 3 bhk + servant Room-60 Nos. Built up Area- minimum 1700 to 1800 sq ft) on EPC/ Turnkey Basis atPlotNo.GH-1,(Area2.5Acreswithdimensions.East188' 3"+237' 10.5", West 418' 9.5", North 272' 7", South 226' 5") Sector-8, Eco City Phase 2 Extension, Greater Mohali, Punjab including Club House, Swimming Pool, Children Swimming Pool, Toddles Splash Pool, Covered parking as per ESS, Guest parking, Consultant cabins, Shops, Guest Houses, Driver Dormitory, Yoga center, Meditation Centre, Indoor and Open Gymnasium, Acupressure Bed, Kids Children Play, Sand Pit. Library, Badmintoncourt, BasketBallcourt, Tenniscourt, Jogging Track, FloorFountain, Party Deck,

Amphitheatre, Spill out, Deck with Sun shelf, electronic security system complete in all respects on turnkey basis, including providing infrastructure facilities namely Plumbing, Internal and External Water Supply, Internal External Sewerage system, Internal Electrical conducting/wiring work, Storm Water Drainage, Roads, Boundary Wall with Gates + Guard Rooms, Fire detection & fire alarm and suppression services, External ElectricalServices,100%PowerBackup,Electronicsecuritysystem,Parks and Horticulture Works, Roof Top Rain Water Harvesting System, Provision for Gas Pipe and Broad Band optical fiber cables including Passenger Lift& Passenger Hospital Elevators and any other work/service contingent thereto, if necessary for completion of work up to the minimum level of getting occupation/completion certificate from with MIVAN technology/latest technology on turnkey basis.

- 1.2 TheworkisproposedtobecarriedoutatplotNo.GH-1, Sector-8, EcoCityPhase2 Extension, Greater Mohali. Plans showing the location of site can be seen at website www.**Plawyerssociety.org** of the Society.
- 1.3 The time allowed for carrying out the work, as entered in the tender, shall be strictly observed by the contractor and shall be reckoned from the date on which the order to commence the work is given to the contractor.

2. INSTRUCTIONSTOBIDDERS

- 2.1 Lump sum Rates in per square meter should be quoted for whole scope of work as per table provided in Section–3.
- 2.2 Tender, not accompanied with process fee of Rs. 28,000/, as depicted in the NIT, shall not be considered / opened.
- 2.3 The tenderer shall visit the site to acquaint itself with the actual site conditions, access, availabilityofmaterialsandotherrelatedproblemsunderwhichtheworkmustbe performed.
- 2.4 No extra claims made in the consequence of ignorance or misunderstanding or site conditions etc. or on grounds of insufficient description will be allowed later.

- 2.5 The tenderer will associate experienced architect at his own level. The tenderer shall have experience of Aluminum Modular Shuttering for executing the work on MIVAN technology.
- 2.6 Lump sum financial bid should be quoted as rates per square meter by the Architects/Firms /Contractors/Joint Ventures/Individual(s)for Preparation of Architectural Drawings, Structural Design and Construction of project including services mentioned above, the same shall be passed on to the Society. Secondly bidder may be given chance to buyback extra units that can be constructed on the plot within permissible GMADA guidelines. The rates of these may also be submitted by bidder during the bidding process and that much amount will be recovered/Deducted from the final Construction cost. Some other modality which benefits the society in price and quality maybe worked out during negotiations, the bidders may also submit their suggestion regarding this.
- 2.7 The tenderer shall obtain all information relating to local regulations, bye laws, application of all laws relating to this work at its own level. No additional claims shall be admissible on this account. The successful agency will be responsible for arranging all statutory clearance required for construction of the project from concerned authorities before start of construction and after completion of construction of the project including Occupation/Completioncertificate.Thesocietywillonlybeliabletobearthestatutory /Official fees, whereas it will be the sole responsibility of the successful agency to bear all the logistic expenses if any, beyond the statutory/official fees.
- 2.8 The tenderer or his identified sub-contractor should possess required valid licenses for executing the electrification, Fire detection & fire alarm and suppression services, water supply, sanitary works or any other connected work required to be carried out at site and should have executed similar works in the past.
- 2.9 Thetenderershallinitialallcorrections/cuttingsinhistenderasregardtoLumpsumrates as per financial bid. Non-compliance of this condition will render the tender liable to be rejected.
- 2.10 The approval of the acceptance of tender will rest with society, which does not bind itself to accept the lowest tender and reserves to itself the authority to reject any or all of tenders received without assignment of any reason.
- 2.11 The rates of the tenderers shall remain valid fora period of 180 calendars days from the date of opening of the pricebid and if a contractor submits a tender limiting the period of validity to a date earlier, then he shall be liable to be blacklisted and his earnest money shall standforfeited without prejudice to other rights and remedies available to the society.
- 2.12 If any tenderer modifies or withdraws his tenders after opening of the price/financial bids subsequently, while on one hand he is liable to be blacklisted, on the other hand his earnest money shall be forfeited without prejudice to other rights are available to the society.
- 2.13 The earnest money deposited for the tender will not be returned to the tenderers / firms till the acceptance of tender or six months, whichever is earlier.
- 2.14 All sort of Taxes i.e. works contract Tax, Income Tax /Education cess /Labor Cess Charges oranyotherleviesimposedbyGovt.atanystagewillbedeductedasapplicablefrom the bills of contractor as per the rules/acts/instructions of the Govt. from time to time. Presently, the deductions for Income Tax @ 2.00% and labour cess @ 1% are applicable. GST will be paid extra as applicable. (as per government rules)
- 2.15 If the tenderer is an individual, he shall sign the tender documents above his full typewritten name with seal and current address.
- 2.16 If the tenderer is a proprietary firm, the tender documents shall be signed by the proprietor as a bove his full name/name of his firm with seal with its current address.

- 2.17 If the tenderer is a firm in partnership, the tender documents shall be signed by all the partners of the firm above their full names and current addresses or alternatively by a personholdingpowerofattorneyforthefirm.Inthelattercaseacertifiedcopyofthepower of attorney should accompany the tender document. In both cases a certified copy of the partnership deed and current address of all the partners of the firm with its seal should accompany the tender document.
- 2.18 If the tenderer is a Limited Company or a Corporation, the tender documents shall be signed by a person duly authorized by the Company / Corporation. The Officer who will give the power of attorney to that person for signing the tender document shall be competent to give such power of attorney in the Memorandum of Articles of Association. The tender document must accompany the copy of the power of attorney given to that person. The Company / Corporation should also furnish a copy of the Memorandum of Articles of Association duly attested by a Public Notary.
- 2.19 Thetendererisexpectedtoexaminecarefullyallinstructions,conditions,Sections.Failureto comply with the requirements of bid submission will be at the bidder's own risk. Pursuant tovariousClausesofthesebiddocumentsthebidswhicharenotsubstantiallyresponsiveto the requirements to the Bid Documents will be rejected.
- 2.20 Price / financial bid of only those tenderers will be opened (after scrutiny & evaluation of **"Technical Bids" as contained in Envelope 'A')** who meets the qualification criteria as mentioned in Section 1 of the Tender document.
- 2.21 Tenderer shall carefully examine the bidding documents and fully inform themselves as to all the conditions and matters which may in any way affect the work or the cost thereof.
- 2.22 Thebidpreparedbythetendererandallcorrespondenceanddocumentsrelatingtothebid shall be written in English or Hindi Language only.
- 2.23 Nopriceescalationispermissibleduringtheentireexecutionoftheproject.
- 2.24 Nointerestshallbepaidonearnestmoney, security deducted and performance Guarantee.
- 2.25 The original bid shall be typed or written in indelible ink and shall be signed by a person dulyauthorizedtobindthebiddertotheContract.Proof of authorizationshall befurnished in the form of a certified copy of a Power of Attorney, which shall accompany the bid. All pages of tender document shall be signed by the person or persons signing the bid.
- 2.26 All witnesses and sureties shall be persons of status and probity, and their full names, occupations and addresses shall be stated below their signatures.
- 2.27 Thepricebidsoftheagencieswhofailtomeetthequalificationcriteriawillnotbeopened.
- 2.28 The envelopes shall indicate the name and address of the tenderer clearly to enable the bid to be returned unopened in case of necessity in accordance with the bid conditions. The bidders should use the proper envelopes with the bid documents.
- 2.29 Nobidshallbeacceptedunlessitisproperlysealed.Biddersshallnotbeallowedtofillinor seal their bids at office of the Society.
- 2.30 Tenderers are requested to submit the bids well in time on or before the stipulated due dateand time.
- 2.31 Any bid received by society after the deadline for submission of bids prescribed by the Society, will be rejected and returned unopened to the bidder.

3. <u>CostofBidding</u>

Thetenderershallbearallexpensesassociated with the preparation and submission of its bid and the Society shall in no case be responsible or liable for reimbursement of such expenses, regardless of the conductor out come of the bid ding process.

4. <u>Brand Names</u>

Brand Names specified by the tender shall be followed. In an alternative or when the brand names are not mentioned / not available, Society will specify the makes to be used and its decision in this regard will be final and binding on the contractor.

5. <u>StampDutyandLegalCharges</u>

Whenever required, under Government regulations, it shall be incumbenton the successful tenderer to pay stamp duty on the Contract and legal charges for preparation of the Contract Agreement, as applicable on the date of execution of the Contract Agreement.

6. <u>PlantsandEquipmentmandatoryrequired.</u>

The tender erwill submit the list of plants and machinery required for execution of work

7. <u>Bid Openings</u>

- 7.1 The Management committee of the society will open the first envelope containing the "Technicalbids and Finacial Bid "int hepresence of Bidders/representativeswhochoosetoattendthe opening of the tender at Society Office in **Punjab** and Haryana High Court Premises , sector 1, Chandigarh at 11.00 am on 06/07/2025.
- 7.2 The "Technical bids" are complete and are with requisite earnest money and processing fee, whether the documents have been properly signed and whether the bids are generally in order. Those bids which are without the requisite earnest money and processing fee or are incomplete will be rejected and shall be sealed without going into further details of bids.

8. <u>Process to be Confidential</u>

8.1 After the public opening of "Technical bids" and "Price or financial bid", information relating to the examination, clarification, evaluation and comparison of bids and recommendations concerning the award of Contract shall not be disclosed to Bidders or other persons not officially concerned with such process until the award of the Contract to the successful tenderer has been announced.

8.2 Any effortsby a bidder to influence the Management committee on matters relating tobids under study in the process of examination, clarification, evaluation and comparison of bids and in decisions concerning award of Contract, may result in the rejection of tenderer's bid

9. <u>DeterminationofResponsiveness</u>

- 9.1 Prior to the detailed evaluation of Bids, Management committee will also determine whether each bid is substantially responsive to the requirements of bidding documents.
- 9.2 Tothisclause, a substantially responsive bid is one which conforms to all the terms, conditions and specifications of the bid ding documents without material deviation or reservation. A material deviation or reservation is one which affects in any substantial way the scope, quality or performance of the works.
- 9.3 If a bid is not substantially responsive to the requirements of the bidding documents, it will be rejected by Management committee and may not subsequently be made responsive by the bidder having corrected or withdrawn the non-conforming deviation or reservation.
- 9.4 The office bearers of the society reserves its right to relax any of the qualifying norms prescribed for the bidders after opening of the bids for any bidders in case his concept or offer finds acceptance which does not constitute a material deviation or reservation in bid provided that the acceptance thereof does not prejudice to affect the relative ranking order of any Bidder in the evaluation of bids.

10. <u>RATETOBEQUOTED</u>

Ratesshallbeenteredinwordsandfigures(both)onlyinthespaceprovidedinpriceBid.In the event of variation of rate in words and figures tender may be rejected or otherwise the lower or the lowest value shall be considered.

11. <u>AwardCriteria</u>

11.1 President will have the right to award the tenders on the advice of office bearers on the basis of majority votes, to tenderer whose bid has been determined to be substantially responsive to the Bidding Documents and who has offered the competiative Price provided further that the tenderer has the capability and resources to carry out the Contract effectively.

12. <u>Society'sRighttoAcceptanyBidandtoRejectanyorallBids</u>

12.1 President will have the right to award the tenders on the advice of office bearers on the basis of majority votes and reserves the right to accept or reject any bid and to amend bidding process and rejectall bids prior to a ward of contract without there by incurring any liability to the affected tenderers or any obligation to inform the affected tenderer or tenderers for the grounds for the Society's action.

13. NotificationofAward

13.1 Prior to the expiry of the period of bid validity prescribed by Society, the Society will notify thesuccessfultenderer bymailto be confirmed inwritingby registered letterthat his bid

Has been accepted .No further correspondence will be entertained by The Society from the unsuccessful tenderers.

14. AGREEMENTS

14.1 Agreement will be drawn for work by the successful tenderer with of the Society.

15. <u>Signing of Agreement</u>

15.1 The successful tenderer shall sign the Contract Agreement within 15 days of receipt of the letter of acceptance/ notification of acceptance.

Signature of Tenderer with seal

President

SECTION-3)

FINANCIALBID/OFFER

FINANCIALBID/OFFER

Name of work: - Preparation of Architectural Drawings, Structural Design and Construction ofMulti- storeyedGroupHousingProjectconstruction of minimum 170 Nos dwelling units (4bhk+Servant Room-110 Nos. Built up area- minimum 2300 to 2400 sq ft .and 3 bhk + servant Room-60 Nos.Built up Area- minimum 1700 to 1800 sq ft)on EPC/ Turnkey Basis atPlotNo.GH-1,(Area2.5Acreswithdimensions.East188' 3"+237' 10.5", West 418' 9.5", North 272' 7", South 226' 5") Sector-8, Eco City Phase 2 Extension, Greater Mohali, Punjab including Club House, Swimming Pool, Children Swimming Pool, Toddlers Splash Pool, Covered parking as per ESS, Guest parking, Consultant cabins, Shops, Guest Houses, Driver Dormitory, Yoga and Meditation Centre, Indoor and Open Gymnasium, Acupressure Bed, Kids Play, Sand Pit, Children Library, Badminton court, Basket Ball court, Tennis court, Jogging Track, Floor Fountain, Party Deck, Amphitheatre, Spill out, Deck with Sun shelf, Fire detection & fire alarm and suppression services, electronic security system complete in all respects on turnkey basis, including providing infrastructure facilities namely Plumbing, Internal and External Water Supply, Internal and External Sewerage system, Internal Electrical conducting work, Storm Water Drainage, Roads, Boundary Wall with Gates + GuardRooms, FireFightingServices, External Electrical Services, (3KW) PowerBackup, electronic security system, Parks and Horticulture Works, Roof Top Rain Water Harvesting System, provision for Gas Piping and Broad Band optical fibre cables including Passenger Lift & Passenger Hospital Elevators and any other work/service contingent thereto, if necessary for completion of work up to the minimum level of getting occupation/completion certificate from GMADA within the premises earmarked for above building blocks with MIVAN technology/latest technology on turnkey basis.

Timelimit:36Months

Eco-CityMohali	LumpSumAmounttobequoted				
		Area	InFigures (Rupees)	InWords	
Plot No. GH-1, Sector-8,Eco-city Phase 2, Greater Mohali, Punjab	170Dwelling units complete in all respects up to atleast level of getting Occupation/ Completion Certificate and common area complete in all respect as per GMADA norms. (Rate to be quoted on per sqm of the total built-up area.)	49,721 sqm			

(A) Total Construction Cost –.....

Note: -The area may vary as per final design from the bidder and duly approved by the President on the President will have the right to award the tenders on the advice of office bearers on the basis of majority votes of, The Punjab and Haryana High Court Bar Association Progressive Lawyer'sCo-operativeHouseBuildingSocietyLtd".

SignatureoftheAgency/Bidder



SECTION-4

PAYMENT TERMS (Subject to Negotiation)

	1			
Soil Investigation Report	1%			
Submission and approval of drawings (Architectural, structural and MEP)				
Earth Work, PCC & Anti-termite Treatment in Foundation	2%			
Lift and Tower RCC Raft foundation (All towers)	5%			
Water Proofing and Basement Casting Concrete level 2	3.5%			
Water Proofing and Basement Casting Concrete level 1	3.5%			
RCC and other structural work complete				
	41 25%			
False Ceiling works	2%			
All External Plaster Work and Finishing	2%			
Roofing and terrace Water Proofing	1%			
UPVC Doors & windows	4%			
All Internal Painting	3%			
All External Painting	1%			
CC Flooring & other Flooring Work in Basement	0.75%			
Flooring, Tiling & Stonework in Superstructure	4.25%			
Woodwork, M.S. Work including Hardware	1.5%			
Internal Electrical Works	3%			
External Electrical Works	1%			
Internal plumbing piping and fixture	2.5%			
CP fittings and Chinaware	1%			
Fire Fighting & Fire Alarm and Suppression (Internal & External Works)	2%			
Road and Pavement	1.5%			
External water Supply	1.5%			
SWD work and Sewer Work	1.25%			
LPG Gas Pipe Supply	0.75%			
Ventilation Works Basement	0.5%			
D.G Set Work	1.25%			
Lift	2%			
Club House and swimming pool work	1%			
Horticulture, R.W.H. Boundary Wall, main Gate & other	1.5%			
On Full & Final Handover	1%			
TOTAL	100			

100%

- *a)* 2.5% of security deposit will be deducted from each running bill up to a maximum of 2% of total cost of project.
- b) 75% of the security will be released after 3 months of 100% completion of all works and balance25% will be released after defect liability period of two years as explained under special condition givenin this tender documents / rectification of defects whichever is more. Or the contractor shallrenew performance Guarantee of 3% of amount of tender cost till successful completion of Defect Liability Period of two years as explained under special condition givenin this tender documents.
- *c) GST will be paid as applicable on the running bill amount.*
- *d) AllotherprevailingTaxestobebornebyContractor.*
- *e)* T.D.S.willbedeductedfromeachbillasperGovt. rules.
- *f)* Mobilization advance @ 5% against bank guarantee will be paid to contractor which is recoverable at 10% of each running bills till the recovery of complete amount.

CONTRACT

OF

CONDITIONS

(SECTION-5)

CONDITIONSOFCONTRACT GENERAL

DEFINITION

TermswhicharedefinedintheContracthavethefollowingdefinitions: - CPWD

means Central Public Works Department.

The **Contract is the contract** between President of Society and the contractor to execute, complete and to maintain the works as per these bid documents.

The **contractor** is a person or corporate body whose bid to carry out the works has beenaccepted by the Society.

The Management committee of the society is in-Charge of work.

The defect liability period is the time asmentioned in the Special Condition for the Civil Works mentioned in this tender document. i. e. twoyears from completion of the 100% of all the works including getting all the approvals from all the Authorities as explained in detail in Special conditions in this Tender Document.

The **Management committee** is designated by the Society to carry out the work as contained in the bid documents.

Decision of Management committee: Except where otherwise specifically stated, **Management committee**will decide contract matter between the Society and contractorin the role of representing Society.

Delegation: Management committeemay delegate any of his duties and responsibility to other people.

Communication: Communication between parties which are referred to in the conditions are effective only when in writing. A notice shall be effective only when it is delivered (in terms of Indian Contract Act).

- **Clause-1 Security deposit.** The contractor will be required to permit the Society at the time of making any payment to him for work done under the contract to deduct such sum as well (with the earnest money deposited by him) amount to 2.5% of all moneys so payablesubject to maximum of 2% only, such deductions to be held by the Society by way of security deposit. All compensation or other sums of money payable by the contractor to the Society under the terms of this contract may be deducted from his security deposit or from any sums which may be due or may become due to the contractor by the Society on any account whatsoever and in the event of his security deposit being deducted by reason of any deduction, the contractor shall within 10 days thereafter make good in cash asaforesaid any sum which may have been deducted from his security deposit or any part thereof.
- Clause-2 Compensation for Delay: The time allowed for carrying out the work as entered in the tender shall be strictly observed by the contractor and shall be reckoned from the date on which the order to commence work is given to the contractor. The workshall throughout

the stipulated period of the contract be proceeded with all due diligence time (36 months) being deemed to be the essence of the contract on the part of the contractor which includes all approvals and permission from GMADA and all other relevant authorities. and the contractor shall pay as compensation an amount equal to 1 by 2000 of the agreement cost se which the Management committee may levy on the estimated cost of the whole work as shown by the tender for everyday that the work remains un-commenced or unfinished, after the proper dates. And further to ensure good progress during the execution of the work the contractor shall be bound in all such cases in which the time allowed for any work exceeds one month to, complete one fourth of the whole of the work before one fourth of the whole of time allowed under the contract has elapsed, one half of the work before onehalf of such time has elapsed and three-fourth of the work before three fourth such time has elapsed. Intheeventof thecontractorfailing to comply with this condition, he shall be liable to pay as compensation, an amount equal to one percent which the Management committee may levy on the said estimated cost of the whole work for everyday that the due quantity of work remains incomplete. Provided always that the entire amount of compensation to be paid" under the provisions of this clause shall not exceed two percent of the estimated cost of work as shown in the tender. TheManagement committeemayon representation from the contractor, reduce the amount of compensation and his decision, in writing shall be final. Whereas if the work is completed before the agreed time period, the proper monetary appreciation be granted to the builder which will be decided mutually at time of signing the agreement.

- **Clause-3** In any case in which under any clause in the contract, the contractor shall have rendered himself liable to pay any compensation to Society on behalf of the Society shall havepowerto adoptanyof thefollowing courses, ashemay deem best suited in theinterestof the Society:
 - a) To rescind the contract of which rescission notice in writing to the contractor under the hand of President shall be conclusive evidence and in such case the security deposit of the contractor shall stand forfeited and belong absolutely to the Society.
 - b) To employ labour paid by the society to supply material to carry out the work or any partof the work debiting the contractor with the cost of the labour and the price of the materials (for the amount a certificate of the Management committee shall be final and conclusive, against the contractor) and crediting him with the valueof the workdone in all respects in the same manner and at the same rate as if it had been carried out by the contractorunderthetermsofhiscontract.ThecertificateofManagement committee asto the value of the work done shall be final and conclusive against contractor.
 - c) To measure up the work of the contractor, and to take such part there of as shall be unexecuted out of his hands and to gives it to another contractor to complete, in which case any expenses which may be incurred in excess of the sum which would have been paid to the original contractor of the whole work has been executed by him (for the amount the certificate in writing of the Management committee shall be final and conclusive) shall be borne and paid by the original contractor and may be deducted from any money due to him by the Society under the contract or otherwise or from his security deposit.
 - d) In the event of any of the above courses adopted by the Management committee, the contractor shall have no claim for the compensation for any loss sustained by him by reason of his having purchased or procured any materials or entered into any engagement or made any advance on account or with a view to the execution of the work or the performance of the contract and in case the contract shall be rescinded under the provision aforesaid the contractor shall not be entitled to recover or be paid any sum for any workthereof, actuallyperformed underthis contract unless and until the Management committee have certified, in writing, the performance of such work and the value payable in respect, thereof,

and he shall only be entitled to be paid the value so certified.

Clause- 4 Contractor remains liable to pay / compensation if action not taken under clause 3: Inany case in which any of the powers conferred upon the Management committee byclause 3 hereof shall have become exercisable and the same shall not exercise the non- exercise thereof shall not constitute a waiver of any of the condition thereof and such powers shall not withstanding be exercisable in the event of any future case of default by the contractor for which by any clauses thereof he is declared liable to pay compensation amounting to the whole of his security deposit and the liability of contractor, for past and future compensation shall remain unaffected.

Powertotakepossessionor require removalorsellcontractor's plant: Intheeventofthe Management committee putting in force either of the power (a) or (c) vested in it under the proceeding clause he may, if he so desire to take possession of all or any tools, plant, materials and stores in or upon the works, or at the site thereof or belonging to the contractor or procured by him and intended to be used for execution of the work or any part thereof paying or allowing for the same on account at the contract rates, in case of these not being applicable at current market rates to be certified by the Management committee where certificate thereof shall be final, otherwise President may by notice, in writing, to the contractor or his clerk of the work, foreman or other authorized agent require him to remove such tools, plants, materials or stores from the premises within a timeto bespecified insuchnotice and intheeventof the contractor failing to comply with any such requisition, the Management committee may remove them at the contractor's expenseor sellthem by auctionorprivate sale,onaccountofthecontractorand athis risk in all respect and the certificate of the Management committee to the expenses for such removalandtheamountoftheproceedsandexpenses, ifany, shallbefinalandconclusive against the contractor.

- Clause- 5 Extension of time: If the contractor desire an extension of the time for completion of the work on the ground of his having been unavoidably hindered in its execution or on any other ground, he shall apply, in writing, to Management committee within 7 days of the date of the hindrance but before the expiry of the contractual period on account of which he desires such extension as aforesaid and the Management committee shall, if in his opinion (which shall be final reasonable ground) be shown therefore authorize such extension of time if any so may in his opinion be necessary or proper.
- **Clause-5(a)Contractor to submit a return every month on any work claimed as extra:** Thecontractor shall deliver in the office of President on or before 10th day of every month during the continuance of the work covered by this contract a return showing details of any work claimed for as extra and such return shall contain thevalue of suchwork as claimed by the contractor, which value shall be based upon the prices in the contract or in Schedule of rates in force in the District for the time being. The contractor shall include in suchmonthly return particulars of all claims of whatsoever kind. However arising which at the date thereof, he has or may claim to have against the Society under or in respect of or in any manner, arising out of the execution of work and the contractor shall be deemed to have waived all claims not included in such return and will have no right to enforce any such claim not so included whatsoever be the circumstances.

- Clause-6 Without prejudice to the right of the Society, under any clause hereinafter contained on completion of the work, the contractor shall be furnished with the certificate by the Management committee (hereinafter called in-Charge of work) of such completion, but no such certificate shall be given nor work shall be considered to be completed until the contractor shall have removed from the premises on which the work shall be executed all scaffolding, surplus materials and rubbish and clean off dirt from all wood works, floor, other parts of any building in, upon or around which the work is to be executed, or part of which he had in possession for the purpose of the execution thereof and the measurements in the said certificate shall be binding and conclusive against thecontractor. If the contractor shall fail to comply with the requirements of this clause as to removal of scaffolding surplus materials and rubbish and cleaning of dirt on or before the date fixed for the completion of the work, the Management committee at the expense of the contractor shall remove such scaffolding, surplus materials and rubbish and dispose of the same as he may think fit and clean off such dirt as aforesaid and the contractor shall pay the amount of all expenses so incurred and shall have no claim in respect of any such scaffolding or such surplus materials as aforesaid except for any sum actually realized on account of sales, thereof.
- Clause-7 Payments on intermediate certificates to be regarded as advances: No payment shall be made for works estimated to cost less than Rs. Twenty Lacs, till the whole of the works beencompletedandthecertificateofcompletiongiven.But, in the case of work shallhave estimated to cost more than Rs. Twenty Lacs, the contractor not submitting the bill thereof, be entitled to receive a monthly payment proportionate to the part thereof as approved and passed by the Management committee or any sub-committee constituted there in under, whose certificate of such approval and passing of the sum so payable shall be final and conclusive against the contractor. But all such intermediate payment shall be regarded as payments by way of advances against the final payment only and not as payments for the works actually done and completed and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be removed and taken away and reconstructed, or reerected or be considered as an admission of due performance of the contract or any part thereof in any respect or the accruing of any claim. Nor shall it conclude, determineor effect in anyway the powers of the Management committee under these terms and conditions or any of them as far the final settlement and adjustments of the accounts or otherwise or in any other way vary or effect the contract. The final billshall be submitted by the contractor within one month of the date fixed for completion of the work, otherwise the Management committee's certificate of the measurements and the total amount payable for work, accordingly, shall be final and binding on all parties. The amount, payable, however, shall be determined after pre-audit of the bill by the Management committee within Thirty days of the presentation of the bill by the Management committee to the Society otherwise the amount already determined by the Management committee shall become binding on both parties. Both the Management committee and the Society shall inform the contractors by registered post about the facts of the movement of the final bill and the amount thereof.
- **Clause7(a)**The deduction referred to in Clause-I herein before or such part thereof as may be due to contractor under this contract shall be payable to contractor after a period of three months has lapsed after the payment of final bill provided the contractor submit a Bank guarantee of equivalent amount valid for a period of 36 months.

- **Clause-8Billstobesubmittedmonthly:** A bill shall be submitted by the contractor each month on orbefore the datefixedbytheManagement committee forallworkexecuted inthe previous month and the Management committee shall take the requisite measurement for the purpose of having the same verified and the claim, as far as admissible, adjusted ifpossible, before the expiry of ten days from the presentation of the bill. If the contractor do not submit the bill within the time fixed as aforesaid, the Management committee may depute a member of Society to measure up the said work in the presence of the contractor whose counter signature to the measurement list will be sufficient and the Management committee may prepare, a bill from such list which shall be binding on the contractor in all respect.
- Clause-9Bills to be on printed forms/computer generated: The contractors shall submit all bills, in triplicate and the charge in the bill shall always be entered at the rates specified in the tender or in the case of any extra works ordered in pursuance of these conditions and not mentioned or provided for in the tender at the rate hereinafter provided for such work.
- **Clause-10** If the specification of estimate of the work provides for the use of any special description of material store supplied by the Society or if it is required that contractor shall use certain store to be provided by the Society (such materials and stores and the prices to be charged thereof as hereinafter mentioned being so far as practicable for the convenience of the contractor, but not so in any way to control the meaning for effect of this contract specifiedin the Section or memorandum hereto annexed) the contractor shall be supplied with such materials and stores required from time to time to be used by him for the purpose of the contract only and the value of the full quantity of the materials and stores so supplied at the rates specified in the said Section of memorandum may be set off or deducted from any sums due or thereafter to become due, to the contractor under the contract or otherwise against or from the security deposit. Materials supplied to the contractor shall remain the property of the Society and shall be kept in safe custody of contractor but shall not on any account be removed from the site of the work without the written permission of the Management committee& shall all times be opened for inspection by it. Any such materials unused and in perfectly good condition at the time of the completion of the contract shall be returned to the Management committee store if by a notice, in writing, under his hand he shall so require, but the contractor shall not be entitled to return any such materials without such consent and shall have no claims for compensation on account of any such materials to be supplied to him as aforesaid being unused by him, or any wastage in or damage toany such materials.
- Clause–11Works to be executed in accordance with specifications drawing orders etc: The contractor shall execute the whole and every part of the work in most substantial and workmen like manner, both as regards to materials and otherwise in every respect in strict accordance with C.P.W.D. specification latest edition / specifications (unless otherwise specified). The contractor shall also confirm exactly, fully and faithfully to the designs, drawing and instructions in writing relating to the work (signed by the Management committee) and lodged in the office and to which the contractor shall be entitled to have access at his office or at the site of the work. For the purpose of inspection during office hours, the contractors shall if he so requires, be entitled at his own expenses to make or cause to be made copies of the specifications and of all such designs and instruction as aforesaid.
- Clause-11ARemovalofemployeeworkmanandforeman: The Management committee shall have full powers at all time to object to the employment of any workman, Foreman or other employeesontheworksbythecontractorandifthecontractorshallreceivenoticeinwriting from the President requesting the removal of such workman from the work, the contractor shall comply with the request forth with.

No such workman, foreman or other employees after his removal from the works by orders of the Management committee shall be re-employed or engaged on the works by the contractor / sub contractor or by any other person of contractor at any time, except with the prior approval, in writing, from the President.

- Clause–12Alterations in specifications and designs: In case of any addition or alteration in original specifications, which resultinto expenditures of more than Rs.2.00 lacs (Rupees TwoLacs) than the society will compensate for such additions etc. as per DSR on the date of ten days, while his failure to do so shall continue and in case of any such failure the Management committee may rectify or remove and re-execute the work or remove and replace with other materials or articles complained of, as the case may be, at the risk and expense of the contractor.
- **Clause15Work to be open to inspections, contractor orhis responsible agent to bepresent:** All works under or in course of execution or executed in pursuance of the contract shall at all times be open to the inspection and supervision of the Management committee and the contractor shall at all times, during the usual working hours and at all other time with reasonable notice of the inspection of the the Management committee to visit the work shall have been given to the contractor either himself be present to receive orders and instruction, or have aresponsible agent duly authorized, in writing, present for thatpurpose. Orders given to the contractor's agent shall considered to have the same force as they had been given to the contractor himself.
- **Clause16Notice to be given before work is covered up:** The contractor shall give not less than Three working days notice in writing to the Management committee before covering up or otherwise placing beyond the reach of measurement any work in order that same may be measured and correct dimensions thereof be taken before the same is so covered up or placed beyond the reach of measuring and shall not cover up or place beyond the reach of measurement without the consent, in writing, of the Management committee. If any work shall be covered up or placed beyond the reach of measurement such notice having been given or consent obtained, the same shall be uncovered at the contractor's expense, or in default thereof no payment or allowance shall be made for such work or the materials with which the same was executed.
- Clause17Contractor liable for damage done and for imperfections for 24 months after 100% completion of all works: If the contractor or his work people or servants shall break, deface, injure or destroy any part of a building in which they may be working, on any building, Road,Fence,enclosureorgrass, land,cultivatedgroundorthepremises onwhich the work or any part of it is being executed, or if any damage happens to the work, while in progress from any cause whatever or any imperfection become apparent in it within twenty fourmonthsafter100% completionofallworksasexplainedunderDefectLiabilityperiod in special conditions of this tender Documents,the contractor shall make the same good at his own expenses and in default, the Management committee may cause the same to be made good by other workmen and deduct the expense (of which the certificate of the Management committee shall be final) from any sums that may be then, or at any time thereafter, may become due to the contractor or from his security deposit. Defect Liability periodis twoyears after100% completionof all theworksincludinggettingallthe approvals from all the Authorities by the contractor as explained in Detail under Special conditions of this tender document.

- Clause18Contractor to supply plant ladders, scaffoldings etc: The contractor shall supply at his own cost all material except such special material, in accordance with the contract be supplied from the Society stores, plants, tools appliances, ladders, cordage, scaffolding and temporary works required for proper execution of the work, whether original, altered or substituted and whether included in the specifications or other documents forming part of the contract referred to in these conditions or not, or which may be necessary for the purpose of satisfying or complying with the requirements of the Management committee, as toany matter as towhich, under theseconditions he is entitled to besatisfied or which he is entitled to require together with carriage thereof to and from the work. The contractor shall also supply without charge the requisite number of persons with the means and materials, necessary for the purpose of setting out works and counting, weighing and assisting in the measurement of examination at any time and from time to time of the work or material. Failingto do so, the same maybe provided by the Management committee at the expenses of the contractor, and the expense may be deducted from any money due to the contractor under the contract or from any other contract of the agency or from his security deposit or the proceeds of sale thereof or sufficient portions thereof. The contractor shall also provide all necessary fencing & lights and safety features required to protect the public from accident and shall be bound to bear the expenses of defense of every suit, actions or other proceedings at law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and cost which may be awarded in any such suit, action or proceedings to any such person or which may with the consent of the contractor be paid to compromise any claim by any such person.
- Clause19 Nochildlabourshallbeemployedonthework.
- Clause20Work on Public Holiday & SUNDAYS: No work shall be done on Public Holiday on which labour cannot be employed without the sanction, in writing, the Management committee.
- Clause21Contractorliableforpaymentofcompensationtoinjuredworkmanorincaseof death to his relations: In every case in which by virtue of the provision of section 12, sub section (1) of the workmen's compensation Act, 1923. The Society is obliged to pay compensation to workman employed by the contractor, in execution of the works. The Society will recover from the contractor the amount of the compensation so paid andwithout prejudice to the right of the Society under section 12, sub section (2) of the saidacts,TheSociety shallbeatliberty torecoversuchamountoranypartthereofbydeducting it from the security or from any sum due to the contractor, whether under this contract or otherwise.

The Society shall not be bound to contest any claim made against it under section 12 subsection (1) of the said act except on the written request of the contractor and upon hisgiving request to the Society full security for all costs for which the Society might become liable in consequence of contesting such claim.

Clause22Sum payable by way of compensation to be considered as reasonable compensation without reference to actual loss: All sums payable by way of compensation under any of thesecondition shall beconsidered as reasonable compensation without reference to the actual loss or damage sustained and whether or not any damage shall have beensustained.

- Clause22ADeduction of amounts due to Government on any account whatsoever to be recoverablefrom sums payable to a contractor: Any excess payment made to the contractor inadvertently or otherwise under this contract or on any account whatsoever and any other sum found to be due to the Society by the contractors in respect of this contract or anyother contract or work order for any sum whatsoever shall be recoverable from the contractor from the payment due to him either in respect of this contract or any other work order or contract or any other account by any other department of the Punjab Government / the Society.
- Clause23Changes in constitution of firm: In the case of a tender by partners, any change in the constitution of the firm shall be forthwith notified by the contractor to the President for his information.
- Clause24Work to be under directions of the Management committee: All works to be executed, under the contract shall be executed under the directions of and subject to the approval of the Management committeefor the time being who shall be entitled to direct at what point or points and in what manner they are to be commenced or from time to time carried on.
- Clause25:Claims for payment of any extra ordinary nature to be referred to the Society for decision: No claims for payment of an extraordinary nature, such as claims for a bonus for extra labour employed in completing the work before the expiry of the contractual period at the request of the Management committee or claims for compensation where work hasbeen temporarily brought to a standstillfor period of 5 (Five) with no fault of the contractor, if the work is stopped beyond 5 days compensation can be allowed to the extent that the same shall have been sanctioned by the Management committee.

Clause25(A): ArbitrationClause:

For any matters/disputes arising out of this contract, subject to arbitration, the courts at Chandigarh, India shall have exclusive jurisdiction. This Contract shall be goverened and construed in accordance with the laws of India. If any disputed, difference or question shall at any time arise between the Parties as to the interpretation of this contract, or arising out of, relatedorpertainingtothiscontract, or astotherights, liabilities andduties of the parties hereunder or as to the execution of the said works, shall be resolved by mutual agreement by the parties within a period of 30 days from the date of such dispute, failing which the dispute shall be referred to arbitration to be conducted by a sole arbitrator appointed by the society. The seat of the arbitration shall be at Chandigarh only.

Clause26 Deleted

Clause27 Deleted

- **Clause28Action where no specification:** All items mentioned in the Delhi Schedule of rate (DSR) shall be carried out strictly in accordance with the C.P.W.D. specification book (unless otherwise specified). If the specifications for any item are not available in the C.P.W.D. specification book, the relevant I.S.I. specifications shall be followed. In case any specifications are not available, the contractor has to submit rate analysis of item and the same is to be approved by the Management committee. The decision of the Management committee, given in writing shall be final.
- Clause29 Deleted
- Clause30 Deleted
- Clause31Unlessotherwisespecified in the contract, the term "the Management committee" referred to in the tender and contract for the work means the Management committee of the Society.

Clause32The contractor shall be responsible for making his own arrangements for securing licences for the materials and their transportation required for the works and the Society shall not be held responsible in any way for making such arrangements.

Clause33ThecontractorundertakesthatheisnotrelatedtoanymemberoftheManagement committee

- Clause34No pit shall be dug by the contractor near the site of the work for taking out earth for use on the work. In case of default, the pit so dug will be filled in by the Society at the cost of the contractor plus 14% charges.
- Clause35All royalty and compensation for building stone, bajri and stone metal or any other material should be included in the rates to be quoted and is payable by the contractor.
- Clause36The rates given are for the work inclusive of all material, all labour, all taxes i.e. octroi charges, salestax, all duties and all other taxes as applicable including labour welfarecess. Only Gst will be paid extra as applicable.
- Clause37It willbetheresponsibility of thecontractor to ensure that trees at the site of work and in the vicinity or their fruit etc. are not damaged by his labour or agent. Cost of damage done, if any, will be assessed at the discretion of the Management committee and deducted from the bill of the contractor. In case of any objection by Govt. the same will be resolved by contractor at his own cost with intimation to Client.
- Clause38Thecontractorshallprovideathisowncostseparatelatrine,bathingenclosuresand platform for use of the men and women labour and keep them clean to the satisfaction of the Management committee. He should also arrange at his own expense for clean drinking water, housing, medical facilities necessary for the welfare of the labour employed at his work. In case of his failure the same shall be provided by the Society at contractor's cost. AnydisputeregardingthiswillbesettledbytheManagement committeewhosedecisionwill be final and binding. Contractor will also follow the fair wage clause attached. All the rulesof SHE (Safety, Health and Environment) as enforced by Govt. to by strictly followed by contractor.
- Clause39 Deleted
- Clause40 Deleted
- Clause41Noclaimonaccountoffluctuationinpricesduetowaroranyothercausewillbe entertained except for those of cement and steel which shall be as per Section-9 of this document.
- Clause42The contractor shall be liable to make good all damages causedby breakage from the moment the stores are handed over to his charge.

Clause43 Deleted

- Clause44The contractor will inform the C.M.O about the employment of laborer on the work for carrying out Malaria Surveillance.
- Clause45 Theterms and conditions of the agreement have been explained to me/us and l/we clearly understand them.
- **Clause46**The contractor at his own cost shall provide necessary barriers signals and all other safety measures as required while excavating, constructing, cutting road or laying pipeline etc. wherever or otherwise necessary so as to avoid accidents. He shall also indemnify the Society against any claim for compensation arising out of negligence in this respect. The centering and shuttering for RCC work, the scaffolding and other such constructional arrangementsmadebythecontractorforexecutionofvariousitemsoftheworkshallbe

made sound and safe by contractor and as per specifications. Any mishap/accident which may occur due to inadequacy in above arrangements shall be the entire responsibility of the contractor.

Clause47 Deleted

- Clause48Incasewherefinalbillis likely tobefor aminus amount, thesecurity deposit willbe with held till the final bill is passed and the recoverable amount is first made good.
- Clause49 TheworkwillbestrictlycarriedoutasperCPWDspecificationandconditionsalso.
- Clause50Duringthedefectliabilityperiodiftheagencydoesnotremovethedefectas notified by the Management committee, the recovery will be made as per the DSR + prevailing ceiling premium for Punjab Schedule of Rate items and as per the market rate for Non DSR items or as per Actual Market Rates whichever is more and contractor will not have any objection to that.

Clause51NOT Applicable

- Clause52Incaseoffloodingofsiteonaccountofrain,floodoranyothercauseorany damage caused due to act of God, whatsoever, no claim financially or otherwise shall be entertained not withstanding any other provisions elsewhere in the tender documents.
- Clause53.a)In the interpretation of agreement the order of descending importance for any ambiguity or discrepancy shall be as follows:
 - Additionalconditionsandadditionalspecificationsofcontractsanddrawings.
 - CPWDstandardspecificationlatestbookwithup-to-datecorrectionslipsand CPWD specifications latest book with up to date correction slips.
 - GeneralConditions
 - B.I.S.Codes
- Clause53.b) The work will be carried out according to CPWD specifications latest book which will form a part and parcel of this contract schedule of rates.
- Clause53.c)Itemandmaterialsnot coveredbythespecificationgiveninthiscontractasawhole shall be covered by the manufacturer's specifications along with relevant and latest Indian Standard Codes/other codes.
- **Clause53.d)** In the absence of any definite provisions on any particular issue in the specifications/codes, reference may be made to the relevant latest I.S. specifications where even the I.S. codes are silent, the design and construction shall conform to sound Engineering practices as approved by the Management committee.
- Clause54The contractor shall, within 30 days of the award of the work and release of 2% mobilisation advance, prepare and submit detailed work programmes based upon

Bar Chart/PERT/CPM Chart and obtain the approval of the Management committee.

The Contractor shall be required to submit a report every month regarding the completion of the work in relation to the targets shown in Bar Chart.During the progressofthework, heshallberequiredtomodify andupdatetheBar Chart in the event of any slack.In the event of any delays within the month he will indicate in the succeeding report his firm proposal for making up the loss of time. If in the opinion of the Management committee it is felt that work is not proceeding as per schedule, the contractor shall mobilize further resources of plants, materials and labours and make up for the loss of time.This is however, without prejudice to the provision under clause-2 of the general conditions of contract.

Clause55EarnestMoneyDepositsandRefund:Deleted

Clause56RefundofSecuritydeposits:

- If no defects are noticed within 3 months of 100% completion of all the works and the contractor has fulfilled all the obligations as per this contract, then 75% of the "Security Deposits" will be released to him.
- Thebalanceamount of the "SecurityDeposit" will be released after the expiry of the defects liability period of twenty four months which will start from date of completion of 100% of all the works by the contractor at site which also includes approval sfrom various authorities such as fire approval from fire authority, lift approval from lift approval authority i.e Chief Lift Inspector , All Electrical works approval from chief Electrical inspector, releasing of Regular electrical connection from Electricity supply Authority, Rain water harvesting well certificate from GMADA /local Authority, Occupation certificate from Estate officer, GMADA, Mohali, Water & Sewer Connection from GMADA/ any other Authority and NOC of solar water heating installation from relevant authority etc. or any other approval from any Authority etc...
- Earnest Money and the security deposit will not carry any interest during the period mentioned above.
- Clause57The Contractor shall be responsible for watch and ward and handling, storing of all material handed over to him by the Society, or brought by him to the site.Nothing extra shall be paid to him for this.
- **Clause58**The bar bending schedule for the reinforcement shall be prepared by the contractor based on the structural drawings prepared by the agency & approved by the Management committee and as per the requirement of the Architect/Site Engineer free of cost.
- Clause59All items of works, which are specialized in nature in the opinion of the Architects/ the Management committee such as pile foundation, fiber-glass work, aluminum fabrication, water proofing etc. shall be done by specialized and competent agencies/firms approved by the the Management committee and such works shall be executed as per approved fabrication drawings/specifications submitted by the specializedagenciesandapprovedbytheArchitects/theManagement committee.
- Clause59(i)Contractor at his own cost shall obtain comprehensive all risk (C.A.R.) insurance policy to cover damages to and loss of property and persons as under:

- a) Civil work under construction including all adjacent boundary walls, power lines, sewer lines, road telephone cable etc. shall be totally protected against all risk during construction.
- b) Materialatsiteincludingplants, machinery and other perishable item.
- c) Injury to persons belonging to the Society, their employees, architects, the Management committee, Consultants, Suppliers and Visitors to site or adjacent premises.
- **d)** Compensation payable under N.C.A. on account of injury to all workers belonging to contractors or sub-contractors' organization.

Clause 59 (ii) The Contractor at his own cost shall arrange a adequate capacity of Crècheas per requirements to keep the children of labour employed at the siteduring the entire construction period.

Clause60Deleted

Clause61

- a) Detail working drawings on basis of which actual work is to proceed will be submitted by the agency and approved by the Society. Variation of any nature atthe time of actual execution of work will not entitle the contractor for claiming additional rate, as the payment will be made on the lumpsum rates quoted by the contractor forming part of this tender document and nothing extra is payable to the contractor due to change in actual working and the drawings approved by the Society.
- **b)** In case of any discrepancy between approved specifications, additional specifications and drawings etc., the interpretation of the Management committee of Society shall be final and binding on the contractor.
- c) Discrepancies if any noted by the contractor in the various drawings must be got clarified before execution of work.
- (i) Should there be any discrepancy due to incomplete description/ambiguity or omission in the drawing and other document whetheroriginal or supplementary during the contract, found during currency of the installation work, the contractor shall immediately on observing the same, draw the attention to the Management committee and the decision by the Management committee regarding this matter shall be binding on the contractor.
- **ii)** The additional conditions and additional specifications of contract shall be read in conjunction with the general conditions of thecontract, CPWDspecifications of work, drawings and other documents relating to the work.
- iii) Large size detail drawings shall take precedence over small drawings and in caseof any difference the contractor shall get the same clarified before execution of the work.
- **Clause62**The layout and alignment and the orientation of the different member of the construction of work should be carried out after thoroughly checking the drawings and obtaining, clarification if any. The setting out work should be carried out by precision surveying instrument and got approved by the Architect/ the Management committee.Thecontractorshallarrangetheequipmentandinstrumentsathiscost.
- Clause63The work shall be carried out under the direction, supervision and in stages as instructed by the Management committee.On acceptance of the tender, the contractor shall intimate the name of his accredited representative who would be responsible for taking instructions from Architects/ the Management committee for carrying out the work.
- Clause64Contractor will make adequate arrangements for arresting of lightening as the work progresses.He will also make requisite provision of lights for work and aviation lights.No extra payment will be made for the above provisions.
- Clause65All relevantISI codes as directed by the Management committee shall be kept by the contractor at his own cost in his office at site.
- Clause66Testingofcementconcretecubesandotherfieldtestsshallbecarriedoutatsite for which the contractor shall establish and maintain a suitable laboratory at hisown cost.Cube testing machine, weighing balance, weights etc. shall be got calibrated after every six months.
- Clause67a)Wherever pipes or any other members/frames are to be fixed to wall or RCC surfaces thecontractor shall be required to userawalplugs for which nothing extra will be paid to the contractor on this account.
 - **b)**Only tubular steel scaffolding shall be used for all works, unless otherwiseauthorised by Architect/ the Management committee nothing extra shall, however, be paid.

Clause68 Deleted

SIGNATUREOFTHETENDERER

President

CONTRACTSLABOURREGULATIONS

- 1. Short titles: These regulations may be called Punjab (1) Public Works Department Contractors Labour Regulations.
- 2. **Definitions** in these regulations unless otherwise expressed or indicated the following wordsandexpressionshallhavethemeaninggivenhereinagainstthemrespectivelythat is to say.
 - "Labour" mean workers employed by the contractor directly or indirectly through sub contractor or other person or by an agent on his behalf.
 - Fair wages means wages whether for time or piece work notified at the time of submitting tender of the work and where such wages have not been so notified the wages prescribed by the Punjab Public Works Department for the district in which the work is done.
 - "Contractors" shall include every person whether a sub-contractor or headmen or agent employing labour on the work taken on contract.
 - "Wages" shall have the same meaning as defined in the payment of wages Act, 1936 and include time and piece rate wages.
- 3. Display of notice regarding wages etc. The contractor shall before he commences his work on contract display and correctly maintain and continue to display and correctly maintain in a clean and legible condition in conspicuous place on the work notice inEnglish and in the local Indian language spoken by the majority of the workers giving the fair wages notified or prescribed by the Punjab Public Works Department and the hours of work for which such wages are earned.
- **4. Payment of wages** (1) Wages due to every worker shall be paid to him direct, (2) all wages shall be paid in current coin or currency or in both.

5. FIXATIONOFWAGESPERIODS:

- The contractor shall fix wage periods in respect of which the wages shall be payable.
- Nowageperiodshallexceedonemonth
- Wages of every workman employed on the contract shall be paid before expiry of tendaysafterthelastdayofwageperiodinrespectofwhichthewagearepayable.
- When the employment of any worker is terminated by or onbehalf of the contractor the wages earned by him shall be paid before the day of expiry of the month in which his employment is terminated.
- Allthepaymentofwagesshallbemadeonworkingday.

6. Wagesbookandwages slipetc.

[1] The contractor shall maintain a wage book of each worker in such form as may be convenient but this shall include the following particulars.

- a. Rateofdailyormonthlywagesorcontractwages.
- **b.** Nameofworkonwhichemployed.
- c. Natureofworkonwhichemployed.
- **d.** Total number of days worked during each wage period and total amount payablefor the work during wage period.
- **e.** All deduction made from the wages with an indication in each case of the groundfor which the deduction is made.

- f. Wagesactuallypaidforeachwageperiod.
- [2] The contractor shall also maintain awages lip for each work eremployed on the work.
- [3] The authority competent to accept the contract may grant an exemption from the maintenance of Wage Book and Slip to a contractor who in his opinion may not directly or indirectly employ more than 50 persons on the work.

7. [1] Fines and deductions which may be made from the wages of a worker shall be paid to him without any deduction of any kind except the following.

- Fines.
- Deductions for absence from duty i.e. from the place or places where by the term of his employment he is required to work. The amount of deduction shall be proportion to the period for which he was absent.
- Deduction for damage to or loss of goods expressly entrusted to the employed person for custody or for less or more for which he is required to account where such damage or loss is directly attributable to his neglect or default.
- AnyotherdeductionwhichPunjabGovernmentmayfrom,timetotimeallow.
- [2] No fine shall beimposedon aworker and nodeduction for damageshallmade befrom his wages until the worker has been given an opportunity or showing causes against such fines or deductions.
- [3] The total amount orfines which may be imposed in any one wage period on a worker shall not exceed an amount equal to five paisa in a rupee of the wage payable to him in respect of that wages period.
- [4] No fine imposed on a worker shall be recovered from him installment or after expiry of 60 days from the date on which it was imposed.
- 8. [1]Register of fines act-8 [1] The contractor shall maintain a register of fines and of all deductions for damage or loss. Such register shall mention the reason for which fine was imposed or deductions for damage or loss, which was made.
 - [2] The contractor shall maintain a list in English and local Indian Language clearly defining acts andomissions for which penalty orfine canbe imposed. Heshall display such list and maintain it in a clear and legible condition at conspicuous place on the work.
- **9 Preservation of Books –** The wage book, the slip and the register of fine deductions required to be maintained under the regulation shall be preserved for 12 months after the date of last entry made in them.
- **10 Powers of Labour Welfare Officer to make investigation or Enquiry –** The Labour Welfare Office or any other person authorized on their behalf shall have power to make enquiry with aviewto ascertaining and enforcingdue and proper observances of the wage clause & the provisions of these regulations. He shall investigate into any complaint regarding the default made by contractor sub contractor in regard to such provision.
- **11 Report of labour welfare officer.** The Labour Welfare Officer or any other person authorized as aforesaid shall submit a report of the result of his investigation or enquiry indicating the extent if any to which the default has been committed andthe amount of fine recoverable in respect of the acts of omission of the labourers with a note that necessary deduction from the contractors bill be made and wages of the other dues be paid to the labourers concerned.

- **12 Appeal against the decision of Labour Welfare Officer** Any person aggrieved by the decision and recommendation of the labour welfare officer or other person so authorized may appeal, against such decision to the Labourcommissioner but subject to such appeal, the decision of the officer shall be final and binding upon the contractor.
- **13** No partyshall beallowed toberepresentedbyalawyerduringanyinvestigation orenquiry appeal or any other proceedings under these regulations.
- **14 Inspection of Register** The contractor shall allow inspection of the wages book and wages slip to any of his workers or to his agent at a convenient time and place after due notice received or the labour welfare officer or any other person authorized on his behalf.
- **15 Submission of return**–Thecontractorshallmaintainandsubmitperiodicalreturnasmay be specified from time to time.
- **16 Amendment**–Fromtimetotimeaddoramendtheseregulationsandoranyquestionasto the application, interpretation or effect of these regulation the decision of the Labour Commissioner to Punjab Government or any other person authorized in that behalf shallbe final.
- **17** The contractor shall be responsible to provide to the entire satisfaction of the Management committee at his own expenses the following amenities for the labour employed by him.
 - a. Suitabletemporaryhuttingaccommodation.
 - **b.** TrenchLatrine, bathingenclosure, platforms, separately formen and women with regular clear Drinking Water.

In the event of his failure to provide any or all theamenities, the same shall be provided by the Society and cost thereof shall be recovered from the contractor. Any dispute regarding above point shall be settled by the Management committee and his decision shall be final.

NOTE:-The contractor shall take adequate precautions during execution of works to ensure that no accident of any type should occur at site due to any of the reason whatsoever it may be. However, it is made clear that Society or its employees willnot be responsible in any way at all for any accident at site & no compensation of any kind will be paid by Society on this account. It is only contractor/ executing agency who will be exclusively responsible for any type of accident or mishap atsite during execution of work for which contractor/ executing agency will pay adequatecompensationoranyotherreliefrequiredasperlaw orawardbyanycourt of law at his own cost & Society or its employees will not pay anything for it.

SIGNATUREOFTHETENDERER

PRESIDENT

FAIRWAGESCLAUSES

a) The contractors hall pay not less than fairwage to labour engaged by him on the work.

Explanation:

Fair wage means wage whether for time or piece work notified at the time of inviting tenders of the work andwhere such wages havenot been so notified, thewage prescribed by the Public Works Deptt., Building and Road (Branch), Punjab for the district, in which the work is done.

- b) The contractor shall, not with standing the provisions of any agreement to the contrary, caused to be paid fair wages to labours, indirectly engaged on the work including any labour engaged by his sub contractors in connection with the said work, as if the labourers had been directly employed by him.
- c) In respect of labour directly employed on the works for the performances of thecontractor's part of this agreement the contract shall comply with or cause to be complied with the Public Works Department. Contractors' Labours Regulations made byGovernment from time to time in regard to payment of wages period, deductions from wages, recovery of wages not paid and deductions unauthorisedly made, maintenance of wage register, wage slip, publication of wages and other terms of employment inspection and submission of periodical returns and all other matters of such like nature.
- d) TheSociety shallhavetherighttodeduct,from themoneyduetothecontractor, any some required or estimated to be required for making good the loss suffered by a worker or workers by reason of non-fulfillment of the conditions of the contract for benefit of the workers, non-payment of wages or deductions made from his or their wages which are not justifiedbythetermsofthecontractorfor non-observanceoftheregulationisreferredtoin clause (c) above).
- e) Vis-à-vis the Society, the contractor, shall be primarily liable for all payments to be made under and for the observance of the regulations aforesaid, without prejudice to his right to claim indemnity from his sub contractors.
- f) The regulations aforesaid shall be deemed to be a part of this contract and any breach thereof shall be deemed to be a breach of this contract.
- **g)** Attendance card should invariably be issued by the contractors to their workers, which should be returned to the contractors concerned at the time of receiving payment of their wages.
- **h)** Before making payment to the contractors, the authorities concerned should obtain a certificate from the contractor that he has made payment to all workers connected with the execution of the work, for which the payment is being made.
- i) The normal working hours of workers employed by contractors for the execution of work allotted to them should be 8 hours per day with a break of 2 hours during summer, one hour during winter after continuous work of 4 hours at the most. The spread over should in no case exceed 10 hours, workers working beyond these hours, should be paid overtime wages, at the double the ordinary rate of their wages, calculated by the hour.

SIGNATUREOFTHETENDERER

PRESIDENT

AFFIDAVIT

(TobesubmittedonNonJudicialStamppaper)

I	S/oSh		residentof	
		Section		
	Distt		contractor	/

partner / share holders (strike out whichever is not applicable) (firm or contractor) do hereby solemnly declare as under:-

- 1. That the person/ firms black listed by PunjabGovt. / Govt. of India from time to time never had any connection and interest in my business.
- 2. Thattheabovesaidcontractor/persons/firmsdonothaveanysubstitutinginmybusiness and
- 3. Thatthesaidpersons/firmsarenotemployeeofmyfirmandarenotinanyway connected with my business.

DEPONENT

WITNESS

DATED:

I do hereby solemnly declare and affirm that the above declaration is true and correct to the bestof my knowledge and belief. No part of it is false and nothing has been concealed.

DEPONENT

WITNESS

DATED:

(6 1.1–6)

SPECIALCONDITIONSOFCONTRACT

SPECIALCONDITIONS

1. <u>GENERAL</u>

1.1 All items shall be carried out strictly in accordance with the C.P.W.D. specifications book, with upto date amendments (unless otherwise specified). If the specifications for any item are not available in the C.P.W.D. specification, the relevant I.S.I. specifications shall be followed and wherever specified, MORTH specifications, DSR-2016, SSR-2004 (for MES) shall be followed. In case any specificationsarenotavailable, the decision of the Management committee, given inwriting shall be final.

NOTE:CPWDSpecificationsmeansCentralPublicWorksDepartmentspecificationswith latest amendments

- 1.2 Notwithstanding the sub-division of the documents into these separate sections and volumes every part of each shall be deemed to be supplementary to and complementary of every other part and shall be read with and into the Contract so far as it may be practicable to do so.
- 1.3 The contractor will provide such recesses, holes, openings etc. as directed by the Management committee, as required for the Electrical / Sanitary/ Fire fighting and other services work and nothing shall be payable on this account.
- 1.4 No pit will be dug by the contractor near thesite of the work for taking out earth for use on the work. Incase of default, the pitsodug will be filled in by the Society at the cost of the contractor plus 14% I charges.
- 1.5 Any trees, branches, bushes, crops, which may be required to be cut during the execution of the work, shall be handed over to the Society.
- 1.6 The water to be used for the work will be got tested by the contractor at his own cost from the approved laboratory with regard to its suitability for use in the work and nothing extra shall be paid on this account. The potable water shall be used in construction of the Project.
- 1.7 Nothingextrashallbepaidonaccountofanydamageduetorain,floodoranyotheractofGod.
- 1.8 Material collected in excess shall not be paid for and if the same is not removed from the site of work within one month from the date of final measurement, the same shall become the property of the Society.
- 1.9 Noclaimonaccountof fluctuationinpricesduetoanycausewillbeentertainedexceptforsteeland cement which shall be per Section 9 of this document.
- 1.10 The contractor shall have to make arrangement of crèche for nourishment of children where 10 or more women worker shall be engaged by him on work. The children shall be under the supervision of one women worker who shall provide them with milk and toys to play in the tent provide at site.
- 1.11 The contractor will not have any claim in case of delay by the Society in removal of trees or shifting, raising removing of telegraph, telephone or electric lines (over head or underground) and other structure if any which comes in the way of the work.
- 1.12 Unless otherwise provided in the contract documents, material such as rubble, gravels, sand, Murram, Kankar, earth soil etc. obtained from excavation and material obtained by dismantling of existingstructureshallremaintheproperty of the Society. If deemed fit, the Management committee may, with the approval of competent authority, permit the use of such materials on the work in substitution of materials which the contractor would have otherwise provided, subject to the condition that asuitabledeductionshallbe made in the rate of the the such materials are used.
- 1.13 If due to any circumstances the site of work is shifted to another nearby site in the same town, the agency will have to execute the work on the same rates. Items & condition of allotment letter. No claim on account of change of site shall be entertained.
- 1.14 The rates included in the price bid cover the cost of filling, water retaining structures; testing for water tightness to the full satisfaction of the Management committee.
- 1.15 The contractor will plan transportation of construction materials components and equipments over public roads in accordance with traffic regulations as applicable at the time and without causing any

obstructiontoothertrafficorcausingaccident.Noclaimwhatsoeverwillbeentertainedonthis account.

- 1.16 The contractor will take all safety precautions pertaining to construction of works such asexcavation, trenching blasting demolition provisions of scaffolds ladder working platforms, gangways, mixing asphalted materials, electric arc and gas welding. Use of hoisting and construction machinery shall be governed by relevant provisions of relevant safety codes and as directed by the Management committee and nothing extra shall be payable on this account.
- 1.17 The contractor will make his own arrangements for water supply and electric power required for the work and shall make necessary payments directly to the Water Supply & Power Department concerned and nothing extra shall be payable on this account. Only recommendatory letters shallbe issued by the Society if requested by the contractor, but Society shall in no way be responsible for delay in getting required connections and no claim will be entertained in this regard.
- 1.18 Some restrictions may be imposed by the security staff etc. on the working and/or movement of labour, materials etc. the contractor shall be bound to follow all such restrictions/instructions and nothing extra shall be payable on this account.
- 1.19 The Contractor will take all precautions to avoid accidents by exhibiting necessary caution boards day and night, speed limit boards, red flags, red lights and providing barriers. He shall be responsible for any damages and accidents caused to existing new work due to negligence on his part. No hindrance shall be caused to traffic/running of institution during the execution of the work.
- 1.20 The Contractor will be responsible for the watch and ward of the building, safety of all fittings and fixtures including sanitary and water supply fittings and fixtures against pilferage and breakage during the period of installation and thereafter till the building is physically handed over to Society.
- 1.21 The Contractor will submit work programme/ BAR CHARTS for successful completion of contract within 7 days from the date of award of work, in case he fails to do so the Management committee will prepare such programme which shall be binding on him and the contractor should submit the progress report fortnightly in the form of photographs and bar/ achievement chart alongwith the detail of work done during the fortnight.
- 1.22 If the Contractoris required towork intwoormoreshifts (including nightwork), noclaim what soever will be entertained on this account not with standing the fact that the contractor will have to pay the labour and other staff engaged directly or indirectly on the work according to the provisions of the labour regulations and the agreement entered upon and / or extra amounts for any other reasons.
- 1.23 All centering / shuttering and scaffolding materials such as shuttering plates, horizontal runners, vertical supports and bracing etc. shall be of steel/aluminum/ply.
- 1.24 The contractor will provide at his own cost separate latrine, bathing enclosures and platform for use of the men and women labour and keep them clean to the satisfaction of the Management committee. He should also arrange at his own expense for clean drinking water, housing, medical facilities necessary for the welfare of the labour employed at his work. In case of his failure thesame shall be provided by the Society at contractor's cost. Any dispute regarding this will be settled by the Management committee whose decision will be final and binding. Contractor will also follow the fair wage clause attached.

1.25 SampleFlat

To determine the acceptable standard of the workmanship, the Contractor shall complete a sample flat of all type at lowest applicable floor completing all items of work and services such required for obtaining Occupation Certificate etc. in all respects.

The contractor has to supply line diagram of Public Health, Electrical, Fire fighting and telephone for each flat for the guidance of each Member to carry out maintenance in future.

1. <u>EXECUTIONOFWORK</u>

2.1 Contractor shall make provision for hangers, sleeves, structural openings and other requirements well in advance to prevent hold up of progress of the construction Section.

- 2.2 The work shall be executed strictly as per the time schedule agreed upon (within the stipulated time period of the contract) and activity wise / bar chart shall be prepared & submitted for detailed monitoring monthly.
- 2.3 In case the work of any item of work contains defects of a nature which do not endanger the structural stability of the work, it may be accepted (subject to the decision of Management committee) and the paymentthereofshallbe made to the contractor at reducedrates. The decision of the Management committee in this regard shall be final and binding.
- 2.4 The contractor or his identified sub-contractor should possess required valid licenses for executing the electrification, firefighting, water supply, sanitary / sewerage works etc. or have executed similar works.
- 2.5 TheContractor shallengagespecialized agency for executingthefollowingitems of work which has adequate technical capability and equipment and has the experience of having executed at least two similar items of work of similar magnitude:
 - (a) Anti-termiteTreatment
 - (b) WaterProofingTreatment
 - (c) AllDoorWindowshuttersFactoryMade.
 - (d) InternalElectricalwork.
 - e) Plumbing/Sanitary work.
 - f) Externalwatersupply, sewerageetc.
- 2.6 The specialized agency for the work shall be got approved from the Management committee before commencement of the actual item of work. The Contractor shall submit the list of specialized agencies proposed to be engaged by him along with the information of their technical capability and list of similar works executed by the specialized agency in the past.
- 2.7 Plinthlevelofbuildingshouldbehigherfromtheroadlevelasperdrawings.

3. DRAWINGS

- 3.1 Contract drawings are diagrammatic but shall be followed as actual site conditions permit. Any deviations made shall be in conformity with the architectural and other services drawings and approval of deviation to be taken from the Management committee.
- 3.2 Architectural drawings shall take precedence over Contract or other services drawings as to all dimensions.
- 3.3 Contractorshallverify all dimensions at site and bringtothe noticeof the Management committee any or all discrepancy or deviations noticed. The decision of the Management committee shall be final.
- 3.4 All drawings approved by the Management committee for the work are the property of the Society and shall not be lent, reproduced or used on any other works than intended, without the written permission of the Management committee.

REFERENCEDRAWINGS

- 3.6 TheContractorshallmaintainonesetofalldrawingsissuedtohimasreferencedrawings.
- 3.7 All corrections, deviations and changes made on the site shall be shown on these reference drawings for final incorporation in the completion drawings.

COMPLETIONDRAWINGS

3.8 Contractorwillsubmit3setof"asbuiltdrawings"ofallArchitecturalandcivilworksrequiredfor completioncertificateandoccupancycertificateofproject.

Obtaining completion/ occupation Certificatewithin a reasonableperiod of 30 days from Estate officer, GMADAMohalior anyother localAuthorityas applicable,will be the liabilityof contractor andallrelatedcost,ifanytobebornebyContractorexceptcompoundingfeesonaccountofcarrying out of work as per architectural drawings. Any compounding fees on account of deviation of architecturaldrawingsbythecontractoratsitewillbebornebythecontractoronly.

Further, it will be exclusively contractor's responsibility to get released regular water and sewer connectionfrom GMADAor electricalconnectionfrom ElectricitySupplyAuthority/Department and any other relevant authority on behalf of Society at his own cost for which nothing will be paid by Society. However, the Government fees, if any on this account will only be borne by Society subject to production of receipts by the contractor.

- 3.9 Completiondrawingsforwatersupply,sanitaryworkandexternalservices:Allthecompletionofthe work and before issuance of certificate of virtual completion the contractor shall submit to the Management committee three sets of layout drawings drawn in at approved scale indicating the following:
 - a) Site plan showing final position of building block and internal electrical and public health servicesasactuallyexecutedshowingdistances,invertandformationlevelsofthelinesetc.
 - b) Allfloorplansshowinglayoutofpipes, sanitarywares, valvesetc.

4. <u>MATERIALS</u>

- 4.1 The Contractor shall make his own arrangement for supply of materials including cement & steel. The contractor shall be responsible for all transportation and storage of the material at site and shall bear all the related cost including Tax. The Management committee shall be entitled at any time to inspect or examine all such materials. The contractor shall provide reasonable assistance for such inspection or examination as may be required.
- 4.2 Materials shall conform to the latest standards & CPWD specifications as amended up to date and carry certification mark.
- 4.3 All materials brought on the project shall be got approved by contractor from the Management committee before use.
- 4.4 Paint conforms to relevant IS specification and of make indicated in the contract, will be arranged by the contractor.
- 4.5 The cement paint primer, ready mixed paint, bitumen and distemper etc. shall be brought in the original sealed containers of the approved manufacturers by the contractors at the site of the work. Thematerial brought to the site at one time shall be sufficient for the use in work for atleast 15 days work. The empty containers shall not be removed from the site till the concerned item is completed fully and the Management committee give permission for its removal.
- 4.6 All material brought by the contractor to the site of work shall be open to suitable test by the Management committee andinaccordancewiththeapprovedmake.Thecontractorshallaffordall suchfacilities and bear thecharges as the Management committee may require forcollecting, forwarding and testing all such samples and shall hold the material represented by the sampleuntil tests have been made the material found as per standard. The contractor will supply the material required for the test samples without any charges.

- 4.7 Any cement slurry added over base surface or for thecontinuation of concreting for better bond is considered to have been included in the Lump Sum Rate.
- 4.8 The contractor if required on the instructions of the Management committee will have to submit the proper recordforprocurement and useofmaterials and documentary proofintokenof having purchased the cement, steel etc. in the shape of bill & delivery challan along with test report.
- 4.9 The consignment of steel procured by the contractor can be further got tested from approved laboratory. The cost of same shall be borne by the contractor.

4.10 <u>STEEL</u>

TMT Steel will be procured by the contractor and following conditions must be fulfilled while arranging the steel.

- i). The steel shall be purchased from those firms which are authorized manufacturer of steel as mentioned in the list of the approved makes.
- ii). The contractors / firms can be asked to give a documentary proof showing the details of manufacturer. The appropriate sample of the consignment of steel procured by the contractor/ firms shall be got tested from any approved laboratory. The cost of the test shall be borne by the contractor.
- iii). The contractor/firm will submit a documentary proof showing the test report of the manufacturer of the lot purchased by him.
- iv). ThecontractorwilluseTMTFe500steelormore.
- v). Bindingwireshallbeusedindoubleloopforbindingthe steel.

4.11 <u>CEMENT</u>

Cement will be procured by the contractor and following conditions must be fulfilled while arranging the cement.

- (a) The cement to be purchased confirming to IS. Marked 43 grade Ordinary Portland Cement (OPC) as **per IS: 8112 (latest**) packed in conventional Jute/HDPE bags of 50 Kg each.
- (b) The Cement shall be purchased from those firms which are authorized manufacturer of cement as mentioned in the list of the approved makes.
- (c) CementfromMinicementplantshallnotbe used.
- (d) The contractors/firms will give a documentary proof showing the details of manufacturer. The appropriate sample of the consignment of cement procured by the contractor/firmsshall be got tested from any approved laboratory. The cost of the test shall be borne by the contractor.
- (e) The contractor/firm will submit a documentary proof showing the test report of the manufacturer of the lot purchased by him.

4.12 SITELABORATORY

Thecontractorshallinstallthelaboratoryatsitesofworkhavingfollowingmachinery equipments for conducting day to day tests at his own cost :-

- i) Machinefortestingofcompressivestrengthofcementconcretecubes.
- ii) Slumptestapparatus.
- iii) DigitalWeighingmachinesof2kg/10kgcapacity.
- iv) Oven
- v) I.S.sieves
- vi) Cubeframesofsize150mm
- vii) F.M.Testing Machine.

vi)Or any other Equipment required for any other tests to be conducted at site as directed by the Management committee and also required by Third Party Inspection Agency appointed by the Management committee for which nothing will be paid to the contractor.

5 <u>STORAGEOFMATERIALS</u>

- 5.1 Allmaterialsshallbestoredinapropermannerprotectedfromnaturalelementssoastoavoid contamination and deterioration.
- 5.2 Contractor'sstoresshallbeopentoinspectionbytheManagement committeeatallreasonable hours.
- 5.3 LocationofstoresandstorageyardsshallbeapprovedbytheManagement committeepriorto construction and occupation.
- 5.4 Contractorshalltakeadequateprotectionofthestoresmaintainedbyhimathisownexpense.

6 INSPECTIONANDTESTINGOFMATERIALS

- 6.1 Contractor shall if required produce manufacturer's test certificates for the materials supplied by him.ThetestcarriedoutshallbeaspertherelevantIndianStandards.
- 6.2 ForexaminationandtestingofmaterialsandworksatthesiteContractorshallprovidealltestingand gaugingequipmentnecessaryforthispurpose.Allsuchequipmentshallbetestedforcalibrationat any approved laboratory, if required by the Management committee.
- 6.3 TheContractorshallcarryoutthevarioustestsasenumeratedinthetechnicalspecificationsofthis tenderdocumentandthetechnicaldocumentsthatwillbefurnishedtohimduringtheperformance of the work at his own cost.
- 6.4 All the tests either on the field or outside concerning the execution of the work and supply of materialsbytheContractorshallbecarriedoutbytheContractorathisowncost.
- 6.5 The Contractor shall provide for the purpose of inspection access ladders, lighting and necessary instruments at his own cost.
- 6.6 All results of inspection and testswill be recorded in the inspection reports, Performa of which will be approved by the Management committee. These reports shall form part of the completion documents.
- 6.7 The contractor shall at his own cost, change/replace all materials and equipment found defective and carry out the whole work again test to meet the requirements of specifications.
- 6.8 Contractor shall also perform all such tests as may be necessary and required by the local authorities to meet the municipal or other bye laws in force at his own cost.

7. Supervisionofworks

- 7.1 The entire work shall be open for inspection at all times by the Management committee or any member of the Society and Third-Party Inspection, Agency appointed by Management committee. The Contractor shall carry out all instructions given during inspection and shall ensure that the work is being carried out according to the technical specifications of this tender and technical documents furnished to him during the performance of work.
- 7.2.1 No concreting shall be carried out by the Contractor until the Management committee or its representativehasinspected the formwork and reinforcement and certified in writing that concreting may proceed. Any Concrete poured without such prior written approval shall be cut out and removed by the Contractor at his own cost.

7.2.2 In case samples have been drawn by representative of Society or Third Party Inspection Agency appointed by Societybut the report and test result of samples have not been received, the payment of running bills; final bill & security will be released after the contractor furnished an undertaking in shape of indemnity boundon the following lines:-

"I _______ son of Shri _______ resident of _______ doherebyundertake to bear the recoveries if any, levied by Society on account of any adverse results for the samples taken by the representative of Society from the work of _______. I further undertake that I will reconstruct the structure if declared unsafe due to result of the samples. I also undertake that in case of any item of work contains defect of nature which do not endanger the structural stability of the work, it may be accepted and the payment thereof shall be made to us at the reduced rates decided by the the Management committee which will be final and binding on us.I have no objection if all the recoveries are made from any other contract executed withSociety as well as with other Organization."

8 <u>METRICCONVERSION</u>

- 8.1 All dimensions and sizes of materials and equipment given in the tender documents are conventional metric sizes.
- 8.2 Any weights or sizes given in the tender having changed due to metric conversion, the nearest equivalent sizes accepted by Indian Standards shall be acceptable without any additional cost. Decision of the Management committee shall be final and binding on the Contractor.

9 <u>REFERENCEPOINTS</u>

- 9.1 Contractorshallprovidepermanentbenchmarks,flagtopsandotherreferencepointsfortheproper execution of work and the same shall be preserved till the end of the work.
- **9.2** All such reference points shall be in relation to the levels and locations given by the Management committee

10. <u>SITEORDERBOOK</u>

- 10.1 The Contractor shall maintain a site order book and cement consumption register at the site office. The contractor will ensure the safe custody of Site Order Book and Cement Register at Site ofWork.
- 10.2 Instructions recorded in Site order book will carry the same meaning as if given in person to contractor or his authorized representative.
- 10.3 Contractorisboundtocarryoutallsuchinstructionsgiventohim.

11 <u>SITECLEARANCE&CLEANUP</u>

- 11.1 The Contractor shall, from time to time, clear away all debris and excess materials accumulated at the site.
- 11.2 After all the fixtures, equipment, panels, appliances etc. have been installed and commissioned, Contractor shall cleanup the same and remove all plaster and paint stains, stickers, other foreign matter and discoloration leaving system in a fit and ready to use condition.
- 11.3 The preparation of new approach road entrance or repair of the existing approach road and its maintenance during the execution of the work including its restoration shall all be carried out by the contractor and nothing extra shall be payable on this account.
- 11.4 Site shall mean the land(s) or other places on in into or through which the work is to be executed under the contract OR any adjacent land, path, OR street, through which the work is to be executed under the contract oranyadjacent landpath orstreet which may be allotted orusedforthe purpose of carrying out the contract.
- 11.5 The contractor shall get the layout for installation of plant / machinery, labour huts, stores, site office, workshop etc. approved from the Management committee in advance. Nothing extra shall be payable on this account.
- 11.6 Clearance of sites at the commencement and completion of work shall be done by the Contractorsat his own cost. It includes clearance of site, jungle, bushes, undulations trees drains, culverts, temporarystructures including any underground features etc. before start of work and dismantling of underground or of other structures, features constructed by the Contractor for execution of works, after completion of work including disposal of malba.

12 <u>LICENCESANDPERMITS</u>

12.1 Contractor shall keep constant liaison with the GMADA/local municipal authority and all other statutoryauthorities(likePowerDepartment)whoseapprovalsandpermissionsarerequiredbefore, during course of execution and after execution of the work.

12.2 It shall be the Contractor's responsibility to obtain the approvals and permissions of work done by him to enable the Management committee to apply for occupation certification. Contractor shall comply with all requirements of the appropriate authorities, submit documents, test reports and conduct such tests as may be required by the concerned authority to its full satisfaction. The contractor shall require to co-ordinate with the concerned authorities and pay for any and all fees and permits required for the installation and subsequent use of this work at his own cost.

13 <u>COMPLETIONCERTIFICATE</u>

On completion of work, a certificate shall be furnished by the contractor, countersigned by the licensed supervisor, under whose direct supervision the installation was carried out. Thiscertificate shall be in the prescribed form as required by the local authority. The contractor shallbe responsible for getting the entire installation duly approved by the authorities concerned and shall bear all expenses in connection with the same.

14 QUALITYCONTROLANDMONITORING

The Contractor shall guarantee that the materials and workmanship are the best of theirrespective kinds for the service intended and that all items of work will be free from all inherent defects in workmanship and materials. He shall also guarantee that works will not fail in any respect due to quality of materials, workmanship and methods of construction. The specifications assume a proper degree of skill on the part of contractor and workmen employed.

15 DEFECTLIABILITYPERIOD

- a) The defect liability periodwill be two years, which will start from thedate of completion of100% of all the works by the contractor at site which also includes approvals from various authorities suchas fire approvalfromfireauthority, lift approval fromlift approvalauthority.eChief LiftInspector, All Electrical works approval from chief Electrical inspector, releasing of Regular electrical connection from power department, Rain water harvesting well certificate from GMADA /local Authority, Occupation certificate/Completion from Estate officer GMADA Mohali and any other Authority approvals, Water & Sewer Connection from GMADA/ any other Authority and NOC of solar water heating installation from relevant authority and any other approval from any Authority etc.
- b) The defect notice shall meet with the following minimum requirements to the entire satisfaction of the Management committee:
 - i) Plaster work and flooring work to be repaired soon after these appear or brought to his notice either during contractor's monthly inspection or by the Management committee or otherwise. Repair shall be carried out in a manner which does not affect the aesthetics.
 - ii) Defective joinery such as door, window, cup board shutters, chowkhats, wire gauge, glass panes, fitting, fixtures etc. to be rectified / replaced immediately after the defects appear.
 - iii) Anystructuraldamage/fault/defecttoberectifiedassoonasthesameappears.
 - iv) White washing / colour washing, distempering, painting ,Acrylic Emulsion & POP Puning etc. (Frequency of item as per PWD Norms) shall be done where aver the finished surface is found damaged due to any reason during above period of defect liability.
 - v) All rain water pipes, sun-shades are to be repaired and cleaned as and when required during the above period.
 - vi) Leakageofwaterofanykindinthebuildingtoberectifiedimmediatelyonpriority.
 - vii) All electrical / public health installations including wiring, pipelines etc. made in the building tobe repaired / rectified / replaced as soon as any defect has appeared / notice.
 - viii) The contractor shall make good all the items / works damaged during the repair being done by him and bring the same in original form.
 - ix) The contractor shall maintain a register in the building for daily recording the defects, damages, shortcomings noticed by user and address the problem within three days else he will approach the Management committee for extension of this time.

- c) To fulfil the objectives laid down in sub clauses of 15 above, the contractor shall undertake detailed inspection of the building at least once in a month. The Management committee can reduce this frequency in case of emergency. The contractor shall forward to the Management committee the record of inspection and rectification every month. The contractor shall pay particular attention on the maintenance of building during rains and rainy season.
- d) The Management committee may issue notice to the contractor to carry out maintenance of defects, ifany for brought to his notice. The contractor shall remove the defects within the period specified in the notice and submit to the Management committee a compliance report. Absence of notice, will not absolve the contractor from his responsibility.
- e) In case the contractor fails to make good the defects, the Management committee may employ and other person to make good such defects and all expenses consequent and incidental there to shall be borne by the contractor.
- f) The contract shall not be considered as completed until a maintenance certificate has been signed by the Management committee and delivered to the contractor stating that the works have been completed. The Itureucertificate shall be given by the Management committee.

16 PERFORMANCEGUARANTEE

TheContractorshallguaranteetheperformanceofequipment/machinery/materials/system during the defect liability period of two years as specified above.

17 <u>ACCESSIBILITY</u>

The Contractor shall verify the sufficiency of the size of shafts and openings of clearance in cavity walls and suspended ceilings for the proper installation of his cabling. His failure to communicate insufficiency of any of the above shall constitute his acceptance of sufficiency of the same. The contractor shall locate all equipment which must be serviced, operated or maintained in fully accessible positions. The exact location and size of all access panels required for each concealed equipment or other devices requiring service shall be finalised and communicated in sufficient time, to be installed in the normal course of work; failing which, the Contractor shall make all the necessary repair and changes at his own expense.

18 <u>UseofFlyAsh</u>

Wherever earth filling/ embankment work is to be executed, the same has to be executed in accordance with the provision in the Fly Ash Notification dt. 14/4/1999 and 27/8/2003 i.e. filling / embankment construction by pond ash/ fly ash as specified in the aforesaid notification after getting the design & material approved from Management committee.

19 DetailofEngineers/foreman&supervisortobeemployedbythecontractor

The contractor will provide & depute at least followings taff for carrying out & supervision of work:

- 1. 1 Number Engineers holding degree in civil engineering from a recognized university with atleast 10 years experience in construction of multistoried buildings.
- 2. 2NumberEngineersholdingdiplomaincivilengineeringfromarecognizeduniversity/ institution with atleast 10 years experience in construction of Multistoried Buildings.
- 3. 1no.EngineersholdingdiplomainElectricalEngineeringfromarecognizeduniversity/institution with atleast 10 years experience in construction of Multistoried Buildings.
- 4. Sufficient no of foremen, charge men, Supervisors, mates & skilled/unskilled labour etc. to the satisfaction of the Management committee.

The Management committee can demand for production of degrees and diploma of the engineers employed by contractor which will be produced within 24 hour of its demand.

SPECIALCONDITIONSFORTHEPLUMBINGSYSTEM

1. <u>GENERAL</u>

Unless otherwise specified the work shall be carried out as per PWD specification (with latest amendments). Before use all the material will be tested as per the latest PWD / BIS specifications. The agency or sub contractor should have valid license for the plumbing system. Appointment of licensed sub contractor, if any for plumbing work shall be got approved from Management committee.

Contractor will submit 3 sets of complete shop drawings of plumbing / water supply / electrical / drainage system to the Management committeefor approval. The work will be executed as per approved design and PWD specifications.

2 <u>TESTINGUPVC&GIPIPES</u>

- 2.1 TestingafterinstallationshallbecarriedoutasperrelevantprovisionsofP.W.D./B.I.Sspecifications.
- 2.2 AtestregistershallbemaintainedandallentriesshallbesignedanddatedbyContractorsand representatives of Management committee.
- 3 Contractorshallberesponsiblefordamage/pilferageoftheplumbing/sanitaryfittingstillthe houses are handed over to the department.
- 3.1 4"i/drainwaterpipeswillbeprovidedatonepipeper400sft.roofarea.
- 3.2 Connectionofrainwaterpipestobemadewithrainwaterharvestingsystem.

SPECIALCONDITIONSFORESTATEPUBLICHEALTHSERVICES

A WATERSUPPLYPIPES&GENERAL

- i) Wherever the natural ground is below the soffit of pipe and pipe can not be laid on hard ground, the pipe will be supported on pillars of length outer dia of pipe + 11.5cm on either side and 23cm wide with suitably designed foundation and spaced in a way that each pipe is properly supported maximum spacing of 3mtr centre to centre.
- ii) Pipewillbearrangedbythecontractorathisownsource.
- iii) PipewillbetestedasperrelevantIScodeinfactorypremisesbytheManagement committee.
- iv) D.I special will normally be used however at places like at joints with sluice valves etc., C.I. specials may be used after obtaining permission in written of the Management committee.
- v) Ratewillincludesalltypesofjointsandjointingmaterial.
- vi) Suitability designed RCC thrust block and duly approved by the Management committee shall be casted at change of alignment and all other locations requiring same.
- vii) Successful bidders will get the surge analysis of pipe network done. Any technical measures required from water hammer point view in rising main & distribution system will be part of contract price and nothing extra will be paid on this account.
- viii) The lead joints should normally be avoided but when become necessary the pig lead to be used for these joints will be of 99.9% purity.
- ix) Water supply and storm water drainage will be laid in berm on one side of road whereas sewer line will be laid on other side.
- x) No water line should cross manhole/lamp holes of sewerage system and storm water drainage and alternatearrangementbemadeatsuchlocationssimilarlywhereversewer/stormwaterdrainage

crosseachother, the levels befixed that there is elevation difference in soff it of one and crown other pipe with preference that storm water drain lies at higher level

- xi) D.I. pipes will be as per IS 8329:1994 with upto date amendments in min. dia of 100mm i/d makeelectro steel.
- xii) D.I.fittingswillbeasperIS9523:1980withuptodateamendment.
- xiii) D.I.pipesshallbelaidasperIS12288:1987andtestedasperIS8329:1994withuptodate amendment.

TherubberGasketshallbeEPDMqualitytermiteproof

TherubberGasketshallbesupplieddulymanufacturedbythefollowingfirms.

- a) M/sPlastoRubberIndustriesKolkata.
- b) M/sPaulRubberIndustriesPvt.Ltd.,Kolkata.
- c) M/sDurablePolymerProudetsPvt.Ltd.Kolkata.
- xiv) Horizontallycastdoubleflangedpipesshallconformto7181:1986withuptodateamendment.
- xv) C.I.fittingwillbeasperIS1538:1976withuptodateamendment.
- xvi) TestingofalltypesofpipeshallbedoneasperPWDspecificationbeforeinstallation.\

B. <u>SPECIALCONDITIONSFORUNDERGROUNDTANKANDBOOSTINGPUMPS</u>.

The capacity of under groundwater storage tank shall be provided equal to one day capacity will be provided taking 5persons per flat and water requirement at 135 LPCD. The pumping machineryshall be for six hours per day to fill the overhead tanks at terrace for each dwelling unit.

C <u>SPECIALCONDITIONSEWERAGE&STORMWATERDRAINAGE</u>

- 1. All pipes/drains will be laid on hard ground. Wherever the natural ground is below soffit of pipe/bed of drain, same shall be properly supported on pillars.
- 2. PipewillbearrangedbythecontractorasperapprovedspecificationsdulyISImarked.
- 3. MinimumwidthoftrenchexcavatedforpipewillbeasperPWDspecification.
- 4. All surplus earth will be disposed of at least 1Km away at a location to be specified by the Management committee. Back filling will be done in15 cm layerswhichwillbethoroughlyrammed & watered so that no settlement taken place later on.
- 5. Stonewareglazed pipeswill be asper IS651-1980with latestamendments.All pipe will be dulyISI marked &accompaniedwith BIScertificates.Laying of S.W.pipeswill bedone as per IS4127-1983 with latest amendments.
- 6. SFRCmanholescoverswillbeheavy dutyandwillbeasperIS12592 Codes.
- 7. ConstructionofManholeswillconformtoIS4111:1986typicaldesign approved.
- 8. Dewatering involved anywhere in any service & structure will be done by contractor at his owncost & nothing extra will be paid on this account.
 - After a sufficient interval has been allowed for the joints to set, the pipes will be tested under aheadofatleast1.20m andinno caseunderagreaterheadthan6.00metersofwaterabove the top of the pipes. In addition the sewers shall be examined for leaks of land water making its way through the walls and joints.
 - ii) Theinteriorsurfaceofeachsewershallbekeptclearofalldirt,cementandsuperfluous materials of every description as the work proceeds.
- 9. Afterpropertestingbackfillingetc.allpipesendsinmanholeswillbesuitablyplugged.

- 10. Manholes will be provided at junctions, change of size, drops etc in addition to spacing mentioned in item.
- 11. Wherever sewer/storm water drainage cross each other, the levels be fixed that there is elevation difference in soffit of one and crown other pipe with preference that storm water drain lies at higher level

SPECIALCONDITIONSFORHORTICULTURE

- 1. Theheightofplantshouldbelessthan5ftandtheirsteamshouldnotbelessthan20mm.The height of shrub should not be less than 3ft.
- 2. The plant which to be planted at site shall be grown in mini bag and minimum height of such bag should not be less 1.5 inch, for shrub plant.
- 3. Theplantshallbehealthyanddisease free.
- 4. The mail/Gardener staff should have sufficient experience and the Supervisory staff should have technical knowledge regarding the plants and their up keeping.
- 5. The minimum qualification of supervisory staff should be diploma in Horticulture/Degree in the related field.
- 6. The species of plant i.e. tree/shrubs/hedges will be decided in consultation with the Management committee. Contractor shall adhere to the different operation required in normal conditionsduring maintenance of the work.
 - i) Mtc.ofgrassylawn

a)	Grasscutting	Thriceinaweek
----	--------------	---------------

b) Watering Thriceinaweek

The grass should be weed free

ii) Mtc.ofhedges:-

Watering, hoeing, weeding and pruning Oncein 15 Days

iii) Mtc.ofedges:-

Making proper edging along walk

Flowerbedsfloweringmoundetc.

iv) Mtc.oftreesand shrubs: Onceina15 Days

Howeverdependingthese as on and requirement the frequency of above operation may be increased as per instruction of the Management committee.

GRASSYLAWNANDRAILING

- **1.** ThePlants/Grassylawns will bemaintained bythecontractor/Executing Agencyathis own cost for three years after the completion of work and no extra cost will be payable in this regard.
- 2. The open area/ park will be surrounded by providing Brick Toe walls, Brick Masonry walls with MS Grill as per drawing to be supplied by the agency and approved by the Management committee.

SPECIALCONDITIONRAINWATERHARVESTING

The work shall be carried out as per specification of Central Ground Water Board (CGWB) with latest amendments. Each and every building block should be covered for bringing the roof top rain water under the above project complete in all respect s per design / drawings of CGWB and to the satisfaction of the Management committee.

NOTE :- It will be contractor responsibility to obtain rain water harvesting well certificate from GMADA/anyotherrelevantauthorityasapplicableaftercompletionofsameathis owncostfor which Society will not pay anything.

SPECIALCONDITIONSOFELECTRICALWORK

1. GENERAL

- IAll electrical work shall be carried out in compliance with specifications given hereunder in this section and in compliance with Indian Standard Specification and Indian Electricity Acts and Rulesin force. The worksshallalso conformtoanyspecial requirement of local State Electricity Board. In any case, the above mentioned rules, regulations etc are not in accord, the decision of the Management committee regarding rules to be followed or manner of execution of work shall be final and binding.
- ii. Work shall be executed through licensed electrical contractor approved by the Management committee. The Contractor should passes Class 'A' approved license issued from StateGovernment

TheseSpecialConditionsofContractshallbereadinconjunctionwiththeGeneralConditionsof Contract,TechnicalSpecifications,Drawingsandotherdocumentsrelatingtotheworkandshall have preference over laid down general conditions and specifications.

- iii. Notwithstanding the sub-division of the documents into these separate sections and volumes, every part of each shall be deemed to be supplementary and complementary to every other part and shall be read with and into the contract, so far as it may be practicable to do so.
- iv. The contractors shall mobilize and employ sufficient resources to achieve the detailed schedule within the broad frame work of the accepted methods of working and safety. The contractor shall provide everything necessary for the proper carrying out of the work, including tools, plants and other materials.
- v. No additional payment will be made to the contractor for any multiple shift work or other incentive methods contemplated by him in his work schedules even though the time schedule is approved by the Management committee.
- vi. The work shall be executed as per the programme drawn or approved by the Management committee and it shall be so arranged as to have full coordination with any other agency employed at site.No claim for idle labour shall be entertained nor shall any claim on account of the delay in the completion of the buildingwork tobe tenable except extension of timesecured by the contractor as stated elsewhere.
- vii. The contractor shall permit free access and afford normal facilities and usual conveniences to other agencies or departmental workmen to carry out connected work or other work services under separate arrangements. The contractor will not be allowed any extra payment on this account.
- viii. All soil, filth or other matter of any offensive nature taken out of any trench, sewer drain, caspool or other place shall not be deposited on the surfaces, but shall at once be carted away by the contractor free of charge to a suitable pit or place to be provided by him.
- ix. The contractor shall provide all equipment, instruments labour and such other assistance required by the Management committee for measurement of the work, materials etc.

2. Materials

- i. All materials, equipments, fittings and fixtures used in electrical works shall conform to the attached Appendix-A.All material shall be new, sound and robust in construction and well finished.Surplus material after completion of work shall be taken back by the contractor and the cost shall be recovered if the advance payment has been made earlier by the Society.
- x. Unless otherwise stated in the conditions of contract, samples of all materials, fittings and fixtures to be supplied by the contractor shall be submitted to the Management committee for his approval. The contractor shall not commence the work until the samples are approved, in writing from the Management committee. The contractor shall ensure that all the materials incorporated in the work are identical in all respects with the approved sample. The samples not destroyed in testing shall be returned to the contractor after completion of contract. No payment shall be made for samples destroyed in testing.

3. Drawings

The drawings, specifications shall be considered as a part of this contract. Any work or materials shown on the drawings, shall be executed as if specifically called drawings indicate the extent and general arrangement of various equipments and their wiring etc and are essentially diagrammatic. The work shall be installed if found essential to coordinate the installation of this work with other trades shall be made without any additional cost to the Society. The data given herein and on the drawings isascouldbesecured, but its complete accuracy is not for the space conditions. The contractor, the exact locations, distance and levels will be governed by the space conditions. The contractor shall be responsible to check exact location of all electrical outlets, the routes and lengths of cables etc.

4. ClarificationsofDiscrepancies

i. In case of any discrepancy between specifications and drawings etc furnished by the Contractor or disputes in respect thereof, the interpretation of Management committee shall be final and binding.

5. WorkandWorkmanship

- i. The work shall be of the highest standard and confirm to the technical specifications both as regard its design and workmanship.Modern tools and first class, latest techniques shall be employed for its execution.
- ii. Any damage done to the building during the execution of work shall be responsibility of the contractoranditshallbemadegoodby him,athiscost,totheentiresatisfactionoftheManagement committee.
- iii. All electrical work shall be executed by skilled and duly licensed electricians under the direct supervision of whole time, fully qualified Electrical Engineers and Supervisors. The contractor shall produce requisite evidence regarding the qualifications of his Engineers, Supervisors and other workers.
- iv. The contractor shall possess all the relevant and valid licenses as per the regulations as per the regulations of the Indian Electricity Rules and the Local Electrical Inspector's requirements.
- v. The work shall have to be coordinated with the building work and other allied jobs/ trades to the entire satisfaction of the Management committee.

6. CertificateofInspection

- i. The contractor shall be responsible for getting the installation inspected and approved by the Electrical Inspector and other local electric supply company as required for which nothing extra will be paid.
- ii. The contractor shall obtain and deliver to the Society the certificate of final inspection and approval of the local electrical authorities concerned. The inspection fees etcs hall be borne by the contractor.
- iii. In case of any defects are pointed out by the Electrical Inspector, the contractor shall remove these defects at his own cost and arrange for re-inspection or inspection by the Electrical Inspector, till suchtimetheinstallationisfinallyapprovedandtherequiredcertificateisissued.Thecontractor

shall bear all expenses and deposit the necessary fees for subsequent inspection by the Electrical Inspector.

- iv. The Management committee shall have full powers to get the material or workmanship etcinspected and tested by an independent agency, at the contractor's expenses in order to ascertain their soundness and adequacy.
- v. Liaisons withelectricitysupplyauthorityforgettingpowerconnection of thesite in areasonabletime of 30 days includingsubmission of necessary testcertificate is exclusive contractor responsibility for which nothing will be paid..

7. Miscellaneous

- i. A site order book will be maintained at site which will be in the custody of the Management committee or its representative and all instructions given to the contractor will be recorded in thesite order book and the same has to be signed by the contractor to comply with the instructions given therein.
- ii. After completion of the work the whole installation shall be tested by the contractor in the presence of the Management committee. The tests shall comply the following I.E.E. Regulations and shall be submitted along with the final bill.
- a) The result of the insulation test shall comply with the I.E.E. Regulations 1101 to 1108A and 1008B as may be applicable.
- b) Testshallbecarriedouttoascertainthatallthenon-linkedSPswitcheshavebeenconnectedto the phase conductor.
- c) The continuity test of the earthing system shall comply with I.E.E. Regulations 1108 to 1109 to the latest addition.

If the result of the above tests does not comply with the I.E.E.Regulations, the contractor shall be bound to rectify the faults so that the required results are obtained.

The contractor shall be responsible to provide all the necessary testing instruments, such as meggerinsulationtester, earthtestermulti-meter, AVOmeteretcforcarryingouttheabovetests.

- iii. The work will not be considered as complete and taken over by the employer till all the components of the work after being completed at site in all respects have been inspected/tested by the Management committee to his entire satisfaction and a completion certificate issued by the Management committee to this effect.
- iv. Shop drawing for electrical work e.g. equipment, cable earthing and conduit layout for all systems shall be prepared by the contractor and got approved before starting of the work.
- v. At the completion of the work and before issuance of certificate of virtual completion, the contractor shall submit 6 sets of drawing and two tracing of each drawing and 2 Nos. soft copies CDs to Society of each layout drawings drawn at approved scale indicating the complete conduit wiring/ cabling/earthing as installed.
- vi. The contractor will submit within 15 days of the award of work, a detailed schedule of programme of work.

8. AdditionalConditions

- i) The whole work shall be carried out strictly in accordance with REC specification / standards (asapplicable to state of Punjab with up to date correction slips.
- ii) The contractor shall not be paid for unforeseen delays on account of non-availability of any kind of material, drawing design etc.
- iii) Before energizing the system for any type of electric installation of the following tests should begiven by the contractor, so as to find out the installations.

- a) Earthresistancetest.
- b) Insulationtest.
- c) Polaritytest.
- iv) All cable connections with main switches and in pole junction boxes shall be through dowells orany other reputed make tinned, copper lugs / thimbles duly crimped with proper crimping tools.
- v) The ST poles should be got inspected at the manufacturer premises before the same are broughtto the site of work.
- vi) Thecontractorhastostrictlyfollowthefairwagesclause.
- vii) The arrangement for the electric supply required for construction purposes shall be made by the contractor at his own cost.
- viii) The contractor licensed by the Chief Electrical Inspector Punjab of 'A' category can only tender. The contractor will employee licensed supervisor of only license given by the Chief Electrical Inspector, Punjab.
- ix) The ST / PCC poles / MS Pedestal / Transformer etc would be laid as per nishans given by the Management committee.
- x) contractorwouldsubmitthetestreportaftercompletionofwork.
- xi) one sample of all items brought at site or the purpose of erection of steel tubular / PCC poles / Cable
 / MS pedestals will be got approved from the Management committee in writing before erection of the same.
- xii) The underground / overhead / PVC cable, PVC copper wire, GI pipe and kitkat used at site of work should be ISI marked and approved by Punjab PWD (B&R) department.

9. Preambletoscheduleofquantities:

- i. Tender shall be on the lumpsum basis which shall include the cost of materials, labours, all taxes, duties and all other services required for the complete installation, testing and commissioning in accordance with the relevant NEC/IER and code in practice including the fees for inspectiontogether with the liabilities and obligations as detailed in the general conditions of contract. It will also be the responsibility of the tenderer to obtain all types of sanctions etc like power/light connections and the drawings etc if any, required by the concerned local authorities.
- ii. Prices shall remain firm and free from variation due to rise and fall in the cost of materials and labours or any other price variation whatsoever whether during extended period of completion, ifany.
- iii. To facilitate the technical scrutiny of the various quotations, the tenderer must supply with their quotations detailed technical particulars make catalogues and erection drawings for various items under different parts specified in the schedule of quantities.
- iv. Power supply shall be3 phase, 4 wire, 415 and single phase 230 volts A.C. and frequency of 50 cycles per second.All-consuming devices shall be suitable for voltage and frequency mentioned above.
- v. Thedrawingandspecificationslaydownminimumstandardofequipmentandworkmanship andthe deviations. In the absence of any deviations, it will be deemed that the tenderer is fully satisfied with the intents of the specifications and drawings and their compliance with the statutory and fire insurance provisions including local codes, where the drawings and specifications conflict, the more stringiest shall apply.
- vi. All equipment and the installations shall be tested as specified and a test certificate in the prescribed form as required by the local supply authorities shall be furnished.

- vii. The entire installation shall be guaranteed against defective materials or workmanship for a periodof 12 months from the date of the installation certified by theManagement committee and taken overbythe Society.Duringtheguaranteeperiodallthedefectsshallberectified bythecontractfree of cost.
- viii. The successful tenderer shall submit the shop drawings for wiring LT boards, distribution boardsand any other to the Consultant for approval prior to start the work. The approval of these drawings will be general and will not absolve the contractor of the responsibility of the correctness of these drawings. Atleast 6 copies of the approved drawings shall be supplied to the Management committee for their distribution to the various agencies at site at no cost to the Society.
- ix. The position of distribution boards and switch boards may require some minor adjustments due to eithersite requirementsor change in structurallayout.Allsuchchangesfrom the position, shownin the drawings, shall be required to be incorporated without any extra payment or deduction for change in length of wiring etc.
- x. The tenderers must see the site conditions and take all the aforesaid and foregoing factors while quotingtherates, as no extrawill be allowed on any ground arising out of orrelating to the aforesaid and foregoing.
- xi. In single phase (230 V) A.C. supply system circuit wires of same phase shall be drawn in same conduit.For 3 phase, 4 wire wiring system wires of different colour shall be used and for insulated neutral only black colour wire shall be used.
- xii. The successful tenderer shall include in his rates for painting with three coats of synthetic enamel paint to match the surroundings or as directed by the Management committee for all down rod hangers pertaining to light fixtures, fans, steel structure used for electrical work at no extra cost.
- xiii. The successful tenderer shall supply completion drawings of the entire installation on tracing clothas well as three prints of each drawing showing the complete wiring diagram as executed at site drawn to scale approved by the Management committee after the completion of work but before completion certificate is given by the Management committee.
- xiv. After layingandjointingthe cables shallbesubjectto necessary tests as stipulatedin IS:5959(Part- I): 1970.
- xv. As more than one make is mentioned, prior approval of particular make for use shall be obtained from the Consultant as per his discretion.All samples of all electric fittings and other accessories shall be approved by the Management committee prior to their installation.In case there is a substantial cost difference be indicated in the tender itself or it will be deemed that any of thespecific make of material may be asked by the Management committee at the quoted prices.
- xvi. Any error in description from the contract shall not vitiate this contract but shall be corrected and demand to be a variation required by the Management committee.
- xvii. All measurements shall be taken in accordance with the Indian Standard Electrical Installation in buildings method of measurements of IS:5908:1970, unless otherwise specified.
- xviii. Thecontractorshallprovide, within one monthafter completion of the work or along with the final bill, three sets of manuals properly bound which shall contain the following information:
 - a) Descriptionofinstallationitemsusingmainitemsofequipments.
 - b) Descriptionofallequipmentsandsystemoperationwithtroubleshootingmanuals.
 - c) Linediagramofeachsystemincludingmainfeatureofequipmentsandshowingmethodof setting controls.
 - d) Methodoffaultfinding,routine,adjustmentandwiringdiagram.
 - e) Descriptionofroutinemaintenance, oil and greasing points and recommended lubricants.
 - f) Manufacturerservicemanualsforallequipments.

- g) Sparesreferencemanuals.
- xix. The contractors hall provide the following at no extra cost to the Society t:
 - a) DangerNoticeBoards
 - b) TreatmentforelectricshockgivingdetailsofFIRSTAIRTREATMENTwithchartdiagrams (mounted in suitable frame).
 - c) Linewiringdiagramsoftheelectricalsystemmountedinsuitableframe.
- xx. The contractorwillremoveallthedebrisand surplusearth fromworksite (belongingtohiswork) free of cost.

10 TESTINGOFINSTALLATION

i General

Inspection and testing of the installation shall be carried out as per Section 10 Part-I of the National Electrical Code 1985 such as:

- a) Insulationresistanceandwiringcontinuitytest.
- b) Earthresistivityandcontinuitytest.
- c) Testofpolarityofnonlinkedsinglepoleswitches.

Besides the above any other test specified by the Local Authorities shall also be carried out by the contractor.

All tested and calibrated instruments for testing, labour, materials and incidentals necessary for conducting the test shall be arranged by the contractor at his own cost.

ii InsulationResistanceTest

The insulation shall be measuredbetween theearth andwholesystem of conductors or any section there of with all fuses in place and all switches closed except in concentric wiring, all lamps in position or both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it does not exceed 660 volts for medium voltage circuits.

Where the supply is derived from the 3 wire (AC or DC) or from a poly phase system. The neutral pole of which is connected to earth, either direct or through added resistance. The working pressure shalldeemedto be that which is mentioned between the phase conductor and theneutral.

The insulation resistance measured as above shall not be less than 50 divided by the number of points on the circuit provided that the whole installation shall not be required to have an insulation resistance greater than one mega ohm.

The insulation resistance shall also be measured between all conductors connected to one pole or phase conductor of the supply and all the conductor connected to the middle wire or the neutral orto the other pole or phase conductor of the supply and its value shall not be less than that specified in above clause.

iii TestingofEarthContinuityPath

The earth continuity conductor including metal conduit and metallic envelopes of cables in all cases shall be tested for electric continuity and the electrical resistance of the same alongwith the earth lead but excluding any added resistance or earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

iv TestingofPolarityofNon-LinkedSinglePoleSwitches

Inatwowireinstallationthetestshallbemadetoverifythatallnon-linkedsinglepoleswitches have been fitted in the same conductor through out and such conductor shall be labelled or marked for connected to outer or phase conductor or to the non earthed conductor of the supply.

In a three wire or a four wire installation a test shall be made to certify that every non-linked single poleswitchisfittedinaconductorwhichislabelledor markedforaconnection one of the outer or phase conductor of the supply.

v LoadBalancingTests

After satisfactory completion of the project the contractor has to check balancing of loads by actual measurements for lighting loads only.

SPECIALCONDITIONSFORFIREFIGHTING

1 General

1.1 Special conditions of this section shall be read in conjunction with the general conditions, specificationsofwork, drawings and any other document forming part of this Contract, where verthe context so requires.

2. ScopeOfWork

- **2.1** Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely do all works relating to internal and external fire fighting system as per approved design.
- **2.2** Without restricting to the generality of the foregoing, the work in this Contract shall include the following:
 - a) HoseReel
 - **b)** 2waysfirebrigadeinlet
 - c) Fireextinguishers
 - d) Electricalpanelandconnectedcablingworks
 - e) Approvalofentireinstallationcontainedinthecontractfromallagenciesconcerned.
 - f) WetRisers.
 - g) Watertanksonrooftopcommonpumpingmachinery.

3. InspectionandTestingofMaterials

- **3.1** Under this section the piping system shall be tested as specified under the relevant clause of the specifications. The Contractor shall maintain a test register at site and all tests carried out shall be recorded in this register. The entries shall be signed by the Management committee or his representative.
- **3.2** Tests shall be performed in presence of the Management committee or Representative of Management committee The contractor shall at his own cost, change/replace all materials and equipment found defective and carry out the whole work again test to meet the requirements of specifications.
- **3.3** Contractor shall perform all such tests as may be necessary and required by the local authorities to meet the municipal or other bye laws in force at his own cost.
- **3.4** Contractor shall provide free of cost all labour, equipment and materials for the performance of the tests.

3.5 The contractor shall provide weighing and measuring equipments for the works to the entire satisfaction of the Management committee at site for measuring of the various articles, materials brought by him to the site of work for use on the work.

4. CompletionDrawings

- 4.1 On completion of works under this section, Contractor shall submit one complete set of original tracings and two prints of "As Built " drawings to the Management committee. These drawings shall have the following information:
 - a) Runofallpipingwithdiametersonallfloorsverticalriserswithlineandlevels.
 - b) Locationofcontrolvalves,accesspanels.
 - c) Layoutof equipment.
 - d) Wiringdiagrams
- 4.2 All "warranty cards" given by the manufacturers shall be handed over to the the Management committee.
- 4.3 Contractor shall provide six sets of maintenance manuals and list of spare parts with name and address of manufacturers for electrical and mechanical equipment installed by him.

5. LicensesandPermits

- 5.1 Contractormustholdemployweldersholdingavalidradiographyqualityweldinglicensefrom the recognized authority / organization.
- 5.2 Contractorshallkeepconstantliaisonwiththelocalauthorityandallotherstatutoryauthorities whose approvals and permissions before and after execution of the work are required.
- 5.3 ItshallbetheContractor'sresponsibilitytoobtainthenecessaryapprovalsandpermissionsof work done by him from the concerned Govt. Authorities.

NOTE :- It will be contractor responsibility to obtain N.O.C from Relevant Fire Authorities of Governmentinstagesandaftercompletionofallfireworksathisowncostforwhich Societywill not pay anything.

SIGNATUREOFTENDERER

PRESIDENT

AdditionalSpecialConditionsofContract

- 1. These conditions shall supersede conditions of contract, special conditions and other conditions in case of any conflict.
- 2. Interest: The contractor shall not be entitled to any interest on any amount due to him andnotreceivedbyhimforwhatsoeverreason.Ithasbeendulyacceptedthateventhe arbitratorwillhavenopowertograntpreawardinteresti.e.interestfromduedate uptill the date of award.
- 3. That since it is a turnkeyproject and a fixed/ lump sum price contract, the contractor will not be entitled to any extra payment or escalation of price of material and labour or any other item used in the process of construction, finishing or completion.
- 4. That is further agreed between the parties that since the contractor himself had hired the architect,thereforeincaseofanyfaultinthedrawingsresultingintosomeextraworkor extracost;thesameshallbethesoleresponsibilityandexpenseofthecontractor.The societywillnotbeliabletopayanyextraamountforsuchworkorcost.Similarlyifany item or quantities are found deficient, the same would be made good at his own costand responsibility the contractor.
- That in case of any ambiguity or items which has not been provided expressly but have to 5. beundertakenoromittedbythecontractor,thesameshallbecarriedoutwithoutcausing delay in the completion of The price adjustment the project. of variation/additions/alterations/modifications shall be based on the rates provided in CPWD Schedule of rates as on date of submission of tender i.e. 12.02.2025. In case such non scheduled item is not found in the CPWD Schedule of rates, then Delhi Schedule of ratesofthesamedatewillbeapplicable.Incasethenonscheduledisnotmentionedinany 3 of the above schedules, then the tender committee will fix the rate of such item by inviting quotations from Tricity (Chandigarh., Panchkula, and Mohali) or in absence of any such agency not available, then from NCR. The lowest quotation would be treated as the price payable by the society to the contractor; however contractor will not cause any type of delay in the execution of the work.
- **6. Jurisdiction:** This agreement has been signed and executed by both the parties at Chandigarh as a result of finalization of tenders at Chandigarh, therefore both parties agree all disputes including seat of arbitration will be at Chandigarh only.
- 7. ADR: The parties have agreed that incase of any difference or dispute, it shall be resolved amicably by negotiations at the first instance between the parties within 30 days. In case of any such difference or dispute not being resolved, before resorting to the arbitration as provided in clause no 25 of Conditions of Contract, it is mandatory that the difference or dispute shall first be referred to mediation before the Mediation Centre of Punjab and Harvana High Court at Chandigarh. During this neither the contractor will stop period the worknorwillthesocietystoptheduepaymentfortheundisputedworkbeingundertaken by the contractor.

(SECTION-7) SCOPEOFWORK&SPECIFICATION FOR **CIVIL, ESTATE SERVICES, INTERNAL WATER** SUPPLY, INTERNALPLUMBINGWORKS, INTERNAL SEWERAGE WORKS, STORM WATER WORKS, **INTERNAL ELECTRICAL WORKS, EXTERNAL ELECTRICAL WORKS, FIRE FIGHTING, EARTHING, D.G. SETS, LIFTS, LIGHTENING PROTECTION** WORKS, HORTICULTUREWORKSANDRAINWATER HARVESTING.

SCOPEOFWORK

1 <u>CIVILWORKS</u>

Dwelling units shall be constructed as per approved Drawings of the Society. The internal sanitary / plumbing, electrical and fire fighting as per approved documents & drawings complete in all respects.

The houses will be structurally designed as per the Bureau of Indian standards and NationalBuilding Code as 3-dimensional MIVAN structure/latest technology and earthquake resistant. The Architectural Drawings Structural design & Drawing will be provided by Agency and Agency willget the said Architectural Drawing approved from GMADA and the said Structure Design & Drawings checked and vetted from IIT Ropar/PEC/Thapar university at his own cost before starting of work & the same will have to be incorporated & executed at site by the contractor without demanding any additional cost.

The 170 Nos. dwelling units in one tower, middle floor is to be kept vacant for recreational purpose, skywalkandfine-dining atroof and everydwelling unitshould receive adequate sun light (4 bhk+Servant Room–110 Nos and 3 bhk+Servant Room-70 Nos) will be complete in all respect as per specifications given in this document.

Thefollowingfacilitieswillbeprovidedcompleteinallrespect:-

- a) ClubHouse;
- b) Swimmingpool;
- c) ChildrenSwimmingpool;
- d) ToddlersSplashpool;
- e) CoveredParkingasperESS
- f) GuestParking-32;
- g) ConsultantCabins;
- h) Shops/shoppingarea;
- i) GuestHouse;
- j) DriverDormitory.
- k) YogaCentre.
- I) MeditationCentre.
- m) IndoorGymnasium;
- n) OpenGymnasium;
- o) AcupressureBed;
- p) Kidsplayarea;
- q) Sandpit;
- r) ChildrenLibrary;
- s) BadmintonCourt;
- t) BasketBallCourt;
- u) TennisCourt;
- v) JoggingTrackatGround;
- w) FloorFountain;
- x) PartyDeck;
- y) Amphitheatre;
- z) SpillOut;
- aa) Deckwithsunself;
- bb) Plumbing;
- cc) Internal&ExternalWaterSupply;
- dd) Sewerage;
- ee) InternalElectricalConducting;
- ff) StromWaterDrainage;
- gg) Roads
- hh) BoundaryWallwithGates+GuardRoom;
- ii) FireFighting,FireAlarmandSuppression Services;
- jj) ExternalElectricalservices;
- kk) DGsetsof!00%Power Backup;
- II) Parks&Horticulture;

- mm) RooftopRainwaterHarvesting;
- nn) GasPipeProvisions.
- oo) 3Nos.PassengerLifts&3Nos.PassengerHospitalElevators;
- pp) ElectronicSecuritySystem;
- qq) DryTypeTransformer;
- rr) Themiddlewillbekeptvacantforre-creationalpurpose.
- ss) DevelopmentofSkywalk&FineDiningatTerrace;

2 ESTATESERVICES:

a. <u>Water Supply:</u> Thescope ofworkincludeslayingofwatersupply networkofD.I.pipeswithC.I./D.I. specials &sluicevalvesdesignedasperCPHEEOnormsatasuitabledepth with minimumcoverof one meter. The internal water supply network is to be connected from GMADA main to the pump house of internal boosting station.

The size of C.I pipes shall not be less than 100 mm i/d and shall be as per ISI specifications. The scope of work also includes from GMADA main to underground water storage tank of suitable capacity i.e. by taking 5 persons per dwelling unit, 135 ltr per capita water demand and for storageof 1 day demand and installation of pumps and machinery, for pumping total demand in 6 hours. All works to be as per the CPHEEO norms, ECBC and BEE norms and all material ISI marked.

- b. <u>Sewerage:</u> The scope of work includes laying of sewer network of SW pipes suitably designed as per CPHEEO norms at a suitable depth. The internal sewerage network is to be connected to the external sewerage facility provided by GMADA.
- **c.** The min. size of sewerage pipe should not be less than 200 mm i/d. Manholes / lamp holes will be provided as per the site requirement in conformation to the standard norms of design.
- d. <u>Storm Water Drainage:</u> Brick drains duly plastered with concrete haunching and 2.5 mm thick 1:11/2.3 floor are to be provided & the drains are to be covered with removable RCC slab, having perforations in atleast 1/3 length. The drain is to be designed with free board of 6 inches. The density of the rain fall to be considered as 1/2 inch per hour. The velocity should not be less then 3 feet per second. The designof RCC slab 1:11/2:3 over drainshouldbestructurally safe.In addition, provision for RCC pre-cast grating should also be made to take the rain water into drain at asuitable distance. The design of section of drain / gradient, structure and distance of gully grating is subject to the approval of the Management committee.
- e. <u>Estate Electrification</u>: The scope of work includes provision of underground insulated conductor designed as per the norms with individual metering panel of each Block. The provision of Street lights and 4-star Copper wound Transformer as per design is also included in scope of work. The scope of work include the providing and underground laying of insulated H.T. Cable from Electricity Supply authority pole to the Sub-Station of the Society.

The electric connection to each dwelling unit will be provided by installing the energy meter in the metering cubicle to be provided by agency from proposed underground L.T. line to metering cubicle with PVC L.T. cable (as per SLD & Drawing) Metering cubicle is to be fixed with Red eye bolt on wall.

- f. <u>Internal Roads</u>: The scope of work includes construction of internal roads in the premises of the housing complex as per drawings, x- section and specifications approved by the Management committee.
- g. <u>Horticulture:</u>The scope of work includes development of Parks and open spaces by providing grassy lawns, pathways brick masonry toe wall, brick wall with MS grill as per drawing as approved bytheManagement committee.Theearthfillingwhereverrequiredtodevelopthe openareasand lawns is also included in the scope of work. The grassing, plants & developing Lawns etc. on the basement roof slab including providing necessary treatment to make underneath basement/podium slabwaterleakageproof,layingofdrainagepipestoflushouttheexcesswaterafterirrigationas

per the drawing to be supplied by the Architect of the project at time of carrying out of horticulture work after completion of civil works.

h. <u>BoundaryWall:</u>ThescopeofworkincludestheconstructionofBrickMasonry,boundarywallwith

R.C.C. column / plinth beam as per the standard x- section and specification approved by the Management committee and fixing of mild steel gates, as per the design approved by the Management committee.

- i. <u>Rainwater Harvesting</u>: As per provisions and recommendations of Central Ground Water Board. Design of Rainwater Harvesting structure will be got approved from concerned competent authority/the Management committee.
- **j. Gas Pipe provisions in Kitchen:** Asperprovisions and recommendations of Gas Authority of India Limited, will be got approved from concerned competent authority/ the Management committee. All LPG / PNG Gas pipe as decided by the Society with safety valves, control valves, regulators in kitchen including vertical riser to kitchens, ring main with Gas bank with all safety precautions to be installed from license contractors.
- **k.** <u>Lift</u>: The lifts as per technical specifications will be installed by the contractor from renowned lift manufacturer as per approvedmakes mentioned in this tender document. NOC/ Registrationwillbe taken from lift / fire Authority by the contractor and submitted to the Society at his own cost.

I. FireFightingsystem:

 The fire fighting system will be carried out as per the National Building Code and BISspecifications. The scope of work includes getting the scheme approved from Fire Deptt and will get the fire fighting and safety installations tested and approved from Fire Deptt. All the expenses related to logistics for approval areto be borneby contractor. Scope of work includes installation of Hose Reels on each floor, external fire hydrants, fire extinguishers, fire pumps with requisite pressure and capacity and terrace tank of minimum 25000 ltrs along with MS welded pipes duly painted. The above work will be completed in all respects as per the drawings, specifications and conditions as mentioned in bid document. The following scope of work should be taken:

1. INTERNALWATERSUPPLY

Internal water supply will be provided as per CPWD specifications and specifications provided in this document. Thesizes of water supply pipes will be provided so as the velocity shall not be more than 2.00 per second in the pipes. The water supply system shall include the following:-

- a) Distributionsystemfrommainsupplyheaderstoallfixturesandappliancesforcold/hotwater.
- b) Coldwatersupplylinesfromcitywaterconnectionstofireandundergroundwatertanks.
- c) MunicipalwaterconnectionstoU.G.watertanks.
- d) Gardenirrigationsystem
- e) Excavationandrefillingofpipestrenches.
- f) Insulationtohotwaterpipes.
- g) Pipeprotectionandpainting.
- h) Controlvalves, masonry chambers and other appurtenances.
- i) Connectionstoallplumbingfixtures,tanks,appliancesandMunicipalmains

2. INTERNALPLUMBINGWORKS

The plumbing works shall be provided as per the CPWD specifications and specifications provided in this document and include the following:-

- i) SanitaryFixtures.
- ii) Soil,Waste&VentandRainWaterPipesandfittings.

- iii) WaterSupplySystem(Cold&Hot).
- iv) Sewerage&Stormwaterdrainagesystem
- v) GardenIrrigationSystem
- vi) WaterSupplyPumps&WatertreatmentEquipments

3. INTERNALELECTRICALWORKS

Internal electrical works shall be provided as per the CPWD specifications and specifications provided in this document.

4. D.G.SETS

TheD.Gsetsshallbe provided asperthe CPWD specifications and specifications provided in this document.

5. EARTHING

All the non-current carrying metal parts of electrical installation shall be earthed properly. All metal conduits, trunking, cable sheaths, switchgear, distribution fuse boards, light fittings and all other parts made of metal shall be bonded together and connected by means of specified earthing conductors to an efficient earthing system. All earthing shall be in conformity with Indian Electricity Rules.

- TheEarthingSystemshallintotallycomprisethefollowing:-
- a) EarthElectrodes
- b) EarthingLeads
- c) EarthConductors

Allthreephaseequipmentshallhavetwoseparateanddistinctbodyearthsandsinglephase equipment shall have a single body earth.

6. LIGHTENINGPROTECTIONWORKS

Theworktobedoneunderthissectioncomprises the supply & installation necessary for the complete installation of the lighting protection systems as per French Standards.

IMPORTANTNOTE:-

- 1. The scope of work also includes providing and constructing expansion joint in basementincluding filling&finishingthesame asdetailedarchitecturaldrawingsupplied by agency and approved by the Management committee for which nothing will be paid extra.
- 2. The Scope of work also include providing dual electrical meter of appropriate capacity i.e. One for electrical reading by Electricity Supply Authority & other for electrical reading of D.G set electrical supply including complete wiring of both electrical connections i.e. for Electricity Supply Authority as well as up to generator for DG set electrical supply complete in all respect *including ventilation with ducting complete in basement or above ground as applicable* for which nothing will be paid extra.
- 3. The scope of work also include providing 4 nos. security guards, 1 nos. security supervisors & nos. trained lift operators for all the 24 hours at site for a period of *12* months free of cost to Society, from thedate of handingover of possessionto Society iefromthedate of start of defectliability period as already explained in detail in special condition of this tender for which nothing will be paid extra .
- 4. Scope of work also includes providing and fixing independentgood quality water supply control valvesto the satisfaction of the Management committeefor each toilet and kitchen of flatsat all floor levels in theexternal water supply pipe coming from roof top to each toilet and kitchen so that

every flat owner can control/ turn offexternal water supply independently of any Toiletand kitchen in his / her flat by sitting in his/her flat only for which nothing will be paid extra.

- 5. Scope of work also include swimming pool in the Society, complete with main pool, Children pooland toddlers splash pool, plant room along with all swimmingpool machinery complete in all respects to the satisfaction of Management committee. All finishing as per approved architectural drawings.
- Scope of work also include construction of guard room, ESS rooms, ramps covering with polycarbonatesheetswithadequatesteelstructuretoholdthepolycarbonatesheetsasperdesign in complex complete in all respects to the satisfaction of Management committeefor which nothing will be paid extra.
- 7. Scope of work also includes horticulture works with landscapes, hardscape, pathways with designer concrete tiles and granite bands, boundary wall, main entrance gate with guard room in complex to the satisfaction of Management committee for which nothing will be paid extra.

Thecontractorwillsubmit, within30daysofawardofwork,shopdrawingsofdoor/window,plumbing work, internal & external electrification, Fire Fighting system, water supply distribution system with clearwater tank, pumping machinery,sewerage system,storm R.C.C. pipe drains,horticultureworks, rooftoprain water harvestingsystem etc detail shop drawings of various services and any other shop drawings as required by Management committee in triplicate. All the shop drawings have to be based on consultants basic design concept and details.

All the shop drawings to be approved by Management committee and after approval. Contractor has tosubmitco-ordinatedshopdrawingsof all the ServicesCo-ordinatedwithCivil drawingsforapproval from the Management committee.

If any error or omission is found in the contractor's shop drawings he will amend the shop drawing within 15 days of pointing out the errors/ omissions. The above shop drawings and shall be deemedto be contractor's drawings and these shall be signed by the contractor. The contractor's drawings shall also include such additional shop drawings including detail to be supplied by the contractor in response to the instructions of the Management committee in writing from time to time during the progress of work. The Management committee will have the right to make such amendments to anyof the said drawings, which in its opinion are necessary during the progress of work and if such amendments shall in no way invalid the contract. The work will be taken in hand after above shop drawings with detail / dimensions are approved by Management committee.

Such approval of drawings and design will not be taken as constituting any expression or in any opinion of the Management committee as to performance of shop drawings in any way as relievingthecontractor from his responsibilities and obligations under thecontract. The contractor willsupply 6 sets of finalized design and shop drawing at his own cost for the use of Management committee before start of the work. If the Management committee will require any other detailed drawings and information relating to the work, the contractor will supply the same within 15 days of receiving of the notice to that effect.

Theresponsibility of performance of all these rvices ystems i.e. Water Supply, Sewerage, Drainage, Harvesting, Low/Hi side Electricals etc. as per relevant codes will be of contractor and in no case it will be of Society.

Note: Any item with regard to the above complete scope of work left un-described in thisdocument, shallbe carriedout bytheagencyasper Punjab PWDspecificationsand relevant ISCode and atits own cost as per the direction of the Management committee as per drawings issued or to beissued by Architect of the Project.

SPECIFICATIONS

SPECIFICATIONSFORBUILDINGWORKS

EarthWorkinExcavationasper CPWDSpecifications

Earth work in excavation in foundation, trenches, etc. in all kinds of soils, including dressing of bottom and sides of trenches, stacking the excavated soil, clear from the edge of excavation and subsequent filling around masonry, in 15 cm layers with compaction, including disposal of all surplus soil, as directed by the Management committee, within a lead of 30 meters.

EarthFillingasperCPWDSpecifications

Earth filling under floors with surplus soil, excavated from foundation and taken only from outside the building plinth, or by sand brought from outside in 15 cm layers including ramming, watering and consolidating with lead upto 30 metres complete.

Anti-TermiteTreatment

Supplying and Injecting chemical emulsion (Chlorpyriphos / Lindane emulsifiable concentrate of 20%) for preconstructional ant-termite treatment and creating a chemical barrier under and around the column pits, wall trenches, top surface of plinth fitting, junction of wall and floor, along with the external perimeter of building expansion joints, over the top surface of consolidated earth on which apron is to be laid surrounding of pipes and conduit etc. complete (plinth area of the building at ground floor shall be measured for payment)

Note:*TheworkistobecarriedoutasperCPWDspecifications(withlatestedition).*

PCCinfoundationasperCPWD Specifications

Cementconcrete1:4:8or1:2:4or1:3:6withstoneballast40mmor20mmnominalsizerespectivelyin foundation and plinth.

DPCasperCPWDSpecifications

Dampproofcourse,40mmthick,ofcementconcrete1:2:4usingstoneaggregate20mmnominal sizewith 2 coats of bitumen 20/30 penetration at 1.65 kg per sqm laid hot and sanded.

C.C.FORFOOTINGasperCPWDSpecifications

Cement concrete ,Minimum M20, M25, M30, M35, M40, M50 or as specified by structural engineer, with stone aggregate 20mm nominal size for reinforced concrete work in footings, strips, foundations, beams, rafts, pedestals including steel reinforcement and including centring and shuttering, laid in position, complete in all respects at all heights.

R.C.CSLABasperCPWDSpecifications

Cement concrete, Minimum M 20, M25, M30, M35, M40, M50 or as specified by structural engineer, with stone aggregate 20mm nominal size for reinforced concrete work in slabs with steel reinforcement and including centring and shuttering, laid in position, complete in all respects at all heights .

RCCFORWALLS, COLUMNS, FACIA, PARAPET and SHELVES as per CPWDS pecifications

Cement concrete, Minimum M 20, M25, M30, M35, M40, M50 or as specified by structural engineer, with stone aggregate 20mm nominal size for reinforced concrete work including steel reinforcement and centring and shuttering, laid in position, complete in all respects at all heights.

Note:-AllRCCmixesandPCCmixeswillbedesignmixbatchedbyautomaticbatchingplants.

BRICKWORKasperCPWDSpecifications

Firstclassbrickworklaidincementsandmortar 1:5infoundationandplinth.

FirstclassbrickworklaidincementsandMortar1:5insuperstructurecompleteinallrespectsatall heights.

11.43cm thick brick wall laid in cement sand mortar 1:4 in superstructure with Hoop Steel as per the PWD Specifications complete in all respects at all heights.

CEMENTPLASTERasperCPWDSpecifications

15mm thick Cement Plaster on rough side of wall in cement sand mortar 1:5 complete in all respects at all heights.

12mmthickcementplasteronwallsincementsandmortar1:5completeinallrespectsatallheights.

10mm thick Cement Plaster on under side of ceiling in cement sand mortar 1:4 complete in all respects at all heights.

Note:

- OnlyFe-500TMTSteeltobeused.
- All the above work is to be carried out as per PWD specifications.

ToproofTerracingasperCPWDspecifications

Providingandlayingintegral cement basedwater proofingtreatment includingpreparationofsurface, and applying a slurry of cement @ 2.75 kh/sqm and on adjoining walls upto 300 mm height, laying brickbats with cement mortar.

In cement mortar of 1:5 (1 cement : 5 coarse sand) over 20 mm bed of cement mortar of 1:5 in required slope and on walls upto 300 mm ht, and cement mortar 20 mm thick over the brick bats laid, complete including cost of water proofing compound as per IS 2645.

100 mm Brick Bat Coba treatment over roof with acrylic water proofing compound cement plaster and rounding of junctions of wall by 1:4 cement coarse sand as per D.S.R. item.

UPVCPIPEANDBENDSFORRAINWATER&BALCONYDRAIN

Providing and fixing of 110 mm dia UPVC pipes (conforming to IS: 4985-2000) of approved makeembedded in wall or fixed on wall face / duct including cost of allied fitting, including suitable jointing to ensureleakproof serviceas perinstruction for laying, jointing laid by the manufacturer, including cost of
cuttingandwastageetc.andcuttingholesinwalls,roofsandfloorsetc.andmakingtoitsoriginal condition to the satisfaction of Management committee.

ProvidingandfixingPVCbendsinpositionwithgutteretc.(for110mmdiapipe)

KhurrasasperCPWDspecifications

Topkhurra0.6mx0.6mforrainwaterpipeIn25mmthickcementconcrete1:2:4over50mmthick cement concrete 1:8:16.

Bottomkhurraonground1.2mx0.6mconsistingofbrick-on-edgelaidincementmortar1:3over75mm cement concrete 1:8:16 including 12mm thick cement plaster 1:3.

<u>CCGolaasperCPWDspecifications</u>

Cementconcrete1:2:4gola10cmx10cmquadrantalongjunctionofroofwithparapetwallfinished smooth.

FlooringasperCPWDspecifications

Base course of floors consisting of 100mm thick cement concrete 1:8:16 and 100mm sand or stone filling. (including plinth protection) for stilt areas.

 $Screed of 50 mm thick cement concrete 1:8:16 to be laid for flooring over RCC \ slabs.$

CeramicGlazedFloorTiles

Providing and laying ceramic glazed floor tile Anti Skid of any specified size, thickness as per manufacturer of 1st class quality conforming to IS: 15622, of approved make, laid on 20mm thick cement mortar 1:4 (1 cement : 4 coarse sand) including pointing the joints with white cement and matching pigment etc. complete in all respects, as desired by the Management committee.

Conglomerate floor 40 mm thick cement Concrete topping 1:2:4. with matchings kirting.

Interlock pavers:

Providing laying 60 mm thick inter lock pavers of M-35 grade with cement mortar 1:4 (1 cement : 4 coarse sand) as per drawings.

Polishedvitrifiedtiles:

Providing and laying polished vitrified double charged floor tiles indifferent sizes (thickness to be specified by the manufacturer) with water absorption's less than 0.08% and conforming to IS : 15622 of approved make in all colour and shades, laid on 20 mm thick cement mortar 1:4 (1 cement :4 coarse sand) including grouting the joins with white cement and matching pigment etc., complete. (toilet per list of makes / models).

Granitestoneflooring.

Providing laying in positiongranite stoneflooringon 20mm to 25mm thickcementmortar1:4 (1 cement: 4 coarse sand) including grinding and polishing complete in all respect in stair case and common area asper architectural drawings

CeramicWallTiles:

Providing and fixing of wall tiles of specified sizes as per drawings and thickness as per manufacturer and IS-15622 in skirting and Dado of approved make on 12 mm thick cement mortar 1:3 in base and jointed with white cement slurry in joist including beveled corner, complete in all respect up to ceiling in toilets.

GraniteFlooringandDado:

Providingandfixing20mmto25mmthick blackgranitestoneinanypattern,overbaseof20mm/12mm cement sand mortar of 1:3 on kitchen counter / lift facia with combination of vitrified tiles and mixed with matching colour pigments, kitchen counter should be of single piece used in one direction.

TrimixConcreting:

M-25gradetrimixconcretingonroadtopsurfacewillbedonein4mx4mpanelsbygettingthesame done from some specialized agency.

Basement:

Proper basement is to be made with RCC raft and RCC walls as per structure drawings to be issued by Architect with proper water proofing to be done with Kota stone 40 mm thick laid below the raft over bed of 150 mm of Lean concrete laid over a bed of 150 mm thick fine Yamuna/Gaggar sand. Further, the basement walls are also to be treated by providing Kota stone treatment all around in tanking effect andall kota stone in floor and walls to have a 20 mm thick plaster layer with applying TAPECRETE water proofing complete as per specifications of Manufacturer including another layer of 20 mm thickTAPECRETE cement plaster 1:3 with a flush coat of neat cement with water proofing. The walls ofbasement shall have 3" Brick wall cladding over RCC wall and shall be plastered1:4 with wall finish in Apex Asian paint finish.

The ramp down to basement shall be in M-35 grade Interlockingpavers of 60 mm thickness of Reputed make over inclined RCC slab as given in Section-8 in the list of Approved makesas per choice of Management committee.

 $\label{eq:alpha} Allabove work is to be carried out as per Punjab PWD specifications and detailed approved drawing.$

PAINTasperCPWDspecifications

Applyingpinkprimerofaluminiumprimingcoatonallwoodworkincludingpreparationofsurface, knotting and stopping, etc. wherever required

Painting two coats, excluding priming coat, with ready mixed paint in all shades on all new wood works.(With 1st quality)etc. wherever required

Applyingprimingcoatwithmetalprimeronallnewsteelorironworkincludingpreparationofsurface. (With 1st quality)

Painting twocoats, excluding priming coat, with ready-mixed paint for metallic surfaces in all shades onnew steel or iron work. (With 1st quality) on all iron grills to be fixed on boundary walls and gates etc.

Acrylicemulsionpaint (of approved manufacturer) three coats excluding priming coaton new work with P.O.Ppuning on walls and where verrequired

Whitewashingthreecoatsinliftshafts.

All outer and exterior sides of all the towers/ buildings includingall walls of all balconiesof flats, clubs buildings, boundary walls, Guard rooms and Electrical substation rooms or any other building will have a Finishing walls with a combination of exterior texture paint as per approved make and tile cladding as per approved elevation drawings and colour scheme to give an even shade including preparation of plaster surface including sand preparing the surface applying & filling with approved quality of Birla putty for all heights of buildings / towers complete in all respects to the satisfaction of Management committee.

Painting two coats, excluding priming coat, with synthetic enamel paint in all shades on new woodwork or metallic or plastered or concrete surfaces to give an even shade plus painting new letters and figures of any shade with synthetic enamel paint black or any other approved colour to give an even shade.

NOTE:-AllcoloursandshadesandmakesshallbeasapprovedbytheManagement committee.

DOORS

- (i) <u>ENTRANCEDOORALONGWITHWIREMESHDOOR</u>:-Providing & fixing ofPanel door shutter as per CPWD Specifications with latest amendments complete in all respects including all suitable door fittings. Outer Entrance door will be provided with jali door, which will be as per SSR-2004(for MES). The Top, Central, Bottom with both side rails shall have minimum thickness of 35mm thick ivory coast teak wood (frames) as per architecture drawings with inside panel of minimum 12 mm thick, both side Solid Teak Ply as specified, with good quality melamine polish with extraordinary smooth finish complete on both side of doors & Chowkhats/door frames to the satisfaction of the Management committee.
- (ii) <u>ALLOTHERINTERNALDOORS</u>:- All other internal Doors Shutters shall be of BWP flush door with teak veneer on both faces as per approved design with good quality melamine polish with extraordinary smooth finish complete on both side of doors as mentioned in list of Approved make.(If required)

DOORS/WINDOWSASPERCPWDSPECIFICATIONS

Providing and fixing external doors and openable/fixed windows, glazed and wire-mesh shutters of standard UPVC sections(3 track system) of approved make including handles, peg stacks, catchers, hinges, lugs, etc. complete in all respects as per detail drawings including glass panes wire mesh and fittings etc.

DOORFRAMES/CHOWKATS

Internaldoorframes/Chowkatsof100mmx62.5mmsectionoflvorycoastteakwoodasperdrawing.

Main door frame/ Chowkat will be of 150mm x 62.5 mm section in double rebate of Ivory coast teak wood as per drawings.(If required)

STEELWORKFORGRILLS, RAILING, GATESETC. ASPERPWDSPECIFICATIONS

Wrought iron and mild steel (using angles, flats, square bars, tees and channels) for ladders, Grills, grating frames, window guards, Gates, including cost of screws and weldingrods or bolts and nuts completely fixed in position, complete in all respects for boundary wall and main gates of complex on both sites.

All Stair case railings and all balconies railings will be of Mild steel material as per Architectural drawings including fixing in position complete in all respects

DOOR&WINDOWFITTINGSlikeTowerBolts,Handles,SlidingBoltsetcwillbeasperPunjabPWDspecifications/DSR Specifications and as per list of make and model

GLASSPANESASPERPWDSPECIFICATIONS

Supplyandfixingofglasspanesof5mmthickincludingmetalsashputty,clipsetc.ofapprovedmake.

THERMO-MECHANICALLYTREATEDBARSFORRCCWORK

Fe-500grade, TMTBarsof companies TATA, TISCO, SAIL, RINL, will be used.

POP/CORNICES

All walls and ceilingswillhave P.O.P. punning and cornices inliftlobbies and corridors orwhereverrequired complete in all respects as per detailed drawings to be supplied..

THERMALINSULATIONOFTERRACES:

 ${\tt Topofroof to be P.U. thermal insulated by some specialized agency with guarantee of minimum 10 years. }$

WATERPROOFINGOFTOILET/KITCHEN/TERRACE/BALCONY:

Toilet/Kitchen/Terrace/Balconies,&swimmingpoolstobewaterproofedasperHaryanaPWDspecifications and shop drawings approved by the Management committee.

<u>AllaboveworkistobecarriedoutasperCPWDspecificationsasapplicabletothesatisfactionoftheManagement</u> <u>committee.</u>

SPECTIONSFORPUBLICHEALTHSERVICES

All the pipe ducts on outer facia will be covered with R.C.C jali or openable and removable any type of materialasperapproveddrawingsissuedbytheManagement committee.Thecontractorwillnothaveany objection and will not be paid any extra cost for any type of material as per approved drawing.

WATERSTORAGE TANK

WaterstoragetankwillbeofR.C.C.asperapproveddrawings.

SPECIALSFORDIPIPESASPERCPWDSPECIFICATION

Drilling&tappingductileironpipelinesofalldiametersandscrewinginferruleandconnections:-

Cutting holes upto 23 cm through brick work in cement walls for pipes and making good including repointing, re-plastering and finishing according to existing finish where required as complete in all respect to the entire satisfaction the Management committee.

Fixing galvanized malleable iron holder bats hold fasts to pipe line fixed on walls and ceilings including all cutting to walls and making good to original condition.

Providing and fixing of gunmetal gate valve with C.I. Wheel of approved quality (screwed end)

WASH BASIN

The basin shall conform to BIS2556 and shall be arthemark of firmmanufacturing it as per approved make.

The basin shall be supported RS or CI standard brackets duly embedded in brick walls. Each basin shall be provided with centre hole mixer, 1¹/₄" C.P. Brass Waste, with 32 mm dia C.P. brass bottle traps with 40mm Dia uPVC waste pipe and jali on trap including angle cocks, PVC connections etc. complete in all respect.

INTERNALWORK(CPVC)

The pipes shall be CPVC (Chlorinated Poly Vinyl Chloride) material for hot & cold water supply piping system using solvent welded CPVC fittings i.e. Tees, Elbows, Couples, Unions, Reducers, Brushing etc. including transition fittings(connectionbetweenCPVC& Metal pipes/ GI) i.e. Brass adapters(bothMale& Female threaded and all conforming to ASTM D-2846 with only CPVC solvent cement conforming to IS standards with clamps / structural metal supports as required /directed at site including cutting chases & fitting the same with cement concrete / cement mortar as required, including painting of the exposedpipes withonecoatof desired shadeofenamel paint.All termination points for installationof faucetsshall have brass termination fittings. Installation shall be to the satisfaction of manufacturer & the Management committee.

GIPIPES(EXTERNALWORK)

Providing, laying, jointing, fixing and testing G.I. Pipe (Class 'B') lines complete with G.I. Specials andfittings and clamps etc. inside building cutting, threading of pipes and cutting and making good the walls etc. (internal work), as complete in all respect to the entire satisfaction of the Management committee.

50mm diameter nominal bore

63mm diameter nominal bore

80mm diameter nominal bore

100mmdiameternominalbore

EARTHWORKFORPIPESANDMANHOLESasperCPWD specification

Excavation, of trenches in streets, lanes or in open areas for storm sewer, sewers running by gravity and manholes to full depths as shown in drawings including shoring, timbering or poling boards, frame system type and removal of surplus Soil, from site of work, upto a lead of 1 km in ordinary soil.

SWPIPESJOINTING

Providing, laying and jointing glazed stoneware pipes Grade'A' with stiff mixture of cement mortarin the proportion of 1:1 (1 cement : 1 fine sand) including testing of joint etc. as complete in all respect to the entire satisfaction of the Management committee.

CC1:4:8AROUNDSW PIPES

Providing and laying cement concrete 1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 20mm nominal size) around SW pipes including bed concrete as per design approved by the Management committee, complete in all respect to the entire satisfaction of the Management committee

MANHOLECHAMBERSasperCPWDspecification

Construction of rectangular standard brick masonry manhole chambers 1:5 cement stand mortar in Brick Work, 12mm thick water tight 1:2 cement sand plaster with a floating coat of neat cement and finished with2coatsofsodiumsilicate,c.c1:6:12belowbedandfoundations.C.C1:2:4inbenching,Suitably

designed reinforced cement concrete slab 180mm thick, Prov. & fixing Heavy duty, 560mm C.I. manhole cover ISI marked and frame painted with 3 coats of black bitumen paint, fixing iron steps complete in all respects.

INSPECTIONCHAMBERasperCPWDspecification

Constructing brick masonry inspection chamber sizes as given below upto 0.60 metre average depth 1:5 lime concrete 1:2:4 benching 12mm thick cement plaster 1:2 R.C.C. $1:1^{1}/_{2}:3$ slab 100mm thick/C.C.topping, 50mm thickwith455mmx455mm/455mmx610mm inside light duty C.I. inspection chamber cover and frame with 3 coats of black bitumastic superior paint complete as per standard design as complete in all respect to the entire satisfaction of the Management committee.

KITCHENSINK

ProvidingandfixingsalemstainlesssteelAISI304(18/8)kitchensinkdoublebowlas perI.S13983withC.I. bracketsandstainlesssteelplug 40mmincluding painting offittingsand brackets,cuttingandmakinggood the walls wherever required with drain board mixers, accessories etc. complete in all respect to the entire satisfaction of the Management committee in every kitchen.

SOILANDDRAIN/SULLAGEPIPES

Providing and fixing of UPVCpipes for soil, waste, vent or anti syphonage pipe (conforming to IS : 4985-2000) of approved make, embedded in wall or on wall face / duct including cost of allied fitting, including suitable jointing to ensure leak proof service as per instruction for laying, jointing laid by the manufacture, cutting and wastage etc. and cutting holes in walls, roofs and floors etc. and making to its originalcondition to the satisfaction of the Management committee and of following minimum sizes:-

- (a) 110mmdia(Soil Pipe)
- (b) 110mmdia.(Wasteandother)

CC1:5:10AROUNDUPVC PIPES

Providing and laying cement concrete 1:5:10 (1 cement : 5 coarse sand :10 graded stone aggregate 20mm nominal size) around UPVC pipes including bed concrete as per standard design as complete in all respect to the entire satisfaction of the Management committee, around

- (a) 110mmdia
- (b) 75mm dia
- (c) 63mmDia
- (d) 40mmDia

DOORTRAPASPERCPWDSPECIFICATION

Providing and fixing uPVCfloor traps I.S.I. marked of the self-cleaning design with suitable grating with frame with or without vent arm and including cement concrete 1:2:4complete in all respects including cutting and making good the walls and floors, etc.

GULLYTRAPASPERCPWDSPECIFICATION

ProvidingandfixinginpositionS.W.gullytraps150X100mmfixingincementconcrete1:4:8complete with C.I. grating 150mm x 150mm cast iron cover.

MIRRORASPERCPWDSPECIFICATION

Providing and fixing in position best Indian make beveled edge 5.5 mm thick mirror mounted on asbestos sheet ground fixed in position by means of 4 nos. chromium plated brass screws and washers complete including cutting and making good the walls etc.

CP FITTINGS

Providing & fixing C.P single lever opal series of Jaquar make including concealed with flange (as approved by the Management committee) as complete in all respect to the entire satisfaction of the Management committee as detail given below:-

TECHNICALSPECIFICATIONFORESTATESERVICES

1 WATERSUPPLY

EXCAVATIONFORPIPELINEasperCPWDspecification

Excavation for pipelines running under pressure in trenches and pits, in open areas, where disposal of surplus earth is done along with the alignment and restoration of un-metalled or unpaved surface to its, original condition, ordinary soil-

DI PIPE& SPECIALS

Providing laying, cutting & jointing of S&S ductile iron pressure pipe class K-9 confirming to IS: 8329 / 2000 (with upto date amendment) including cost of freight and storage charges labour for fixing DIspecials including cost of rubber ring/gas-ket for jointing complete in all respect duly tested to the entire satisfaction of the Management committee (including cutting & jointing etc). The Rubber ring shall be ISI marked and of food grade.

100mm internal diameter of pipes

150mminternaldiameterofpipes.

providing and fixing flanged joints to double flanged D.I. Pipes and special sincluding testing of joints (conforming to IS specifications)

100mminternaldiameterofpipes

150mminternaldiameterofpipes

CIFOOT VALVE

Providing and fixing cast iron foot valve with flange for 100mm dia pipes (confirming to IS specifications). The arrangement for the testing as per BIS shall be made by the contractor/firm.

CISLUICE VALVE

Providing & fixing cast iron sluice valve, surface boxes & indicating plates including cartage from to correct levels in cement mortar 1:3 and construction of masonry chamber of standard design.

CCINFOUNDATIONASPERCPWDSPECIFICATION

Cementconcrete1:8:16withstoneballast20mmnominalsizeinfoundationandplinthistobe provided.

CCTOPPINGASPERCPWDSPECIFICATION

Conglomeratefloor40mmthickcementconcretetopping1:2:4istobeprovided.

BRICKWORKFORCHAMBER/HOUDIASPERCPWDSPECIFICATION

Firstclassbrickworklaidincementsandmortar1:5infoundationandplinthistobe provided.

CEMENTPLASTER&CEMENTRENDERINGASPERCPWDSPECIFICATION

12mmthickcementplaster1:3plus1mmthickcementrenderingonplaster.

RCCSLABASPERCPWDSPECIFICATION

<u>Cement concrete 1:1.5:3 or richer grade with</u> stone storage agreement 20mm nominal size for reinforced concrete work in slabs with inclination not exceeding 25 degree with horizontal, including steel reinforcement and including centring and shuttering, laid in position, complete in all respects. The steel shall be provided conforming to IS specification.

DISPECIALS

Supplying & fixing D.I. specials, nut & bolt etc. as per specification confirming to ISI including cost of loading, unloading, carriage insurance, royalties and taxes etc. to the entire satisfaction of the Management committee.

- i) D.ITee100mmx100mmx100mm
- ii) D.I.Collars100mm
- iii) Crosstee100mmx100mmx100mmx100mm
- iv) D.I.Bend100mmx90 degree
- v) Tailpieces(F/P)
- vi) Nut&Bolt

2. <u>SEWERAGE</u>

EXCAVATIONOFTRENCHESFORSEWER.

SWPIPE

Supplying, lowering, jointing and cutting of salt glazed stoneware pipes and specials into trenches for all depths and laying out the same to correct alignment, gradient, level etc. in trenches, including all dressing and trimming of bed and side of trenches if required trimming and cutting the concrete beds and joints holes, supporting the pipes and specials in correct position in a suitable rigid manner while the same are being jointed and until the surrounding benching, hunching and envelopes are completed. The sewer shall restonthebed at everypoint through-out its length and to ensurethis, itshall be grouted inwithoutextra charge with 1:3 cement sand mortar. Jointing in trenches using cement sand mortar 1:1 and best white Italian tarred Hemp/ Yarn including finishing and trowel ling to each joint atan angle of45 degreewith the longitudinal axis of pipes, watering, keeping joints covered and wetted till the same are cured. Testing the sewer lines for leakages and making all leakages and defect good, complete. The cost of S.W pipes, cement, sand, hamp yarn etc. including cutting the stone ware pipes and specials chipping and finishingthe cut surface to a uniform finish and roughing the part of pipes if any entering the sockets of theadjacentpipescomplete, to the used in External Services will be 200 mm i/d.

<u>Note:</u>Incaseseweristobelaidunderwater,provisionfordewateringofSubSurface/Sub Soil Water Level and plugging etc. shall have to be provided by the contractor and no addition cost shall be admissible on the account.

MANHOLECHAMBERS

Constructingbrickmasonrymanholeschambersofstandarddesignaspermanualofsewerageand treatment issued by CPHEEO and shall consist the following specification.

LEANCONCRETEASPERCPWDSPECIFICATION

Cement concrete 1:6:12 with stone aggregate 20 mm nominal size infoundation and plinthin 9 inchdepth.

BED&BENCHINGASPER CPWD SPECIFICATION

Cementconcrete1:11/2:3 with stone aggregate 20 mm nominal size as perdesign approved by the Management committee.

RCCSLABOVERMANHOLECHAMBERASPERCPWDSPECIFICATION

RCC1:1½:3forslab(7inchesor175mmthick)includingsteelreinforcement,centeringandshuttering complete in all respect. Slab to be suitably designed.

First class brick work laid cement sand mortar 1:5 in foundation and plinth for underground structure for sewerage and manholes.

Brickworkinfirststoreyupto4mtraboveplinth level.

CEMENTPLASTER&CEMENTRENDERINGASPERCPWDSPECIFICATION

12mmthickcementplaster1:2pluscement rendering1mmthickonplasterinsidemanhole. Manhole

Covers & frames

Providingandfixingincementsandmortar1:2, setting the same to correct lines and levels heavy duty SFRC manhole cover and frame, Heavy Duty, duly approved by the Management committee.

MASONRYPLUGSASPERASPERCPWDSPECIFICATION

Providingmasonryplugstoendsofsewerofalltypeswith11.43cmthickbrickwallincementsandmortars 1:7 with 12mm thick cement plaster 1:6 required by the Management committee.

CI/SFRCSTEP

Providing&fixingofC.IorM/I/SFRCstepsincludingcarriageandsettingin1:2cementsandmortar complete in all respect as desired by the Management committee.

3. STORMWATERDRAINAGE

EXCAVATION OF EARTH WORK as per CPWD specification

Excavationoftrenchesinopenareasforstormdrainasperdesign. BRICK

WORK FOR BRICK DRAIN AS PER CPWD SPECIFICATION

Firstclassbrickworklaidincementsandmortar1:5infoundationandplinthistobe provided.

CC1:8:16INF&PASPER CPWDSPECIFICATION

Cement concrete 1:8:16 with brick ballast 20mm nominal size infoundation and plinth is to be provided as per drawing.

CC1:2:4INFLOORINGASPER CPWDSPECIFICATION

Cement concrete 1: 2: 4 with stone aggregate 20 mm nominal size infoundation and plinth.

RCCSLABOVERBRICKDRAINASPERCPWDSPECIFICATION

RCC slab as per design including steel reinforcement centering and shuttering complete in all respect. This slab will have perforations in atleast $1/3^{rd}$ length for entry of storm water

CEMENTPLASTERINBRICKDRAINASPERCPWDSPECIFICATION

12 mm thick cement plaster 1:2 plus cement rendering 1 mm thick on plaster.

REMOVABLESLAB

Removableslabin30%lengthshallbeprovided.

TECHNICALSPECIFICATIONSFORINTERNALPLUMBINGWORKS

1.0 GENERALREQUIREMENTS

1.1 <u>ScopeofWork</u>

- 1.1.1 The formofContractshallbe accordingtothe "ConditionsofContract". The following clauses shall be considered as an extension and not inlimitation of the obligation of the Contractor.
- 1.1.2 Workunderthiscontractshallconsistoffurnishingalllabour,materials,equipmentandappliances necessary and required. The Contractor is required to completely furnish all the Plumbing and other specialized services as described hereinafter and as specified in the Schedule of Quantities and/or shown on the Plumbing Drawings.
- 1.1.3 Without restricting to the generally of the foregoing, the sanitary installations shall include the following:-

A.PlumbingWorks

- i) Sanitary Fixtures.
- ii) Soil,Waste&VentandRainWaterPipesandfittings.
- iii) WaterSupplySystem(Cold&Hot).
- iv) Sewerage&Stormwaterdrainagesystem
- v) GardenIrrigationSystem
- vi) WaterSupplyPumps&WatertreatmentEquipments
- 1.1.4 Servicesrenderedunderthissectionshallbedonewithoutanyextracharge.

1.2 <u>Specifications</u>

- 1.2.1 Work under this contract shall be carried out strictly in accordance with Specifications attached with the tender.
- 1.2.2 Items not covered under these Specifications due to any ambiguity or misprints, or additional works, the work shall be carried out as per Specifications of the latest Central Public Works Department with upto date amendments as applicable in the contract and or as per the requirement of the client or its representative.
- 1.2.3 Works not covered above in para 1.2.1 and 1.2.2 shall be carried out as per relevant Indian Standards and in case of its absence as per British Standard Code of Practice.

1.3. ExecutionofWork

1.3.1 The Contractorshouldvisitand examinethesite of workand satisfy himselfasto the natureof the existing roads and other means of communication and other details pertaining to the work and local conditions and facilities for obtaining his own information on all matters affecting the execution of work. No extra charge made in consequence of any misunderstanding, incorrect information on any of these points or on ground of insufficient description will be allowed.

- 1.3.2 The work shall be carried out in conformity with the Plumbing drawings and within the requirements of Architectural, Fire fighting, HVAC, Electrical, Structural and Other specialized services drawings.
- 1.3.3 The Contractor shall cooperate with all trades and agencies working on the site. He shall make provision for hangers, sleeves, structural openings and other requirements well in advance to prevent hold up of progress of the construction schedule.
- 1.3.4 On award of the work, Contractor shall submit a schedule of construction in the form of a PERT Chart or BAR Chart for approval of the Project Manager/Architect/Consultant. All dates and time schedule agreed upon should be strictly adhered to, within the stipulated time of completion/commissioning along with the specified phasing, if any.

1.4 Drawings

- 1.4.1 Plumbing drawings are diagrammatic but shall be followed as closely as actual construction permits. Any deviations made shall be in conformity with the Architectural and other services drawings.
- 1.4.2 Architectural drawings shall take precedence over Plumbing or other services drawings as to all dimensions.
- 1.4.3 Contractorshallverify all dimensions at site and bringtothe noticeof the Management committee all discrepancies or deviations noticed. Decision of the Management committee shall be final.
- 1.4.4 Large size details and manufacturers dimensions for materials to be incorporated shall take precedence over small scale drawings.
- 1.4.5 All drawings issued by the Architects/Consultant for the work are the property of the Society and shall not be lent, reproduced or used on any works.

1.5 InspectionandTestingofMaterials

- 1.5.1 Contractor shall be required, if requested, to produce manufacturers Test Certificate for the particular batch of materials supplied to him. The tests carried out shall be as per the relevant Indian Standards.
- 1.5.2 For examination and testing of materials and works at the site Contractor shall provide all Testing and Gauging Equipment necessary but not limited to the followings:
 - a) Theodolite, Steel tapes
 - b) Dumpylevel
 - c) Weighingmachine
 - d) Plumbbobs,Spiritlevels,Hammers
 - e) Micrometers, Tachometers
 - f) Thermometers, Stoves
 - g) Hydraulictestmachine
 - h) Smoketest machine
- 1.5.3 All such equipment shall be tested for calibration at any approved laboratory, if required by theProject Manager.
- 1.5.4 AllTestingEquipmentshallbepreferablylocatedinaspecialroommeantforthepurpose.

1.5.5 Samplesofallmaterialsshallbegotapprovedbeforeplacingorderandtheapprovedsamples shall be deposited with the Management committee. Any materials declared defective by the Management committee shall be removed from the site within 48 hours.

1.6 <u>MetricConversion</u>

- 1.6.1 All dimensions and sizes of materials and equipment given in the tender document are commercial metric sizes.
- 1.6.2 Anyweights, orsizes given in the tender having changed due to metric conversion, the nearest equivalent sizes accepted by Indian Standards shall be acceptable without any additional cost.

1.7 <u>ReferencePoints</u>

- 1.7.1 ContractorshallprovidepermanentBenchMarks,FlagTopsandotherreferencepointsforthe proper execution of work and these shall be preserved till the end of the work.
- 1.7.2 All such reference points shall be in relation to the levels and locations given in the Architecturaland Plumbing drawings.

1.8 <u>ReferenceDrawings</u>

- 1.8.1 The Contractor shall maintain one set of all drawings issued to him as reference drawings. These shall not be used on site. All important drawings shall be mounted on boards and placed in racks indexed. No drawings shall be rolled.
- 1.8.2 All corrections, deviations and changes made on the site shall be shown on these reference drawings for final incorporation in the completion drawings. Allchanges to be made shall be initialled by the Management committee.

1.9 ShopDrawings

- 1.9.1 TheContractorshallsubmittotheProjectManagerthreecopiesoftheshopdrawings.
- 1.9.2 Shopdrawingsshallbesubmittedunderfollowingconditions:-
 - (a) Showinganychangesinlayoutintheplumbingdrawings.
 - (b) Equipmentlayout,pipingandwiringdiagram.
 - (c) Manufacturer'sorContractor'sfabricationdrawingsforanymaterialsorequipmentsupplied by him.
- 1.9.3 TheContractorshallsubmittwocopiesofcatalogues,manufacturer'sdrawings,equipment characteristicsdataorperformancechartsasrequiredbytheManagement committee.

1.10 <u>CompletionDrawings</u>

- 1.10.1 On completion of work, Contractor shall submit one complete set of original tracings and two prints of "as built" drawings to the Management committee. These drawings shall have the following information.
 - a) Runofallpiping, diameters on all floors, vertical stacks and location of external services.
 - b) Groundandinvertlevelsofalldrainagepipestogetherwithlocationofallmanholesand connections upto outfall.

- c) Runofallwatersupplylineswithdiameters,locationsofcontrolvalves,access panels.
- d) Locationofallmechanicalequipmentwithlayoutandpipingconnections.

No completion certificates hall be issued unless the above drawing sare submitted.

- 1.10.2 Contractor shall provide two sets of catalogues, service manuals manufacturer's drawings, performance data and list of spare parts together with the name and address of the manufacturer for all electrical and mechanical equipment provided by him.
- 1.10.3 All "Warranty Cards" given by the manufacturers shall be handed over to the Management committee.

1.11. <u>ContractorsRates</u>

- 1.11.1 Rates quoted in this tender shall be inclusive of cost of materials, labour, supervision, erection, tools, plant, scaffolding, service connections, transport to site, taxes, octroi and levies, breakage, wastage and all such expenses as may be necessary and required to completely do all the items of work and put them in a working condition.
- 1.11.2 Ratesquotedareforallheightsanddepthsandinallpositionsasmayberequiredforthiswork.
- 1.11.3 All rates quoted must be for complete items inclusive of all such accessories, Fixtures and fixing arrangements, nuts, bolts, hangers as are a standard part of the particular item except where specially mentioned otherwise.
- 1.11.4 All rates quoted are inclusive of cutting holes and chases in walls and floors and making good the samewith cementmortar/concrete/water proofing of appropriatemix and strength as directed by the Management committee. Contractor shall provide holes, sleeves and recesses in the concrete and masonry work as the work proceeds.
- 1.11.5 The Contractor shall furnish the Management committee with vouchers and test certificates, on request, to prove that the materials as specified and to indicate that the rates at which the materials are purchased in order to work out the rate analysis of non tendered items which hemay be called upon to be carried out.

1.12 Testing

- 1.12.1 Pipinganddrainageworksshallbetestedasspecifiedundertherelevantclause(s) of the specifications.
- 1.12.2 Testsshallbeperformedinthepresenceofthe Management committee.
- 1.12.3 All materials and equipment found defective shall be replaced and whole work tested to meet the requirements of the specifications.
- 1.12.4 Contractorshall performall suchtestsasmaybe necessaryand required by the local authorities to meet Municipal or other bye-laws in force.
- 1.12.5 Contractorshallprovidealllabour, equipment and materials for the performance of the tests.

1.13 <u>SiteClearanceandCleanup</u>

1.13.1 The Contractor shall, from time to time clear away all debris and excess materials accumulated at the site.

- 1.13.2 After the Fixtures, equipment and appliances have been installed and commissioned, Contractor shall clean-up the same and remove all plaster, paints stains, stickers and other foreign matter of discoloration leaving the same in a ready to use condition.
- 1.13.3 On completion of all works, Contractor shall demolish all stores, remove all surplus materials and leave the site in a broom clean condition, failing which the same shall be done at Contractors risk and cost.

1.14 LicensePermitsandAuthorities

- 1.14.1 Contractor must keep constant liaison with the Municipal/statutory authority and obtain all approval of all drainage, water supply and other works carried out by him.
- 1.14.2 Contractor shall obtain, from the Municipal and other authority's necessary completion certificate(s) with respect to his work as required for occupation of the building. Contractor shall obtain permanent water supply and drainage connections from authorities concerned. Employer shall pay all fees/deposits as required to be paid to the authorities towards connection charges.

1.15 <u>Recovery of Cost for Materials issued to Contractors Free of Cost</u>

1.15.1 Ifanymaterialsissuedto theContractorfreeofcost, aredamagedorpilfered, the cost of the same shall be recovered from the Contractor on the basis of actual cost to the Society which shall include all freight and transportation, excise duty, sales tax, octroi, importduty etc. plus 100%. The decision on the actual cost given by the Society shall be final and binding on the Contractor.

1.16 <u>CuttingofWaterProofingMembrane</u>

No walls, terraces shall becut formaking and opening after water proofing hasbeen donewithout written approval of the Management committee. Cutting of water proofing membrane shall be done very carefully to ensure that other portion(s) of water proofing is (are) not damaged. On completion of work at such place the water proofing membrane shall be made good and ensured that the opening/cutting is made fully water proof as per specifications and details of water proofing approved by the Management committee.

1.17 <u>CuttingofStructuralMembers</u>

No structural member shall be chased or cut without the written permission of the Management committee.

1.18. <u>MaterialsSuppliedbyOwner</u>

1.18.1 The Contractor shall verify that all materials supplied by the Society confirm to the specifications of the relevant item in the tender. Any discrepancy found shall be brought to the notice of the Management committee.

1.19 Materials

1.19.1 Unless otherwise specified and expressly approved inwriting by the Management committee, only materials of makes and specifications mentioned in the list of approved makes attached with the specifications shall be used.

1.19.2 If required, the Contractor shall submit samples of materials proposed to be used in the works. Approved samples shall be kept in the office of the Management committee and returned to the Contractor at the appropriate time.

2.1 BASISOFDESIGN

The Plumbing, Sanitary & Drainage System for the project is designed keeping in view thefollowing:

- 2.1.1 RequirementofadequateandequalpressureavailabilityofcoldwaterlinesinToilets, Pantry/Kitchen etc.
- 2.1.2 Adequatestorageofwaterinundergrounddomesticwatertanks.
- 2.1.3 Levelsofroads/pavementsandotherservicesinthearea.
- 2.1.4 Landscapelayout.

 $\label{eq:theta} The execution of works and material sused shall be a spectral execution of the statement of the statement$

The extension of work shall in stick compliance to the Environmental Clearance granted by MoEF, Govt. of India & license issued by local municipal Department.

Wherever reference has been made to Indian Standard or any other specifications, the same shall mean to refer to the latest specification irrespective of any particular edition of such specification being mentioned in the specifications below or Schedule of Quantities.

2.2 CONCEPTOFTHESYSTEM

Thefollowingservicesareenvisagedforthe complex:

- 2.2.1 Domestic water supplythroughGravitySystemformakingwateravailableattheresidualpressure 1.5to2.0kg/sq.cm.
- 2.2.2 SewageandSullagecollectionsystembasedonIS:1742andapplicablestandardsfordomestic drainage.
- 2.2.3 Storm / Rain water drainage system from various levels of the building and disposal to availablemunicipal storm water disposal and recharge wells.

3.0 WATERSTORAGE&DISTRIBUTIONSYSTEM:

3.1 WaterRequirement

The water requirement for the project is proposed to be based on the provisions of IS:1172 and prevalent practice. The estimated requirement of water per day for the Complex is based on the number of users and other services.

3.2 SourceofWater

It is expected that the daily domestic water requirement for the Complex shall be through municipal mains supply.

3.3 WaterStorage

 $\label{eq:constraint} A dequate storage is planned to meet the peak demand of water in the complex.$

3.4 WaterQuality

The domestic water supply will be a sper BIS standard for potable water.

3.5 WaterDistribution

The water distribution for cold water supply for the Complex shall be designed on principle of gravity to ensure availability of adequate residual head at user outlet. Water transfer pumping system shall be provided with level controllers for cut-in and cut-out the pumps in case of water level is low and high in OH water tank respectively.

3.6 Appurtenant

Followingcomponentsshallbeincludedinthewatersupplysystemforefficientfunctioning:

- i. Airventateachofthehigh point.
- ii. Flowmeter.
- iii. PressureGauge.
- iv. Anchorblock/thrustblock.

4.0 SEWAGE, SULLAGEANDSTORMWATER

The soil and waste shall be carried down in separate independently vented pipes. Two pipe drainage systems shall be adopted as per NBC (Part-IX). Provision of maxi vent shall also be made for hygiene, safety consideration and to avoid foul smell entering through trapped gully in WC. Provision of grease trap shall be made for waste water from Kitchen.

4.1 **DesignLimitations**

Thesystemisdesignedconsideringthefollowing:

- a. Highthrustdevelopedatsoil&waterpipeconnections.
- b. Terminationofventcowl/Maxiventsatterrace level.
- c. Provision of adequate slope for horizontal header pipes for achieving self-cleaning velocity in the pipes.
- d. Provisionofcleanoutplug.

5.0 WORKMANSHIP

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

6.0 MATERIALS

 $\label{eq:alpha} All materials shall be best of their kind and shall conform to the latest Indian Standards.$

All materials shall be of approved quality as per samples and origins approved by the Management committee.

As and when required by the Management committee, the contractor shall arrange to test the materials and/or portions of works at his own cost to prove their soundness and efficiency. If after tests any materials, work or portions or work are found defective or unsound by the Management committee, the contractor shall remove the defective material from the site, pull down and re-execute the works at his own cost to the satisfaction of the Management committee. To prove that the materials used are as specified the contractor shall furnish the Management committee with original vouchers on demand.

A. <u>SANITARYFIXTURES&CPFITTINGS</u>

1. ScopeofWork

- 1.1 Work under this section shall consist of furnishing all materials and labour as necessary and required to completely install all Sanitary Fixtures, chromium plated fittings and accessories as required by the drawings and specified hereinafter or given in the Schedule of Quantities.
- 1.2 Without restricting to the generally of the foregoing the sanitary fixtures shall include the following:
 - a) Sanitary fixtures
 - b) Chromiumplatedfittings
 - c) Porcelainorstainlesssteelsinks
 - d) Accessoriese.g.toiletpaperholders,soapdispensers,handdryersetc.
- 1.3 Whether specifically mentioned or not all fixtures and appliances shall be provided with all fixing devices, nuts, bolts, screws, hangers as required.
- 1.4 All exposed pipes within toilets and near fixtures shall be chromium plated brass or copper unless otherwise specified.

2. <u>GeneralRequirements</u>

- 2.1 Sanitary fixtures shall be of best quality approved by the Management committee. Wherever particular makes are mentioned, the choice of selection shall remain with the Management committee.
- 2.2 All fixtures and fittings shall be provided with all such accessories as are required to complete the item in working condition, specifications, drawings accessories shall include proper fixing arrangement, brackets, nuts, bolts, screws and required connection pieces.
- 2.3 Fixing screws shall be half round head Chromium Plated brass screws with C.P. washers where necessary.

- 2.4 Contractor shall furnish without cost of all such accessories and fixing devices that are necessary and required but not supplied along with the Plumbing Fixtures and C.P fittings by the manufactures as a part of the original standard supply.
- 2.5 All Fittings and Fixtures shall be fixed in a neat workmanlike manner true to levels and heights shown on the drawings and in accordance with the manufacturer's recommendations. Care shall be taken to fix all Inlet and Outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, tiling or terrace shall be made good at Contractors cost.
- 2.6 Contractor seal fixtures fixed near wall,marble and edges. With an approved type of poly-sulphide sealant appropriate for its application.

3. Fixtures&Fittings

- 3.1 All Porcelain fittings, bathtubs, C.P fittings and accessories shall be supplied by the Contractor at site, unless specified otherwise.
- 3.2 If fixtures supplied by Society, Contractor shall take the delivery of the materials directly from the suppliers and will be responsible for its safe storage and custody in the godown.
- 3.3 Only materials, accessories and fixing devices supplied as standard supplies by the manufacturer shall be given to the Contractor free of cost at site.
- 3.4 All balance materials e.g. nuts, bolts, CP nuts and bolts; other fixing devices shall be supplied by the Contractor within the quoted rates.
- 3.5 Description and method offixingisgiven below for the contractor tounderstandthe scope and extent of the work.

4. EuropeanW.C

- 4.1 European W.C. shall be wall mounted set flushed by means of concealed flushing cistern with plastic flushing systems which will be an integral part of the wall system. Where ever applicable bend shall be connected to the W.C. by means of a suitable rubber adapter. Wall hung W.C. shall be supported by a floor mounted chair.
- 4.2 Each W.C. set shall be provided with a plastic seat covers shall be with rubber buffers and chromium plated hinges.
- 4.3 Plasticseatcoversshallbeso fixedthatitremainsabsolutelystationeryinverticalpositionwithout falling on the W.C.
- 4.4 Flushing cistern (exposed/coupled/concealed/others) when provided shall be provided with all internal flushing mechanism, 15 mm dia ball cock with unbreakable polyethylene float and overflow pipe. Any framework required for fixing cistern has to be provided by the Contractor. Each W.C shall be suitable for flushing in low volume of water 3-6 liters.

5. LavatoryBasin

5.1 LavatorybasinsshallbewhiteglazedvitreousChinaofsize,shapeandtypespecifiedinthe drawings.

- 5.2 EachBasinshallbeprovidedwithbracketsandclipsofapprovedandsecurelyfixed.Placingof Basins over the brackets without secure fixing shall not be accepted.
- 5.3 Each Basin shall beprovided with a 32mmdia wastewith overflow,pop-up wasteor rubber plug and chain mentioned in the drawings, 32 mm dia CP brass bottle trap with pipe to wall and flange.
- 5.4 Eachbasinshallbeprovidedwithmixingfittingasspecifiedinthedrawings.
- 5.5 Basinsshallbefixedatproperheightsasshownondrawings.Ifheightisnotspecified,therim level shall be 79 cms or as directed by the Management committee.
- 6. <u>Sinks</u>
- 6.1 Sinksshallbestainlesssteeloranyothermaterialasspecifiedinthedrawings.
- 6.2 Each sink shall be provided with brackets of approved and securely fixed.Counter top sinks shall be fixed with suitable brackets or clips as recommended by the manufacturer.Each sink shall be provided with 40 mm dia C.P. waste with chain and plug as given in the Schedule of Quantities. Fixing shall be done as directed by the Management committee.
- 6.3 SupplyfittingsforsinksshallbemixingfittingsorC.P.taps.

7. Accessories

- 7.1 Contractor shall install all ChromiumPlated and porcelainaccessoriesas shown on the drawings or directed by the Management committee.
- 7.2 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 the Management committee.
- 7.3 C.P.accessoriesshallbefixedinwallsandsetincementmortar1:2(1cement:2coarsesand)and fixedinrelationtothetilingworkasperInteriorDesigner's drawings.

12. Measurement

- 12.1 Sanitary fixtures and accessories shall be measured by numbers in the unit.
- 12.2 Rates for all items shall be inclusive of cutting holes and chases and making good the same, C.P brass screws, nuts, bolts and any fixing arrangements required and recommended by manufacturers, testing and commissioning.

B. SOIL, WASTE, VENT&RAINWATERPIPES& FITTINGS

1. ScopeofWork

- 1.1 Workunder thissectionshall consistof furnishing all labour, materials, equipments and appliances necessary and required to completely install allsoil, waste, vent and rainwater pipes and fittings as required by the drawings, and given in the drawings.
- 1.2 Without restricting to the generally of the foregoing, the soil, waste, vent pipes system shall include the followings:-

Verticalandhorizontalsoil, wasteandventPipes, and fittings, joints, clamps, connections to fixtures.

Connection of pipestose werlines as shown on the drawings at ground floor levels. Basement

drainage, channels, gratings and floor drains.

Floorandurinaltraps, cleanoutplugs, in let fittings and rainwaterheads/Khurras.

Testing of all pipe lines.

2. <u>GeneralRequirements</u>

- 2.1 Allmaterialsshallbenewofthebestqualityconformingtospecificationsandsubjecttothe approval of the Management committee.
- 2.2 Pipesandfittingsshallbefixedtrulyvertical,horizontalorinslopesasrequiredinaneatworkmanlike manner.
- 2.3 Pipesshallbefixedinamannerastoprovideeasyaccessibilityforrepairandmaintenanceand shall not cause obstruction in shafts, passages etc.
- 2.4 Pipesshallbesecurelyfixedtowallsandceilingsbysuitableclampsatintervalsspecified.
- 2.5 Access doors for fittings and cleanouts shall be so located that they are easily accessible for repair and maintenance. Any access panel required in the Civil structure, false ceiling or marble cladding etc. shallbeclearly reported to the Society intheformofshopdrawings sothatother agenciesare instructed to provide the same.

3. PipingSystem

3.1 Soil,WasteandVentPipes

- a) The soilandwastepipe systemabove groundhasbeenplannedasa <u>"Twopipe system"</u> having separate pipes for waste for janitor sinks, wash basins, drains and floor drains and soil from the WCs and Urinals, and or a <u>"Single stack system"</u> where all waste and soil pipes are connected to the same stack. Necessary venting shall be done by using Air Admittance valves, to be installed based on manufacturers recommendations.
- b) Vertical soil and waste stacks shall be connected to a separate horizontal drain / single horizontal drain at basement ceiling/ground floor generally as shown on the drawings.
- c) ToiletlayoutshavebeensoarrangedthattheW.Coutletsshallbewith"P"trapaboveground level.
- d) All soil/waste from areas in basement areas will be collected in sumps and pumped into sewer lines or as specifically designed.

3.2 RainwaterPipes

- a) Allopenterracesshallbedrainedbyrainwaterdowntakes.
- b) Rainwater down takes areseparate and independentof the soil and waste system and will discharge into the underground storm water drainage system of the complex.

- c) Rainwaterinopencourtyardsshallbecollectedincatchbasinsandconnectedtothestorm water drains.
- d) Any dry weather flow from waste appliances e.g. Parking and Drainage Sumps shall connected to the Storm Water Network and Sewerage Sumps will be connected to the Sewerage System.

3.3 Balcony/PlanterDrainage

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

3.4 SoilWasteandRainWaterPipes

All horizontal/Vertical soil, waste & rain water piping work inside toilets, basement ceiling, vertical in shaft and ground floorlevel shall be carried out uPVC SWR piping system as shown in drawings.

INSTALLATION: The piping system must be clamped properly using rubber padded (internally) "flat U clamps", pipes passing through walls, beams, slabs, columns should pass through sleeves which are padded with insulation material.

3.4.1 UPVCPIPESANDFITTINGS

The pipes shall be round and shall be supplied in straight lengths with socketed ends. The internal and external surfaces of pipes shall be smooth, clean, free from groovings and other defects. The ends shall be cleanly cut and square with the axis of the pipe. The pipes shall be designed by external diameter and shall conform to IS:13592. The pipes shall be of Class-B pressure rating.

FITTINGS

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

LAYING&JOINTING

The piping system must be clamped properly using rubber padded (internally) "flat U clamps", pipes passing through walls, beams, slabs, columns should pass through sleeves which are padded with insulation material.

The supports shall allow the repeated movements to take place without abrasion. Jointing for UPVC pipes shall be made by means of solvent cement for horizontal lines and 'O' rubber ring for vertical line. The type of joint shall be used as per site conditions / direction of the Owner's site representative. Where UPVC pipes are to be used for rain water pipes, the pipe shall be finished with GI adopter for insertion in the RCC slab for a water proof joint complete as directed by Owner's site representative.

3.5 <u>Traps</u>

3.5.1 FloorTraps

Floor traps where specified shall be siphon type full bore UPVC, as specified in Drawings having a minimum 50 mm deep seal. All traps are under hung from the slab and shall be adequately supported.

3.5.2 FloorTrapInlet

Bath room traps and connections shall ensure free and silent flow of discharging water. Where specified, Contractor shall provide a special type of floor or manhole inlet fitting fabricated from UPVC pipes as specified in drawings without, with one, two or three inlet sockets welded on sideto connect the waste pipe or joint between waste and inlet socket shall be with sealant compound/push-fit as per requirement of the system. Inlet shall be connected to a P or S trap, floor trap inlet and the traps shall be set in cement concrete blocks where varied in floors as specified without extra charge.

3.6 Cleanout

PlugsFloorCleanOut

Plug

Clean out plug for soil, waste or rain water pipes laid under floors shall be provided near pipe junctionsbends,tees, "Y's" and onstraightruns at such intervals as required as persite conditions. Clean out plugs shall terminate flush with the floor levels. They shall be cast brass suitable for the pipedia. With screwed to a UPVC socket. The socket shall be joined to the pipewith dripseal/pipe seal.

3.7 EncasinginCementConcrete

Encasing of pipes is required to provide stability to the line and prevent its damage during construction.

Soilandwastepipesunderfloor

Pipes laid in sunken slabs and in wall chases (when cut specially for the pipe) shall be encased in cementconcrete1:2:4mix(1 cement:2coarsesand:4gradedstoneaggregate12mm size)75mm in bed and all round. When pipes are running well above the structural slab, the encased pipesshall be supported with suitable cement concrete pillars of required height at intervals of1.8m. All drainagepipesexceptwhenfixedabovegroundorinexposedlocationsshallbeencasedincement concreteasspecifiedaboveforsoilandwastepipes.Thebedandencasingthickness shallhowever be 150mm in bed and all round as shown on the drawing.

3.8 CuttingandMakingGood

Contractor shall provide all holes cut outs and chases in structural members necessary and required for the pipe work as building work proceeds. Wherever cut outs, holes are left in the original construction, they shall be made good with cement concrete 1:2:4 (1 cement : 2 coarse sand:4stoneaggregate20mmnominalsize)orcementmortar1:2(1 cement:2coarsesand)and the surface restored as in original condition.

3.9 Sleeves/Cutouts

Contractor shallutilizeall cutout and sleeves provided during construction to prevent breaking. The annular space between the pipe and the sleeves hall be filled up with approved type of fire

hydrant sealant. When sleeves are misplaced or inaccurately located contractor shall make the holes in the wall or structural members at his own cost but only with the prior permission of the Management committee.

4.0 <u>Testing</u>

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

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

All materialsobtained and used on sitemusthave manufacturers hydraulictest certificate for each batch of materials used on the site.

4.1 Measurements

4.1.1 General

- a) Ratesquotedforallitemsshallbeinclusiveofallworkanditemsgiveninthespecifications and Drawings.
- b) Ratesareapplicablefortheworkinbasements,undertheground,floors,inshaftsat ceiling level area for all depths and building upto 100 m in height.
- 4.1.2 Rates are inclusive of cutting holes and chases in masonry work/RCC Slabs by core cutting method and making good the same.
- 4.1.3 Ratesareinclusiveofpretestingandonsitetestingoftheinstallations, materials and commissioning of the works.
- 4.1.4 Pipes(unitofmeasurement.Linearmetertothenearestcentimetre)
- 4.1.5 Soil,waste,vent,antisiphonage,rainwaterpipes,anddrainagepipesshallbemeasurednetwhen fixed correct to a centimetre including all fittings along its finished length.
- 4.1.6 Cement concrete around pipes shall be measured along the centre of the pipe line measured per linear meter and include any Masonry Supports, Shuttering and Centring Cutting complete as described in the relevant specifications.
- 4.1.7 Slotted angles/channels shall be measured per linear meter of finished length and shall include support boltsandnutsembeddedinmasonrywallswithcement concreteblocksandnothingextra will be paid for making good the same.
- 4.1.8 Fittings(excludingpipefittings)(Unitofmeasurementbynumbers)

Urinaltraps,trap gratings,hoppers,cleanoutplugsshallbemeasuredbynumberperpieceand shall include all items described in the relevant specifications.

4.2 <u>Excavationforsoilpipes</u>:

No extra payment shall be admissible with respect to excavation, refilling and disposal of surplus earth for pipes laid below ground, in sunken/filled up slabs or over basement rafts.

4.3 <u>AirAdmittanceValves (AAV)</u>

Air admittance valves shall be made in ABS/PVC capable of operating at temperatures between 0 degree c and 60 degree c. The AAV shall be of suitable flow rate and installed in main discharge stacks and / or branches.Design based on air flow capacity required in proportion to the discharge unit capacities. The vendor is to supply data sheet showing relevant calculations and drawings indicating location and type of AAV as required.

AAV'stohavefollowingperformanceparameter:

- Temperaturerange:-20degreeCelsiusto60degreeCelsius.
- Openpressure:-70pa(-0.010psi)
- Max.Pressureratingtightness:10,000pa(1m/40"h2o)at0paorhigher

4. INTERNALWATERSUPPLYSYSTEM

1.1 ScopeofWork

- 1.1.1 Work under this section consists of furnishing all labour, materials equipment and appliances necessary and required to completely install the water supply system as required by the drawings, specified hereinafter and given in the Drawings.
- 1.1.2 Without restricting to the generality of the foregoing, the water supply system shall include the following:-
- j) Distributionsystemfrommainsupplyheaderstoallfixturesandappliancesforcold/hotwater.
- k) Coldwatersupplylinesfromcitywaterconnectionstofireandundergroundwatertanks.
- I) MunicipalwaterconnectionstoU.G.watertanks.
- m) Gardenirrigationsystem
- n) Excavationandrefillingofpipestrenches.
- o) Insulationtohotwaterpipes.
- p) Pipeprotectionandpainting.
- q) Controlvalves, masonry chambers and other appurtenances.
- r) Connectionstoallplumbingfixtures,tanks,appliancesandMunicipalmains

1.2 GeneralRequirements

- 1.2.1 All materialsshallbe newof thebestquality conforming to specifications. Allworks executed shall be to the satisfaction of the Management committee.
- 1.2.2 PipesandFittingsshallbefixedtrulyvertical,horizontalorinslopesasrequiredinaneatworkmanlike manner.
- 1.2.3 Short or Long bends shall be used on all main pipe lines as far as possible. Use of Elbows shall berestricted for short connections.
- 1.2.4 Pipes shall be fixed in a manner so as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

- 1.2.5 Pipesshallbesecurelyfixedtowallsandceilingsbysuitableclampsatintervalsspecified.
- 1.2.6 Clamps,hangersandsupportsonRCCwalls,columnsandslabsshallbefixedonlybymeansof approved made of expandable metal fasteners inserted by use of power drills.
- 1.2.7 Allpipeclamps, supports, nuts, bolts, washers shall be galvanized MS steel throughout the building. Painted MS clamps & MS nuts, bolts and washers shall not be accepted.
- 1.2.8 Valves and other appurtenances shall be so located as to provide easy accessibility for operations, maintenance and repairs.

1.3 WaterSupplySystem

1.3.1 Contractorshouldstudythesiteplanandwatersupplysystemdiagramforanoverviewofthe system.

1.3.2 Source

WatersupplywillbeacquiredfromGMADA/MunicipalCorporationwatermainstoaservice connection and collected in water storage tanks located in basement.

1.4 WaterSupplyPipingSystem

All water supply work in side toilets in wall chase and on toilet ceiling shall be carried out in CPVC (Class-SDR11).

All water supply piping works in shafts and in exposed location upto 50 mm diameter shall be carried out in CPVC (Class-SDR-11).

All water supply piping works above 50mm dia and in pump room shall be carried out in GI Heavy class pipes and fittings.

1.4.1 CPVCPipes& Fittings

The pipes shall be CPVC (Chlorinated Poly Vinyl Chloride) material for hot & cold water supply piping system using solvent welded CPVC fittings i.e. Tees, Elbows, Couples, Unions, Reducers, Brushing etc. including transition fittings (connection between CPVC & Metal pipes / GI) i.e. Brass adapters (both Male & Female threaded and all conforming to ASTM D-2846 with only CPVC solventcementconformingtolSstandardswithclamps/structuralmetalsupportsasrequired /directed at site including cutting chases& fitting thesamewith cement concrete / cementmortar as required, including painting of the exposed pipes with one coat of desired shade of enamel paint. All termination points for installation of faucets shall have brass termination fittings. Installation shall be to the satisfaction of manufacturer & the Management committee.

JoiningPipes&Fittings

a. Cutting:

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

b. Deburring/Beveling:

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

c. Fittingpreparation:

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

d. SolventCementApplication:

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

e. Assembly:

After applying the solvent cement on both pipe and fitting socket, pipe should be inserted into the fitting socket within 30 seconds, and rotating the pipe ½ to ½ turn while inserting so as to ensure even distribution of solvent cement with the joint. The assembled system should be held for 10 seconds (approximately) in order to allow the joint to set up.

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

Set &Cure times:

Solventcementsetandcuretimesshallbestrictlyadheredtoasperthebelowmentioned table.

Ambient	PipeSize		
TemperatureduringCoreperiod	1⁄2" -1"	1.¼"-2"	
Above15deg.C	1 Hr	2 Hrs	
4-15deg.C	2 Hrs	4 Hrs	
Below4degC	4 Hrs	8 Hrs	

MinimumCorepriortopressuretestingat150PSI

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

f. Testing

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

g. TransitionofFlowguardCPVCtoMetals

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

ThreadedSealants

Teflont a peshall be used to make threaded connections leak proof.

SolventCement

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

Diameterofpipeininch	1⁄2"	3⁄4″	1″	1⁄4″	1½"	2"
(flowguard)						
Approx. nos. of joints whichcanbemodeper litreofsolventcement.	200No.	180No.	150No.	130No.	100No.	70No

Hangersandsupports

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

Hangersshouldnothaveroughorsharpedgeswhichcomeincontactwiththetubing. Supports

should be as per the below mentioned table:

SizeofPipe	21°C	49°C	71°C	82°C
Inch	Ft.	Ft.	Ft.	Ft.
1/2"	5.5	4.5	3.0	2.5
3/4"	5.5	5.0	3.0	2.5
1″	6.0	5.5	3.5	3.0
1¼"	6.5	6.0	3.5	3.5
1½"	7.0	6.0	3.5	3.5
2"	7.0	6.5	4.0	3.5

SCHEDULE-40							
	RecommendedSupportspacing(infeet)						
Nom.Pipe Siz	e	Tempe	rature⁰C				
(In)	(mm)	23	38	49	60	71	82
21/2	65	7 ½	7	7	6 ½	6	3½
3	80	8	7	7	7	6	31⁄2
4	100	8½	7½	7½	7	6½	4
6	150	9½	8	8	7½	7	4½
8	200	9½	8	8	7½	7	5

1.4.2 G.I.Pipes, Fittings&Valves(Terrace Ring)

All pipes inside the buildings and where specified, outside the building shall be galvanized steel tubes conforming to I.S. 1239 of medium/ heavy class.

Fittings shall be malleable iron with a reinforcing ring over the threaded ends upto 50mm dia and without reinforcing rings for sizes 65mm dia and above. Each fitting shall have manufacturer's trade mark stamped on it.Fittings for G.I. pipes shall include Couplings, Bends, Tees, Reducers, Nipples, Unions, and Bushes.Fittings shall conform to I.S:1879 (Part I to X).

Pipes and fittings shall be jointed with screwed joints. Care shall be taken to remove burr from the end of the pipe after reaming with a proper time.

Pipe threaded joints will be made by applying suitable grade of TEFLON tape used for drinking water supply.

All pipes shall be fixed inaccordance with layout and alignment shownon the drawings. Care shall be taken to avoid air pockets. G.I. pipes inside toilets shall be fixed in wall chases well above the floor. No pipes shall be run inside a sunken floor as far as possible. Pipes may be run under the ceiling or floors and other as shown on drawings.

Pipe Supports

All pipes clamps, supports, hangers, rods, pipe supports, nuts and washers shall be factory made galvanized MS steel or alternatively galvanized after fabrication to suit site requirements.

G.I pipes in shafts and other locations shall be supported by galvanized M.S clamps of design approved by pipes in wall chases shall be anchored by G.I hooks, pipes at ceiling level shall be supported on structural clamps fabricated from M.S structural steel. Pipes in typical shafts shall be supported on Galvanised slotted angles/channels as specified elsewhere.

Clamps

G.I. pipes in shafts and other locations shall be supported by M.S. clamps of design approved by the Management committee. Pipes in wall chases shall be anchored by iron hooks, Pipes at ceiling level shall be supported on structural clamps fabricated from M.S. structural steel as described above. Pipes in typical shafts shall be supported on slotted angles/channels as specified.

AnchorFasteners

All pipe supports, hangers and clamps to be fixed on RCC walls, beams, columns, slabs andmasonry walls 230mm thick and above by means of galvanised expandable anchor fasteners in drilled holes of correct size and model to carry the weight of pipes. Drilling shall be made only by approved type of power drill as recommend and approved by manufacturer of the anchor fasteners. Failure of any fastening devices shall be the entire responsibility and contractor shall redo or provide additional supports at his own cost. He shall also compensate the owner for any damage that may be caused by such failures.

Unions

Contractor shall provide adequate number of unions on all pipes to enable easy dismantling later when required. Unions shall be provided near each gunmetal valve, stop cock, or check valve and on straight runs as necessary at appropriate locations as required and/or directed by the Management committee.

Flanges

Flanged connections shall be provided on pipes as required or where shown on the drawings, all equipment connections as necessary and required or as directed by connections shall be made by the correct number and size of GI nuts, bolts & washers with 3 mm thick gasket. Where hot water connections are made insertion gasket shall be of suitable high temperature grade and quality approved by Bolt hole dia for flanges shall conform to match the specification for C.I. sluice valveto I.S.780. and C.I. butterfly valve to IS: 3095.

1.5 Valves

BallValves

Valves upto 50 mm dia. shall be screwed type Ball Valves with stainless steel balls spindle teflon seating and gland packing tested to a hydraulic pressure of 20 kg , sq.cm., and accompanying couplings and steel handles.(to BS 5351)

ButterflyValves-SlimSealType

Valves 65 mm dia and above shall be cast iron butterfly valve to be used for isolation. The valves shall be bubble tight, resilient seated suitable for flow in either direction and seal in both direction with accompanying flanges and steel handle.

ButterflyvalveshallbeofbestqualityconformingtolS: 13095.

NonReturnValve(DualSlim Type)

Where specified, non return valve shall be provided through which flow shall occur in onedirection only.

Each Butterfly and Slim Type Swing Check (NRV) Valve shall be provided with a pair of flanges screwed or welded to the main line and having the required number of nuts, bolts and washers of correct length.

1.6 Testing

Allpipes, fittings and valves, after fixing atsite, shall be tested by hydrostatic pressure of 1.5 times the working pressure or 7 kg / sq. cm which ever is more. Pressure shall be maintained for a period of at least thirty minutes without any drop. A test register shall be maintained and all entries shall be signed and dated by Contractor (s) and Project Manager.

Inadditiontothesectionaltestingcarriedoutduringtheconstruction,Contractor shalltesttheentire installation after connectionstothe overhead tanks or pumpingsystem or mains. He shallrectify all leakages and shall replace all defective materials in the system. Any damage done due to carelessness, open or burst pipes' or failure of fittings, to the building, furniture and fixtures shall be made good by the Contractor during the defects liability period without any cost.

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

Hot water pipes chasedinto the walls shall be provided with a6mmthick insulation with elastic flexible materialhavinghermetic closedcellstructureofexpandedsynthetic materialratedfor 60°C hot water supply.

1.7 Measurement

Pipes above ground shall be measured per linear meter (to the nearest cm) and shall be inclusive of all fittings e.g. coupling, tees, bends, elbows, unions, flanges and U clamps with nuts, bolts & washers fixed to wall or other standard supports.

Jointing with teflon tape, white lead, solvent, crimping and insertion gasket of appropriate temperature grade.

Cutting holes, and chases in walls, floors, any pipe support required for pipes below ground & making good the same.

Excavation, backfilling, disposal of surplus earth and restoring the ground & floor in original condition.

Pipe Supports

Fabricated and / or galvanised supports shall be measured by weight. Weight for each type of clamp shall be calculated on basis of the quantity of structurals and MS used from the theoretical weight calculated on basis of the components theoretical weight of the sections.

Ratequotedforsupports&hangersshallbeinclusiveof:

- a) Expandableanchorfastens.
- b) Galvanisingofallsupports&hangers.

- c) Cuttingholesinwalls,ceilingsonfloorsandmakinggoodwherepermitted.
- d) Nuts, bolts and washers for fixing and assembling.
- e) Wooden/PVCpipesaddlesforverticalorhorizontalruns.

Valves

Gunmetal, cast iron, butterfly and non return valves and puddle flanges shall measured by numbers and shall include wheels I caps, GI nuts, bolts, washers, insertion gasket.

Painting/pipeprotection/insulation

Painting/pipe protection /insulation for pipes shall be measured per linear meter over finished surface and shall include all valves and fittings for which no deduction shall be made. No extra payment shall be made for fittings, valves or flanges.

5. COMMISSIONING&GUARANTEE

1. SCOPE OF WORK

Workunderthissectionshallbeexecuted without any additional cost. The rates quoted in this tender shall be inclusive of the works given in this section.

Contractor shall provide all tools, equipment, metering and testing devices required for the purpose.

On award of work, Contractor shall submit a detailed proposal giving methods of testing and gauging the performance of the equipment to be supplied and installed under this contract.

All tests shall be made in the presence of the Management committee or any inspecting authority. At least five working days notice in writing shall be given to the inspecting parties before performing any test.

Waterflowratesofallequipmentandinpipelinesthroughvalvesshallbeadjustedtodesign conditions.Complete results of adjustments shall be recorded and submitted.

Contractor shall ensure proper balancing of the hydraulic system and for the pipes / valvesinstalled in his scope of work by regulating the flow rates in the pipe line by valve operation. The contractor shall also provide permanent Tee connection (with plug) in water supply lines for ease of installing pressure gauge, temperature gauge & rota meters. Contractor shall also supply all required pressure gauge, temperature gauge & rota meter for system commissioning and balancing. The balancing shall be to the satisfaction of the Management committee.

Three copies of all test results shall be submitted to the Engineer inA4size sheet paper within two weeks after completion of the tests.

2 PRE-COMMISSIONNIG

On completion of the installation of all piping, valves, pipe connections, insulation etc. the Contractor shall proceed as follows:

Priortostart-upandhydraulictesting,theContractorshallcleantheentireinstallationincludingall fitments and pipe work and the like after installation and keep them in a new condition.All pumpingsystemsshallbeflushedanddrainedatleastoncethroughtogetridofcontaminating

materials.All pipes shall be rodded to ensure clearance of debris, cleaning and flushing shall be carried out in sections as the installation becomes completed.

- a) Allstrainersshallbeinspectedandcleanedoutorreplaced.
- b) Checkallclamps, supports and hangers provided for the pipes.
- c) Check all theequipment, piping and valves coming under hotwater system and operate each and every valve on the system to see if the valves are functioning properly. Thereafter conduct & hydro test of the system as for (b) above.
- d) Fill up pipes with water and apply hydrostatic pressure to the system as given in the relevant section of the specification. If any leakage is found, rectify the same and retest the pipes.

3 FINALACCEPTANCETESTS

Following commissioning and inspection of the entire installation, and prior to issue of the Completion Certificate, the Contractor shall carry out final acceptance tests in accordance with a programme to be agreed with the Management committee.

Should the results of the acceptance tests show that plant, systems and/or equipment fail to perform to the efficiencies or other performance figures as given in this Specification, the Contractorshall adjust, modify and if necessary replace the equipment without further payment in order that the required performance is obtained.

Where acceptance tests are required by the relevant Authorities having jurisdiction, these tests shall be carried out by the Contractor prior to the issue of Completion Certificate to the acceptance of the Authorities.

4 REJECTIONOFINSTALLATION/PLANT

Any itemofsystemorcomponentwhichfails comply with therequirements of this Specification in any respect what so ever at any stage of manufacture, test, erection or completion at site may be rejected by the Management committee either in whole or in part as it considers necessary/appropriate. Adjustment and/or modification work as required by the Management committee so as to comply with the Authority's requirements and the intent of the Specification shall be carried out by the Contractor at his own expense and to the satisfaction of the Management committee.

After works have been accepted, the Contractormay be required to carry out assist incarrying out additional performance tests as reasonably required by the Management committee.

5. WARRANTYANDHANDOVER

The Contractor shallwarrant that all plant, materials and equipment supplied and all workmanship performed by him to be free from defects of whatsoever nature before handover to the Society.

6. HANDINGOVEROFDOCUMENTS

All testing and commissioning shall be done by the Contractor to the entire satisfaction of the Management committee and all testing and commissioning documents shall be handed over to Society.

The Contractor shall also hand over all maintenance and operation manuals, all certificates and all other documentation as per the terms of the contract to the Society.

7. PIPECOLOURCODE:ColorcodetoconfirmtolS:2379:1990

S.No.	Pipe Lines	Ground/Base	First	Second
		Color	ColorBand	ColorBand

1	DrinkingWater(Allcoldwater linesafterfilter)	Sea Green	FrenchBlue	SingleRed
2	TreatedWater(SoftWater)	Sea Green	LightOrange	
3	DomesticHotWater	Sea Green	LightGrey	
4	Drainage	Black		

LISTOFBUREAUOFINDIANSTANDARDSCODES

All equipment, supply, erection, testing and commissioning shall comply with the requirements of Indian Standards and code of practices given below as amended upto date. All equipment and material being supplied by the contractor shall meet the requirements of IS., electrical inspectorate and Indian Electricity rules and other Codes / Publications as given below:

1. Pipesand Fittings

IS : 458	$\label{eq:specification} Specification for precast concrete pipes (with and without reinforcement) \ \mbox{IS}:$
651	Salat glazed stone ware pipes and fittings.
IS : 1239	(Part1)Mildsteel,tubes,tubularsandotherwroughtsteelfittings:Part1 Mild Steel tubes.
IS : 1239	(Part2)MildSteeltubes,tubularsandotherwroughtsteelfittings: Part
	2Mild Steel tubulars and other wrought steel pipe fittings.
IS : 1536	Centrifugallycast(spun)ironpressurepipesforwater,gasandsewage. IS :
1537	Vertically cast iron pressure pipes for water, gas and sewage.
IS : 1538	CastIronfittingsforpressurepipesforwater,gasandsewage. IS :
1879	Malleable cast iron pipe fittings.
IS:1978	Linepipe
IS:1979	Hightestlinepipe.
IS:2501	Coppertubesforgeneralengineeringpurposes

IS : 2643	(Part1)Dimensionsforpipethreadsforfasteningpurposes:Part1Basicprofile and dimensions.
IS:3468	Pipenuts.
IS : 3589	Seamless or electrically welded steel pipes for water, gas and sewage (168.3 mmto 2032 mm outside diameter).
IS : 3989	Centrifugallycast(sun)ironspigotandsocketsoil,wasteandventilating
	pipes, fittings and accessories.
IS : 4711	Methodsforsamplingsteelpipes, tubes and fittings. IS :
6392	Steel pipe flanges
IS : 7181	Specificationforhorizontallycastirondoubleflangedpipeforwater, gas and sew age.
Valves	
IS : 778	$\label{eq:specification} Specification for copperalloy gage, globe and check valves for water works purposes.$
IS:780	Specification for sluice valves for water work spurposes (50 mm to 300 mm size).
IS : 1703	Specification copper alloy float valves (horizontal plunger type) for water supplyfittings.
IS : 2906	Specificationforsluicevalvesforwaterworkspurposes(350mmto1200mmsize) IS :
3950	Specification for surface boxes for sluice valves.
IS : 5312	(Part 1) Specification for swing check type reflux (non return) valves : part 2 Multi door pattern.
IS : 5312	(Part 2) Specification for swing check type reflux (non return) valves : part 2 Multi door pattern.
IS : 12992	(Part1)Safetyreliefvalves, springloaded: Design IS:
13095	Butterfly valves for general purposes.
SanitaryFitting	IS
IS:771	(Part1to3)Specification for glazed fire clays an itary appliances.
IS : 774	Specification for flushing cistern for water closets and urinals (other than plasticcistern)
IS:775	${\sf Specification} for castiron brackets and supports for wash basins and sinks$
IS : 781	Specification for cast copper alloy screw down bib taps and stop valves for water services.

IS:1700 Specificationfordrinkingfountains.

2.

3.

IS: 2556(Part 6 Sec 2) Specification for vitreous sanitary appliances (vitreous china) part 6Specific requirements of urinals, section 2 half stall urinals.
IS : 2556	(Part 6 Sec 4) Specification for vitreous sanitary appliances (vitreous china) Part 6 specific requirements of urinals, section 4 partition slabs.
IS : 2556	(Part 6 Sec 5) Specification for vitreous sanitary appliances (vitreous china) Part 6 Specific requirements of urinals, section 5 waste fittings.
IS : 2556	(Part 6 Sec 6) Specification for vitreous sanitary appliances (vitreous china) Part6 Specific requirements of urinals, section 6 water spreaders for half stall urinals.
IS:2692	Specificationforferruleforwater services
IS : 2717	Glossaryoftermsrelatingtovitreousenamelwareandceramicmetalsystems IS :
5961	Specification for cast iron gratings for drainage purposes.
IS:6249	$\label{eq:specification} Specification for gel-coated glass fibre reinforced polyester resinbath tubs.$

- IS:6411 Specificationforgel-coatedglassfibrereinforcedpolyesterresin bathtubs.
- IS: 8931 Specificationforcopperalloyfancysingletaps,combinationtap assemblyandstop valves for water services.

4. WaterQualityTolerance

- IS: 3025 (Parts 1 to 44) Method of sampling and test (physical and chemical) for water and waste water.
- IS:10500 DrinkingWater

5. Pumps& Vessels

IS : 2002	${\it Steelplates for pressure vessels for intermediate and high temperature sevice}$
	including boilers.
IS:2825	Codeforunfired pressure vessels.

- IS:5600 Specificationforsewageanddrainage pumps
- IS:8418 Specificationforhorizontalcentrifugalselfprimingpumps.

6. General

SP:6	(1)StructuralSteelSections
IS:325	ThreePhaseInductionMotors
IS : 779	Specificationforwatermeters(domestictype). IS
: 782	Specification for caulking load.
IS:800	Codeofpracticeforgeneralconstructionin steel
IS : 1068	Electroplated coatings of nickelplus chromium and copper plus nickelplus chromium.

- IS:1726 Specificationforcastironmanholecoversandframes.
- IS:1742 Codeofpracticeforbuildingdrainage.
- IS:2065 Codeofpracticeforwatersupplyinbuildings.
- IS:2104 Specificationforwatermeterforboxes(domestic type)
- IS:2373 Specificationforeatermeter(bulktype)
- IS:2379 Colourcodeforidentificationofpipelines.
- IS:3114 Codeofpracticeforlayingofcastironpipes
- IS:4127 Codeofpracticeforlayingglazedstonewarepipes.
- IS:4853 Recommendedpracticeforradiographicinspectionoffusionweldedbutt
 - jointsinsteelpipes.
- IS:5455 Castironstepsformanholes.
- IS:7558 Codeofpracticefordomestichotwater installations.
- IS:8321 Glossaryoftermsapplicabletoplumbingwork.
- IS:9842 Preformedfibrouspipeinsulation.
- IS:10221 Codeofpracticeforcoatingandwrappingofunderground mild steel pipelines.
- IS:10446 Glossaryoftermsrelatingtowatersupplyandsanitation.
- IS:11149 RubberGaskets
- IS:11790 Codeofpracticeforpreparationofbutt-weldingendsfor pipes,
 - valves,flangesandfittings.
- IS:12251 Codeofpracticefordrainageofbuildingbasements.
- IS:5572 Codeofpracticeforsanitarypipe work.
- BS:8301 Codeofpracticeforbuildingdrainage.
- BSEN:274 Sanitarytapwere,wastefittingsforbasins,bidetsandbaths.

TECHNICALSPECIFICATIONFORROADS

- 1. The right of way, formation width, side slope, metalled width etc. of various roads will be referred as per drawings submitted by the agency and approved by the Management committee.
- 2. The work of clearing and grubbing shall consist of cutting, removing and disposing of all materials such as trees, bushes, stumps top organic soilnot exceeding of 150mm in thick which in the opinion of the Management committee are unsuitable for incorporation of the works from thearea of the land complete as per MORTH specification as per clause 201.1
- 3. Earth work shall be carried out and finished in accordance with the specification ordered by the Management committee. Before placing the earth fill, the surface area of ground that will be covered by earthwork shall be cleared of trees and bushes and the surface shall then be ploughed over. Compaction of earth work in layers of 15 to 30 cms will be done as per PWD specification.
 - (a) Providing and laying of compacted, granular sub base (GSB) 250 mm (in two layer & each layers of 125 mm) having density of 2gm/cc as per MORTH specifications
 - (b) Providing and laying of compacted, (2 layers compacted each) of total thickness 200 mm (in2 layers and each layer of 100 m) Wet mix macadam (WMM) confirming to clause-406 of MORTH specification.
 - (c) 200mm trimixofM-35 grade concrete onmetalwidth willbeprovidedonallthe roadsasper MORTH specifications
- 4. Thesideslopsshouldbe2Horizontal:1verticalandcambercompletewillbe2.5%minimum.
- 5. Noearthtobeliftedfromthe site.
- 6. The compaction of the embankment of the road/pavement/parking of site of work shall consider satisfactory when desired DBD is achieved. The DBD will be got tested as per CPWD specification and latest addition from Central Road Research Institute, Delhi.
- 7. Fielddensitywillnotbelessthan97%ofdrydensitydeterminedinlab.
- 8. Nothing extrawill be paid for any unforeseen circumstances regarding land compensationofearth taken from private sources and or what so ever. Earth brought for filling may require cement/line stabilization. The rate quoted should also take care of such contingencies.
- 9. The location of the source of availability of earth required for filling will be responsibility of the contractor and the Management committee will have nothing to do in this regard.
- 10. The contractor shall be required to produce samples of all materials sufficiently in advance for the material to be used in the actual execution of work shall strictly confirm to be quality of the samples approved. In case of variation such material shall be liable to be rejected.
- 11. Thematerialandgeneralrequirementsofearthworkinembankmentforconstruction.
 - $a. \ \ Physical requirements shall be a sper MORTH clauses no. 305. 2.1.1 to 305. 2.1.5.$
 - b. Compactionrequirementofembankment&subgradeshallbeaspertable 300.2
 - c. Spreading of material in layers, bringing to appropriate moisture contents and compactionshall be governed by MORTH of clause No.305.3.1 to 3054.3.5.6
- 12. The construction of subsequent layer of same or other material over the finished layer shall be done after obtaining written permission from the Management committee. Similar written permission from the Management committee shall beobtained in respect of all other item of work prior to proceeding with the next stage of construction.
- WhereverinthedescriptionoftheiteminthebillofthequantitiesthespecificationclauseNo.of
 M.O.R.T. & H is missing, the same shall be carried out strictly in accordance with the M.O.R.T. & H (Road wing) specification (IV revision) of 2001.
- 14. No compensation for any damage caused to the work/materials by rain, floods or other natural calamities shall be paid to the contractor. The contractor shall make good all such damages at his own cost as per directions of the Management committee.
- 15. The contractor shall make his own arrangement for obtaining electrical connection, if required, and make necessary payment directly to the department concerned.

- 16. No work should be done in the absence of the contractor or his authorized representatives. A technician and surveyor will be provided/made available for all working time by the contractor for carrying out quality control tests and surveying. Nothing extra will be paid on this account.
- 17. The contractor will be responsible for setting out the work, establishing benchmark, centre lineetc. and will carry out all such works at his own cost.
- 18. Before start of the work, the contractor will submit the program of execution of work, get is approved from the Management committee and strictly adhere to the same for timely completion of the project.
- 19. The stacking will be done at site for various type of material in the sequence as approved by the Management committee, which will have to be maintained.
- 20. The contractor shall remove all bitumen spots on kerbs and channels and all heaps of wasted mix from gulley grating, bell mouth and other installation at the end of the day work, failing which the same shall be done at his risk and cost.
- 21. The quality control for road work and materials will be exercised as per section 900 of MORT & H specification (IVth revision) 2001 and for determining the quality of bitumen used by extraction method as per procedure laid for doing such tests by IRC, the frequency of sampling will be:
 - a) PreMixcarpet:-onetestper50metercubeandnotlessthantwotestsperday.
- 22. At the time of start of work, the contractor shall get a sample work done in presence of the Management committee who shall fix up the degree of compaction/consolidation required for a particular item of work and conduct suitable tests at regular intervals to determine how far the work done approaches the desired limit. In case tests reveal any deficiency, the contractor shall make good the same without extra payment or work will be rejected if not according to required specification.
- 23. The contractor shall progress on different parts simultaneously to ensure Completion of the road so that minimum breakage and repairs are involved.
- 24. To ensure quality of intermediate fraction test check may be carried out on sample taken from materials. In case that is not found according to specification the work may be rejected. However, the Management committee if considered it expedient and in the interest of work, he may ask the contractor of supply the missing fraction up to quantity as determined by him, separately, free of cost. The cost of test is to be borne by Contractor.
- 25. Before tendering the tenderer shall inspect thesite,ofwork and shall fullyacquaint/satisfy himself about the condition with regard to site, nature of soil, availability of material, suitable location for construction of go downs, stores and labour huts, the extent of leads and lifts is involved in the work (over the entire duration of contract) including local conditions, traffic restriction, obstructions and other conditions as required for a satisfactory execution of work, His rate should take in to consideration all such factors and contingencies. No claim whatsoever shall be entertained by the department on this account.
- 26. Weather and seasonal limitation: The work of lying of premix carpet etc. shall not be taken up during rainy or foggy weather or when base course is damp or wet or during dust storm or when atmospheric temperature is 25° C. or less at site of work of particular reach.
- 27. The rate quoted should include hire charges of land or purchase of land for installation of Hot Mix plant etc.
- 28. **Trimix:-**TrimixconcretingwillbedonebysomespecializedagencywithV.D.S.method.
 - **i.** All W.B.M. surface will clean by compressor and channels will be placed at a specified distance to prepare panels to cast alternatively.
 - **ii.** After concreting the panels surface floater will be run and vacuum dewatering compactor will finish the surface. Excess water will be taken by channels.
 - **iii.** Surface so finished should be properly sloped with camber and protected from use of movement till getting final strength in supervisor of the Management committee.
- 29. At least one authorized representative of the contractor should always be available at site of work to take instructions fromdepartmentalofficersandensure properexecutionofworkisdone in the absence of the contractor. Separates ite or derbooks will be maintained at plantand at site of

work. Any instruction given in site order book will have the same bearing as if, it is given to contractor in person.

- 30. The contractor shall be required to produce samples of all materials sufficiently in advance for the material to be used in the actual execution of work shall strictly confirm to be quality of the samples approved. In case of variation such material shall be liable to be rejected.
- 31. **(A)**Identify defects: the Management committee shallcheckthecontractor'sworkand notify the contractor any defects that are found. Such checking shall not relieve the contractor/contractors responsibility/responsibilities. The Management committee may instruct the contractor to search for defect and to uncover and test any work that the Management committee considers may have a defect.

(B)Correction of defects: -The Management committee shall give notice to the contractor of any defects before the end of defects liability period/maintenance period which begins at completion as per definition. The defect liability period/maintenance shall be extended as long as defects remain to be corrected. Every time notice of a defect is given, the contractor shall correct the notified defect within the limit of time specified by the Management committee notice. If the contractor has not corrected a defect within the time specified in the Management committee notice, the Management committee will assess the cost of having the defect corrected and the contractor will pay the amount.

- 33. The quality control tests will be got done by department and the material for such tests will be supplied by the contractor free of cost. In case the material is not found up to the requirement, the same will be rejected. Testing cost shall also be borne by contractor.
- 34. Cost of such tests will also be borne by contractor. Various quality control operation will be maintained as per clause No. 901,902,903, ofMORT&H (Road wing) Specification (IVth revisionof 2001/ latest edition.)
- 35. Noextrapaymentonaccountofquality controlmeasuresshallbepaidtothecontractor.
- 36. The Management committee at his discretion can get any type and No. of tests carried out from any other approved laboratory for his satisfaction for which all the expenses incurred would be borne by the agency. The results so obtained from the laboratory would be acceptable/ binding to the agency.
- 37. Theridingqualityofeachandeveryreachwillbestrictlyasper specifications.
- 38. Kerb&channelofM-30concretewillbeprovidedononesideofroads.

BOUNDARYWALL

Boundarywallofcomplexwheredwellingunitsaretobeconstructedasper PWD specificationand design / drawings / x-section approved by the Management committee.

TECHNICALSPECIFICATIONFORHORTICULTURE&RAINWATERHARVESTING

HORTICULTURE

- **1.** Theheightofplantshouldbelessthan5ftandtheirsteamshouldnotbelessthan20mm.The height of shrub should not be less than 3ft.
- **2.** The plant which to be planted at site shall be grown in mini bag and minimum height of such bag should not be less 1.5inch, for shrub plant.
- **3.** Theplantshallbehealthyanddiseasefree.
- **4.** The mail/Gardener staff should have sufficient experience, and the Supervisory staff should have technical knowledge regarding the plants and their up keeping.
- **5.** The minimum qualification of supervisory staff should be diploma in Horticulture/Degree in the related field.
- **6.** The species of plant i.e. tree/shrubs/hedges will be decided in consultation with Engineer-in- Charge. Contractor shall adhere to the different operation required in normal conditions during maintenance of the work.
 - i) Mtc.ofgrassylawn

a)	Grasscutting	Oncein aweek
----	--------------	--------------

b) Watering Twiceinaweek

The grass should be weed free

ii) Mtc.of hedges:-

Watering, hoeing, weeding and pruning Oncein 15 Days

iii) Mtc.of edges:-

Making proper edging along walk

Flowerbedsfloweringmoundetc.

iv) Mtc.oftreesand shrubs: Onceina15 Days

 ${\it However} depending these as on and requirement the frequency of above operation may be$

increased as per instruction of the Management committee.

SPECIFICATIONFORGRASSYLAWNANDRAILING

- 7. The Plants/ Grassy lawns will be maintained by the contractor at his own cost for one year after the completion of work and no extra cost will be payable in this regard.
- **8.** The open area/ park will be surrounded by providing Brick Toe walls, Brick Masonry walls with MS Grill as per drawing.

RAINWATERHARVESTING

1.TheworkshallbecarriedoutasperspecificationofCentralGroundWaterBoard(CGWB)with latest amendments. Each and every building block should be covered for bringing the roof top rain water under the above project complete in all respect s per design / drawings of CGWB and to the satisfaction of the Management committee. It is entirely contractor responsibility to get issued rain water harvesting well certificate from GMADA or any other local authority for which nothing will be paid by Society.

SPECIFICATIONSOFLIFTS

A. GENERALSPECIFICATIONS;-

1.0 The Lift Installation works shall be carried out in accordance with following standards IS: 1860 :- Code of practice for Installation, Operation and Maintenance of Electrical Passenger and GoodLifts. IS:3534 :-Outline dimensions of Electric Lifts.IS:4666, IS: 14655, Parts 1, 2, 3, 4, 5, IS: 14671, IS: 2147, IS: 2332 & such State & Local codes as may be applicable, BS: CP 407-1978 Safety code for elevators dumbwaiters, escalators and moving walks, American National Standards Institution.Lift Installation work shall be in conformity with National Electrical Code with uptodate amendments.All Electrical work shall be carried out in accordance with the provision of Indian Electricity Act 1910 & Indian Electricity Rules 1956 amended upto date. The work shall also conform to Indian Standard Code of Practice for the type of work involved.It shall also be in conformity with regulations and requirements of the Local Electricity Supply Authority and Fire Insurance regulations so far as these become applicable to the installation.

Wherever this Tender Specifications call for a higher standard of material and or workmanshipthan those required by any of the above mentioned regulations and specifications then the particular specifications given here under shall take precedence over the said regulations and standards.

1.1 Thework shall be executed and measured as per the dimensions given in the Bill of Quantities. Drawings, Designs, Specifications etc. The abbreviations used shall mean as under:-

//	-	Inch(25.4mm)
/	-	Foot(12inchesor30.48cms)
Sq.Ft.	-	Square Feet
Sq.Mt (M²)	-	SquareMetre.
Cu. Ft.	-	Cubic Feet.
Cum(M ³)	-	CubicMetre.
Kg.	-	Kilograms(Equivalentto1000gms)
T.(M.T.)	-	Tonne (Equivalent to 1000 Kgs.)No.
	-	Numbers.
Cm.	-	Centimetre.
MorR.M.	-	MetreorRunningMetre.

2.0 CONTRACTOR'SDRAWINGS:-

- a) Drawings provided to the CONTRACTOR:-TheCONTRACTOR willgotapproved thedocuments and drawings listed together with any further drawings issuedunder conditionsof contract and other relevant documents.
- b) Shop Drawings :- The Contractor shall prepare and furnish Shop Drawings in quadruplicate at no extra cost for the approval by the Management committee before commencing fabrication/manufacture of the equipment.Such shop drawings shall be based on the requirementslaiddowninthespecificationsandaspersiteconditions.Themanufactureof

equipment shall be commenced only after the shop drawings are approved in writing by the Management committee. The Contractor shall submit shop drawings for Hoist way details of Hoist way beam, Electrical power points and cable size etc. i.e. all the works not in their scope but to be carried out by others.

- c) Builder's WorkDrawings:-TheCONTRACTORshallprovidedrawingsshowingtheexactdimensions and locations of all holes, ducts, recesses, access points, etc. These drawings shall also specify all necessary Builders' Work in connection with movement precaution, sound and thermal protection etc.
- d) As Built Drawings and Working and Maintenance Instruction Manuals:- The CONTRACTOR shall provide to the Management committee prior to the time of completion of the works as defined in the Conditions of Contract. As Built Drawings and Working and Maintenance Instruction Manuals for all elements within the scope of work. Immediately on completion of any relevant works the CONTRACTOR shall prepare two sets of "As Built" drawings of such works for their approval by the Management committee. These drawings shall be a complete record of the works showing the positions and dimensions of all elements executed within the CONTRACTOR's scope of work.

The CONTRACTOR shall provide the Management committee for approval two bound sets of Working and Maintenance Instruction Manual for all services, installations and equipment installed. The Working Maintenance Instruction Manuals and preventive maintenance schedule shall contain all manufacturer's operating and maintenance instructions, and detailed drawings of all equipment supplied. The detailed drawings do not require to be specially prepared, and can comprise copies of the Manufacturer's shop drawings with suitable titles and reference numbers added. The exacts cope details of theOperatingInstructions shall be agreed with the Management committee

After approvalby the Management committee the CONTRACTOR shallforwardto the Management committee four copies of the approved "AS BUILT DRAWINGS" & Working and Maintenance Instructions Manuals and four prints and one reproducible copy of each drawing.Drawings fileson computer disk shall also be forward.

(e) ApprovalofDrawings :-

- i) All drawings prepared by the CONTRACTOR shall be submitted to the Management committee within ten days from actual date of award of letter in phased manner agreed and approved by Management committee and this will be the only accepted and contractual method. The Management committee shall check and approve these drawings in a reasonable time and issue them to the CONTRACTOR as "Approved for Construction". Such approval shall not relieve the CONTRACTOR of responsibility for any discrepancies, errors or omissions in their submittals.
- ii) If the Management committee instruct the re-drawing, alteration or amending of any of the submitted drawings which, in his sole opinion, do not properly interpret the intent of the Contract or for any reason do not comply with good Engineering practice, then the CONTRACTOR shall ensure the carrying out of the Management committee's instructions and no claim for extra payment shall be allowed for any reason in this respect.
- iii) Should the Management committee instruct the alteration or amending of any drawing prepared by Contractor/Manufacturer, then the CONTRACTOR shall ensure that this is done immediately in

ordertoavoidanydelaytotheconstructionprogrammeandnoclaimforextrapaymentor extension of time for completion of the works shall be allowed for any reasons in this respect.

- iv) The CONTRACTOR shall prepare a detailed programme for the production of the drawings / supply of materials/ deployment of skilled and unskilled worker month wise and information required immediately upon receipt of the Management committee's order to commence the works. The programme, whichwill be subject to the scrutiny of the Management committee who may alter or amend it as he sees fit, shall be compatible with the programme for the construction works. The programme shall show the following in details:
 - a) DatesonwhichtheCONTRACTORshallcommencethedrawings/materials/deploymentof skilled and unskilled worker.
 - **b)** Dates on which the CONTRACTOR shall submit the drawings / materials/ deployment of skilled and unskilled worker to the Management committee.
 - c) ReasonableperiodfortheManagement committeetocheckandapprovethesubmitted schedule of drawings / materials/ deployment of skilled and unskilled worker.
 - d) Dateofcommencementoftherelevantasappropriateintheirproper sequence.
 - e) Alltradesand/orelementsasappropriateintheirproper sequence.
 - f) Keyapprovaldatesforlongdeliveryitems.
 - g) AnyotherinformationtheManagement committeemayrequest.

No related manufacturer or installation shall be taken-up in hand until & unless co-ordination drawings, together with any explanatory literature, are approved in writing by the Management committee

The detailed programmes hall reflect the requirements for production of information to permit timely coordination with all trades and other agencies working at site.

NOTE :-TheCONTRACTOR's failure to comply with the provisions of this clause shall be deemed to constitute a default of his obligations under the contract.

- v)All drawings shall be produced using AUTOCAD and a disk file copy shall be submitted in additionto any prints specified at each stage of approval.Drawings by the CONTRACTOR shall be prepared in a clear and proper manner, with adequate size so that the drawings will be easily legible even when reproduced on a reduced scale.The drawing shall be drawn in black ink on a white background to facilitate printing bearing at the bottom right corner the approval, Contract reference, Scale; title block and numberetc.
- **vi)** AlldrawingsbytheCONTRACTORshallbeorientatedtomatchthedesigndrawingsandshallhave a key plan identifying the location or area of the works to which they apply. They shall also bear indication and make reference to the geographical co-ordinates of the site.
- vii) When a drawing is revised, the particulars of the current revision shall be clearly marked or circled, to facilitate checking. All prior revision numbers and reference of drawings possibly superseded by current issue shall also be clearly shown.
- **viii)** When drawings are submitted for approval without complying with these requirements, they may be rejected.

- **ix)** TheCONTRACTOR shallsubmittothe Management committee a diskcopyand two printsofeach drawing or document. If the drawing or document is approved, one print will be returned to the CONTRACTOR bearing the "Approved for Construction" Mark which may also bear the provision "subject to". The CONTRACTOR shall then submit further disk copy, fourprints and one reproducible copy of the approved drawing or document to the Management committee. If the drawing is not approved, one copy will be returned to the CONTRACTOR, bearing the "Not Approved" mark for resubmission.
- **x)** Re-submission of drawings not approved shall be made using the same procedures as in the original submission.
- **xi)** The CONTRACTOR shall ensure that drawings etc. submitted for approval are forwarded in 15 working days from award date to allow the Management committee a reasonable time to examine them and to meet the approved drawing production programme.
- **xii)** The CONTRACTOR shall ensure that drawings are submitted at regular intervals, on aneven flow basis, with sufficient and reasonable time prior to the date required for approval to permit amendments to be made.
- **xiii)** If during the course of construction, revisions to approved details are required, the CONTRACTOR shall amend all Drawings affected and resubmit for approval, following the procedure described above, ensuring that the workingdrawings are at all times an accurate reflection of work on site.
- **Note :** The provision of the above Working Maintenance Instruction Manuals shall form part of the Contract obligations, which shall not be deemed to be complete in respect of virtual handing over to the owner's representative until they are received and approved by the Management committee.

3.0 EXECUTION:-

The works shall be carried out in accordance with the with Lift Work, Architectural Drawings and Structural Drawings, to be approved by the Management committee as "GOOD FOR CONSTRUCTION". The Lift Works Drawings, Structural Drawings and Architectural Drawings shall have to be properly Co-related before executing the works.

4.0 QUALITYOFMATERIALS&GENERALSTANDARDSOFWORK:-

The CONTRACTOR under this contract commits himself to use first classmaterials and assumes full responsibility for the quality of allmaterials incorporated or brought for incorporation in the work. The work shall be executed in accordance with the best Engineering practice and as per directions of the Management committee.

5.0 BARCHARTFOREXECUTIONOFWORK :-

The Contractor shall submit within one week of the acceptance of the tender, a BAR Chart to Management committee, which shall indicate the planning for the execution of the entire work under the contract within the stipulated time given for completion. This shall be scrutinized by the Management committee. The mutually agreed BAR-CHART shall be binding on the Contractor for progress of the work & for completion by the due date.

The Contractor shall during the entire tenure of site work, provide accurate monthly reviews of BAR-CHART showing work targets & completed works for discussions with the Management committee.

Contractor's shall maintain a register of daily deployment of Skilled/Unskilled Labour etc. on various activities and get it signed from Management committee on daily basis and shall produce before the Management committee as and when asked for.

6.0 <u>CIVILWORKSTOBEDONEBYLIFTSCONTRACTOR:</u>-

Contractorshallprovide/carryoutthefollowingathisowncost.

- a) The quoted rates shall be inclusive of all the works in hoist way pertaining to installation of elevators including providing required scaffolding except lighting of hoist way.
- **b)** Steel items such as machine beams, bearing plates and buffer support channels, or any steel required for erection and commissioning etc. cutting holes, grouting with cement concrete and finishing smooth etc.
- c) Asuitableverticalironladderforaccesstothepit.

7.0 WORKNOTINCLUDEDINLIFTSCONTRACT

Works not included in Lift contract but to be furnished by the Civil Contractor in accordance with Local Codes and Regulations and the approved drawings of the Lift Contractors:

- a) A legal hoist way, properly framed and enclosed, including a pit of proper depth with drains and water proofing, if required. The hoist way and pit walls will be treated and white washed to minimize accumulation and circulation of dust.
- **b)** A hoisting hook in the machine room, to hoist equipment during installation and to facilitate maintenance in the future.
- c) properly lighted and ventilated fire resistant machine room, including floors, access door, ladders and guards as required with walls, floor and ceiling treated and painted to minimize accumulation and circulation of dust.
- **d)** Pouring and finishing of machine room floor after elevator machine and relevant equipment have been set in place by elevator contractor.
- e) Painting, except of elevator materials. The hoist way and pit walls shall be treated/whitewashed by OWNER to minimize accumulation and circulation of dust.

8.0 OBTAININGCLEARANCES/CERTIFICATESFROMAUTHORITIES

- 8.1 The Contractor shall arrange, stage wise as may be required, for submitting all the required documents and drawings, for execution and installation of the Lifts, their inspection and obtaining approval/ completion certificates with respect to his works, required for use and connection of the utilities and occupation of the building from the concerned statutory Authorities. The Contractor shall obtain and deliver to the Management committee, on completion of the works, the final inspection and approval from the concerned Authorities including Registration certificate and NOC from Chief lift inspectorfor operation at his own cost for which the Societywill not pay anything.
- **8.2** The contractor shall warrant that all actions taken by him in the execution of the contract shall conform with all applicable Local City, State and Central Government laws, Ordinances and Regulations.TheContractorshalldefendandkeepManagement committeeharmlessfromloss,

cost or damage by reason of any actual or alleged violation of any statutory requirements and safety.

9.0 FEES/CHARGES/DEPOSITSTOBEPAIDTOAUTHORITIES

The fees/charges/deposits to be paid to authorities towards scrutiny, inspection, connection charges and security deposit shall be paid by the Contractor and reimbursed by the Management committee on submission of documentary evidence by the Contractor.

10.0 PROJECTEXECUTIONANDMANAGEMENT

The Contractor shall ensure that senior planning and erection personnel from his organisation are assigned exclusively for this project. They shall have minimum 10 years experience in this type of installation. The Contractor shall appoint one erection engineer and one senior supervisor posted at site on full time basis.

For quality control and monitoring of workmanship, contractor shall assign at least one full time engineer who would be exclusively responsible for ensuring strict quality control, adherence to specifications and ensuring top class workmanship for the installation.

The contractor shall arrange to have mechanised and modern facilities of transporting material to place of installation for speedy execution of work.

11.0 GUARANTEE, MAINTENANCE

11.1 Guarantee

The elevator contractor shall guarantee all equipment parts, materials and workmanship furnished for the installation. The elevator contractor warrants for a period of 24 months from the date of acceptance to replace all failed part or parts exhibiting unusual wear and tear during guarantee period and shall bereplaced without any cost to the Owner, such replacement shall be factory approved new, equal or better than original. All labour, tools, materials, transportation, insurance, etc. required in performance of guarantee shall be at the elevator contractor's expense.

11.2 Maintenance

The elevator contractor shall maintain the elevator system in a first class and safe manner during guarantee period. Such maintenance shall be for the entire elevator system except when failure occursdue towork performed byothers.Responsibilityentails daily inspectionby thesupervisor/ technician and unlimited call back service including nights, weekends and holidays.

Apart from the above this maintenance shall include 1 visit by Engineer per month the first 6 months from the dateofacceptanceoftheelevator system.Callbackserviceshall be provided for emergencies, and responded within 2 Hrs.

Engineer's Visits for the next ten months shall be not less than 1 per fortnight with visit timings adjusted so as not to coincide with the busiest usage period. Call back service shall be responded within 2 Hoursandserviceinvolvingmorethanonestalledorerraticelevatorshallbeimmediately provided regardless of the time of day or night. Emergency call back service for trappedpassengers shall be responded to within 10 minutes. There shall be no compensation for call back service regardless of the hour/ day, etc.

The elevator contractor shall maintain theelevator system in a professional, firstclass manner and keep and maintain elevator machine room and equipment in a neat workman like order.

The contractor shall anticipate demand on supplies and parts and keep an inventory of a reasonablenumberofspare parts, at hisowncost, onsite inaself provided lockable metal cabinet

The contractor shall provide AMC details and service centre details of lift company after expiry of defect liability period.

12.0 PAINTING/POWDERCOATING

All exposed metal work furnished under these specifications, unless otherwise specified, shall be shop primed and properly painted. Shop coats of paint that have become damaged during shipment or erection, shall be cleaned off with mineralsprits, wirebrushedand spot painted over theaffectedareas, then coated with enamel paint/powder coated to match the finish over theadjoining shop painted surface.

13.0 IMPORTLICENSE

Should any import license be required for import of any component, the contractor shall make his own arrangement for the same. The Society shall not undertake any responsibility for import of components and all payments shall be made in Indian rupees only.

14.0 DEVIATIONS

Contractor shall stipulate the deviations, if any, from these Technical Specifications, and reason thereof the contractor has to take approval from Management committee for any deviation if required by manufacturer.

15.0 STRUCTURALREQUIREMENTS

Contractor shall clearly indicate the structural and electrical requirements for the installation of elevators. Machine room, shaft and pit shall be provided by the Owners through other agency. Other preparation work and all items of supplyand installation in the hoistwayshallbethe responsibility of the contractor.

B. <u>PARTICULARSPECIFICATIONS</u>

1.0 GENERAL:-

The lifts shall be A.C. variable voltage variable frequency microprocessor controlled with machine room above.

2.0 SIZE&SPEED:-

- 2.1 TwoPassengerLiftsshallbefor8Persons(544Kg)andtwo PassengerLiftsshallbefor10 Persons (680 Kg) and one Hospital lifts shall be 15 Persons (1020 Kg) and one Freight Lift of 20 Persons (1360 Kg) capacity as specified.
- **2.2** MachineSpeedshallbe1.5MPSforallpassengerliftsand1.0MPSforallhospitalandfreight lift.

3.0 TRAVEL:-

3.1 Thetravelofliftsshallbeasmentionedinscheduleofrequirement.

3.2 Tenderer shall note that all dimensions are as indicated in the enclosed drawings and his design shall be based on the same .These specifications have been based on Indian standard and equipments available locally as per Indian codes and rules. Equipment from other countries will be acceptable if it is of better quality and competitive in price and conforms to InternationalStandards The size of hoist way and car enclosure will, however be the same as specified namely.

Configuration of Lifts shall be as following

Passenger Lift

(a)	Lift Capacity	:	8Passengers(544Kg)	
(b)	Car Entrance	:	800x2100mm.	
Passen	gerLift			
(a)	Lift Capacity	:	10Passengers(680 Kg)	
(b)	Car Entrance	:	900x2100mm.	
Hospit	talLift			
(a)	LiftCapacity	:	15Passengers(1020Kg)	
(b)	CarEntrance:		1000x2100mm	
Freightl Lift				
(a)	LiftCapacity	:	20Passengers(1360Kg)	
(b)	CarEntrance:		1200x2100mm	

3.3 ShaftsSizes:

 $\label{eq:constraint} The clear finished available hoist ways izes hall be a sperschedule of requirement.$

4.0 DRIVINGMECHANISM:-

The lift shallbe provided with A.C, variable voltage, variable frequency, microprocessor controlled motion and drive control system. The tenderers hall indicate the model No. name of manufacturer and country of origin being provided, and the cable size required.

5.0 OPERATION:-

- 5.1 Each car shall be arranged so that momentary pressure of one or more of its buttons shall cause that car to start.
- 5.2 A carcannot bestartedunlessthecar door isintheclosedpositionand allhoistway doorsforthat car are locked in the closed position.
- 5.3 Alltheliftsshallbeprovidedwithfiremanswitchandallrequirementsof CFO.
- 5.4 Alltheliftsshouldfollowstandardcodesofsafetyandservices.

6.0 OPERATIONWITHATTENDANT:-

- 6.1 When the key switch is in position of "without Attendant" the elevator shall operate as described above.
- 6.2 With the key switch in the position of "with Attendant" the direction lights and buzzer shall be operative and "up" direction and the "down" direction buttons in the regular car operating panel shall be effective for the attendant operation.
- 6.3 When on attendant operation, the car and hoist way doors shall open automatically at each stop but the closing of the above shall be subject to the "up" or "down" direction buttons.
- 6.4 As a visual signal to the attendant, the "up" or "down" direction-jewel shall illuminate upon registrationeithercarorlandingcallsto indicate thetraveldirectionofthecar. The attendant shall operate the lift normally in the direction indicated by the direction -jewel. Travel may be realised by the pressureofa carbutton for a landing inthat direction from the car and the direction button in the car operating panel for that direction.
- 6.5 When the key-operated independent service switch is "on" the corresponding car shall operate onlyfrom itscar buttonand shall beentirely independent of the other car. The other carshall then operate as a Simplex Collective Elevator responding to its own car calls and all landing calls.
- 6.6 The pressure of direction button shall cause the doors to close and start the car in the direction desired, provided a car on landing call is registered for the direction. If pressure of the direction button is released before the car starts, the doors shall reopen. After the car has started, the direction button can be released and the car shall answer car and landing button calls.
- 6.7 Continuous pressure of the non-stop button shall cause the car to by-pass all landing calls and respond only to registered car calls.
- 6.8 In order to have a car available at the main floor while both lifts are in operation "with Attendant" a "down" light signal shall be registered. Automatically in the first car which clears all its calls. This signal shall indicate to the attendant that this car should be started "down" and pressure of the "down" direction button shall move the car automatically to the main floor.
- 6.9 The car shall also have emergency stop and alarm push buttons. In the machine room manual Cranking device shall be provided.

7.0 MACHINE&LOCATION:-

Machine speed shall be 1.5 & 1.0 MPS for passenger lifts and Hospital/Freight lift respectively. Machines shall be preferably of gearless type with permanent magnets, located directly above the hoist way.

8.0 BUFFERS:-

Car and counter weight buffers shall be of hydraulic/ spring type and shall be mounted on steel supporting channels.

9.0 GUIDE&FASTENINGS:-

9.1 Plannedheavydutysteeltee-sectionsasspecifiedinIS-1173shallbeprovidedascarandcounter- weight guides. Steel sections of guides shall be tongued and grooved to provide smooth joints.

9.2 Guide Rail brackets shall be fixed to the wall by anchor fasteners. Adequate steel brackets of suitable design and spacing shall be provided, so that guides shall not deflect more than 5 mm. under normal operation.

10. COUNTER-WEIGHT:-

- 10.1 Counter-Weights shall consist of iron oreweights instructural steel frame. Counter weight shall be equal to the weight of the car plus 40% of the contract load.
- 10.2 Ametalwiremeshcounter-weightguardatthebottomofthehoistway.

11.0 ROPES&SHEAVES:-

- 11.1 Hoisting ropes shall be multi-strand traction steel with hemp core. The size and number of ropes shall be as required for achieving a factor of safety of not less than ten. The ratio of diameter of driving sheave shall be minimum 40 times the diameter of ropes.
- 11.2 Governorropesshallbeofmulti-strandsteelwire.
- 11.3 In case a diverter is to be used it should be suitably mounted. The machine and V sheave shall be suitably mounted on a common bed plate with isolation pads and sheave shall not protrude into the hoist way.

12.0 HOISTWAYENTRANCE:-

- 12.1 Lifts shall be provided with automatic centre opening sliding doors (single speed double leaf panels).
- 12.2 Each hoist way door shall be provided with hangers and hanger rollers with kicking rollers below the track. Tracks shall be rolled steel shaped with eccentric pins etc.
- 12.3 Eachhoistwaydoorshallbeequippedwithahoistwaydoorinterlockbyacamonthecar.

13.0 DOOROPERATOR:-

- 13.1 Door operator shall be positive acting and powered by an A.C. motor rigidly connected to the door and controlled by aVVVFunit. Operator shall simultaneously open the carandhoist way doors and maintain the doors fully open or closed at each door step. Door operators shall be suitable for Attendant/Automatic operation and shall be provided with solid state panel using Triads for operational control. The panel should be mounted on Car Top.
- 13.2 The equipment shall consist of a door operator unit on the elevator car operating the car door when the car is stopping at a landing. The car door and hoist way door shall be mechanically coupled and shall move simultaneously during opening and closing.
- 13.3 The car door and the hoist way door shall be power opened and power closed and shall bechecked in opening and closing with an oil cushioning mechanism built into the gear unit.
- 13.4 Each hoist way door shall be provided with an interlock which will prevent movement of the car away from the landing until the doors are locked in the closed position.
- 13.5 An electric contact for the door shall be provided which shall prevent car movement away from the landing unless the door is in the closed position.

- 13.6 Necessary switches shall be provided in the lift machine room to control the operation of the doors.
- 13.7 The car door and the hoist way shall open automatically as the car is stopping at a landing. The closing of the car door must occur before the car can be started. Doors can be stopped and reversed during their closing motion.

14.0 CONTROLS:-

- 14.1 A controller shall be provided to control starting, stopping and the speed of the lift motor which shall also automatically apply the brake if any of thesafety devices operateor the power fails from any cause.
- 14.2 Controls shall be A.C. Variable voltage Variable Frequency Drive System. The inverter and Data Net work system shall be provided with micro processor based control.
- 14.3 Lift motor control system shall be closed-loop control system using solid state device and electronic speed pattern generator to command the motor speed, with digital speed feedbackfrom a velocity transducer and load compensation circuits.
- 14.4 In normal operation, the electromagnetic brake shall only be applied when the lift has come to a complete standstill. The brake shall hold the lifts in position at every landing, and shall provide stopping without any jerking effect.
- 14.5 Load compensation circuits shall also be included to further improve upon the levelling accuracy. The levelling shall be ensured within <u>+</u> 2 mm.
- 14.6 Theaccelerationanddecelerationshallbeadjustableatsiteusingaservicetool.
- 14.7 A reverse phase relay shallbe provided onthecontroller whichshall be designed to protect the lift equipment against phase reversal and phase failure.

15.0 HALLPOSITIONINDICATOR:-

Digital carposition indicators in Halls and luminous hall but tons shall be provided on all the floors.

16.0 CAR: -

- 16.1 The car frame/sling shall be fabricated from steel angle or channel section and be separate from the lift car. The safety gear positioned below the sling shall be of gradually applied type which can be released by lifting the car. This safety gear shall be operated by an over speed governor located in the motor room. The governor tension weight shall be provided with a built-in switch to detect broken rope. Sheet steel thickness for Car shall be 1.6 mm and for floor it shall be 2 mm.
- 16.2 Car enclosures shall be stainless steel (SS 304) hairline finish for Passenger Lift and for Hospitallifts.
- 16.3 A flush type Stainless Steel"caroperatingpanel"with the following devices shall be fitted in all the cars:
- a) Bankofcallbuttonscorrespondingtolandingsserved.ButtonilluminationtobebyLED'sandnot incandescentbulbs.

- b) Alarmbutton.
- c) Fan/Blowerswitch.
- d) Opendoor button.
- e) Closedoor button.
- f) "Up"&"Down"direction indicators.
- g) Keyoperatedswitchfor"Attendant"and"Automatic"operation.
- h) Anon-stop button.
- i) Firemainsswitchshallby-passalllandingcallsandliftwilltraveltogroundfloorincaseof fire.
- j) Astopswitchtostopthecaratsomeparticular floor.
- k) Provision in car tobe connected with P.A. System / Machine Room & Fire Control Room or BMSControl Room.
- I) Overloadpanelalongwithaudio/visualindication.

The car panel shall be provided such that it can swing open when released from the top of the car to gain full and easy access to all the terminals behind the car station and also provide easy access for flex terminations coming up from the inside of the car.

Non-stop service should be achievable with a separate coded push button in the car. A load weighing device shall be provided to by-pass landing calls, should the load of the lift reach 90% of the full contract load.

The fan switch shall be a toggle switch. Fan shall be isolated with vibration isolators from the car and the sling. The "up" and "down" reversal buttons and key operated inspection switch shall be provided on a maintenance control device on top of the lift car.

In case of "Attendant" operation of the car indicator on the car station shall be provided for the attendant to know on which landing the call has been registered to answer that call.

If the sole control of the lift is to be retained on the car station, a car preference switch shall be provided to ignore all landing calls.

- 16.4 AscrollingdigitalcarpositionindicatorwithLED/LCDilluminationshallbeprovidedineach passenger car indicating the landing at which the car is stopped or passing.
- 16.5 Carentranceshallbeprotectedbystainlesssteeldoorsofthesamesizeaslandingdoorsfor Passenger and Powder coated doors for Service Lifts.Door opening shall be as follows:

Lifts shall be provided with automatic centre opening sliding doors (single speed double leaf panels).

The door shall be provided with safety shoe, high speed door operators, sheave type two point hangers, and tracks as specified.

- 16.6 Car enclosure will be provided with arrangement for fixing of Internal Telephone. Car shall have a provision for communication with main control room.
- 6.7 The landing doors shall be stainless steel (SS 304) hairline finish for Passenger and Powder coated for Service Lifts..

17.0 CARSAFETYANDGOVERNOR:-

Car safety shall be provided to stop the car whenever excessive descending speed is attained. The safety shall be operated by a centrifugal speed governor located at the top of the hoist way and connected to the governor through a continuous steel-rope. Suitable means shall be provided to cut off power from the motor and apply the brake on application of the safety.

18.0 DoorHangers&Tracks:-

For each car and each landing sliding door sheave type two point suspension hangers complete with of steel and shall include shielded ball bearing rollers shall be provided to take the upward thrust section with smooth surface.

19.0 CARSAFETY:-

Photo electric cell curtain shall be included in the lift. In case the photo electric curtain be obstructed, due to any person / object, it shall affect the doors to reverse the closing operationand open the doors till the time the obstruction is removed.

20.0 BRAKE:-

The direct current brake shall be spring applied and electrically released and designed to provide smooth stops under variable loads.

21.0 MICROSELF-LEVELING:-

The lifts shall be provided with a Micro Self-Levelling feature that shall automatically bring the car to the floor landings. This Micro Levelling shall within its zone, be entirely automatic and independent of the operating device and shall correct for over-travel or under-travel and rope stretch.

22.0 PAINTING:-

All lift metal work shall be given one shop coat of rust inhibiting paint in the factory and painted with finishing coats on site. Factory finished powder coated paint to desired shade is acceptable. Any damage caused during erection of the equipment shall be repaired to restore it to required finish.

23.0 FIREPROTECTION:-

To prevent fire from spreading by means of the lift well, lift well enclosure should be fire resisting. A vent of size 0.2 sq. m. should be provided at the top of the lift well enclosure or on side wall at topof liftwell to allow anyaccumulation f smoke there in to escape to the openair. The machine room should be constructed of a suitable grade of fire resisting material and precautions should be taken to minimize spread of fire from the machine room into the lift well.

24.0 ELECTRICALEQUIPMENTANDWIRING:-

24.1 Scope:

The scope of this section comprises supply, installation and wiring of all electrical equipment including controlwiring.Power supplyat415 V,3 phase,50 Hz,4wirewithdouble earthingwill be supplied by the Owner in the machine room with a MCCB in sheet steel enclosure for each lift. All further wiring to motors and controllers, hall buttons, alarm bell, car position indicators etc. shall be provided by the lift Contractor.

 ${\it Lift} machineroom ventilation requirements hall be specified by the Contractor.$

24.2 <u>Wiring:</u>

All wires and cables shall be insulated with polyvinyl chloride base insulation rendered flame retardant armoured and rated for 1100 volt service and suitable for use in dry and wet locations. Makes of wires and cables shall be subject to the approval of the Management committee before delivery.

Allcontrolwiringshallbeof copper.

Wires and cables subject to movement and abrasion shall be protected by flexible galvanized steel conduit.

Travellingcablesshall beofflat typewith flame &moisture resistantproperties for the service and shalloriginateatmachineroom and at teel junction boxes on the car, hungs that the propersize loop may be obtained. they shall have a fire and moisture resistant outer covering and contain a steel supporting strand. Travelling cables shall be suitably suspended to relieve strains in individual conductors. Travelling cables shall be provided for telephone, signals, controls, lights, fans, alarm bell, emergency circuit, music and communication with control room etc.

Earthingofallequipmentisinthescopeofthecontractor.

SCHEDULEOFREQUIREMENT

1.0 PASSENGERLIFT

1.	Capacity/ Weight	:	8persons(544kg)/10Persons(680Kg)
2.	Quantity	:	Asperrequirement.
3.	Speed	:	1.5 MPS
4.	TypeofDrive	<u>:</u>	ACV3F
5.	LocationofMachineRoom	:	ABOVE
6.	Travel	:	Asperapproved drawings.
7.	Serving	:	Asperapproved drawings.
8.	Floors	:	Asperapproved drawings.
9.	WellSize	:	Asperapproved drawings.
10.	CarSize (Approx.)	:	800mmWIDEx 800mm DEEPx2300mmHIGH/900mmWIDEx900mm DEEPx2300mmHIGH.Deviations, if any, shall be mentioned by bidder and shall not be less than asspecified by Bureau of Indian Standards.
11.	Car Enclosure	:	StainlessSteelPanel SS304gradeinhairline finish.
12.	Flooring	:	25mmthickgranitestoneasapprovedbytheClient.(Matt finish).
13.	ElectricLight	:	Compactfluorescentlightstomaintain50LUXillumination.

14.	Fan	:	300mmsweeptwinblowersilentfan.
15.	No.ofCar Entrance	:	Onelocationfront-Centered
16. 17	EntranceDoor Hoistwaydoor	:	CentreopeningpoweroperateddoorsinStainlessSteelSS304grade hairline finish – Design as/arch Approval with ¹ / ₂ Hour fire resistant. StainlessSteelSS304gradehairline finish
18	Clear Entrance	:	800/900mmWIDEx2100mmHIGH
19.	Operation	:	Automatic
20.	Control	:	AlternatefloorCollectiveduplexController(withLiftP2)with32bitmicro processor with or without Attendant.(Staggeredstartingwhen generator switcheson).
21.	Indicator(Car&Landing)&Features	:	 Digitaldirectionandposition. SignalFixtureinfinish-As/Arch.Approval Inverter basedunitrecessedemergencylightintothecarceiling Systemcapableofwithstanding+10%to-10%supplyvoltagefluctuation. Firemanswitch. VFdoor operator. Inverterbasedemergencyalarm linkedtotechnicalalarm panel. HallLantern&Gong-As/Arch.Approval Selflevellingaccuracyof+/-2mm. FullHt.caroperatingpanelwithspaceforliftinspector'scertificates. Loadweighingdevicewithoverloadindicator(warninglightand sound) Cardoor-Frequencyvariationoperator,heavytrafficobstacle detector using photo electric cell curtains. Adjustableguideshoesandguidesinprofiledsteel. In-built Voltage Stabilizer, Pressure Limit Switch, metal Ladder, facia plate, car top railing. Provision for loud speaker for Music through central music system & Scrolling Indication in Car. Liftcarwithcontroldeviceworkingwithkeyin emergency. ZHourfireresistingLiftlanding doorlinkedtofiresafetysystem. Foldingsteelladderoncartopforcarescape.
22.	PIT Depth	:	1600 mm

2.0 HOSPITAL/FREIGHTELEVATOR

1.	Capacity/ Weight	:15Persons(1020Kg)/20Persons (1360kg)
2.	Quantity	:Asper requirement
3.	Speed	:1.0 MPS
4.	TypeofDrive	ACV3F
5.	LocationofMachineRoom	:ABOVE
6.	Travel	:Asperapproveddrawings.
7.	Serving	:Asperapproveddrawings.
8.	Floors	:Asperapproveddrawings.
9.	WellSize	:Asperapproveddrawings.
10.	Car Size (Approx.)	:1000mmWIDEx2400mmDEEPx2300mmHIGH/1200mmWIDEx2400 mm DEEP x 2300 mm HIGHDeviations, if any, shall be mentioned by bidder and shall not be less than as specified by Bureau of Indian

		Standards.
11.	Car Enclosure	:Stainless SteelPanel SS304gradeinhairline finish.
12.	Flooring	:25mmthickgranitestoneasapprovedbytheClient.(Matt finish).
13.	ElectricLight	:Compactfluorescentlightstomaintain50LUXillumination.
14.	Fan	:300mmsweeptwinblowersilent fan.
15.	No.ofCar Entrance	:Onelocationfront- Centered
16.	EntranceDoor	:CentreopeningpoweroperateddoorsinStainlessSteelSS304grade hairline finish – Design as/arch Approval with ¹ / ₂ Hour fire resistant.
17	Hoistwaydoor	StainlessSteelSS304gradehairline finish

18	Clear Entrance	:1000/1200mmWIDEx 2100mm HIGH
19.	Operation	:Automatic
20.	Control	:FullCollectiveSimplex Controller with32 bit micro processor with or withoutAttendant.(Staggeredstartingwhengeneratorswitcheson).
21.	Indicator(Car&Landing)&Features	: • Digital direction and position.

- . Digital direction and position.
- SignalFixtureinfinish-As/Arch.Approval
- Inverter basedunitrecessedemergencylightintothecarceiling
- Systemcapableofwithstanding+10%to-10%supplyvoltagefluctuation. .
- Firemanswitch.
- . VFdoor operator.
- Inverterbasedemergencyalarm linkedtotechnicalalarm panel. .
- . HallLantern&Gong-As/Arch.Approval.
- Selflevellingaccuracyof+/-2mm. .
- ${\sf Full Ht. car operating panel with space for lift in spector's certificates.}$ •
- Loadweighingdevicewithoverloadindicator(warninglightand sound) .
- Cardoor-Frequencyvariationoperator, heavy trafficobstacle detector . using photo electric cell curtains.
- Adjustableguideshoesandguidesinprofiledsteel.
- In-built Voltage Stabilizer, Pressure Limit Switch, metal Ladder, facia plate, car top railing.
- Provision for loud speaker for Music through central music system & . Scrolling Indication in Car.
- Liftcarwithcontroldeviceworkingwithkeyin emergency. •
- 2HourfireresistingLiftlanding doorlinkedtofiresafetysystem.
- Foldingsteelladderoncartopforcarescape. .

22. PIT Depth

1600 mm :

TECHNICALSPECIFICATIONFORINTERNALELECTRICALWORKS

1.0 <u>WIRING</u>

1.1 <u>GENERAL</u>

 $\label{eq:constraint} Technical Specifications in this section cover the Internal Wiring Installation scomprising of:$

- Wiringforlightsandconveniencesocketoutletsetc.inconcealed/surfaceconduit/raceways.
- Wiringfortelephoneoutlets.
- Wiringforfiredetection system
- Submainwiring.

1.2 STANDARDSANDCODES

The following Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended up to date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standardsshall be applicable.

BIS certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.

It is to be noted that updated and current Standards shall be applicable irrespective of those listed below.

660/1100VgradePVCinsulatedwires.	IS694:1990
Rigid steel conduits for electrical wiring.	IS 9537 : Part I 1980
	IS9537:PartII1981
Accessoriesforrigidsteelconduits	IS3837:1990
Flexiblesteelconduitsforelectricalwiring	IS3480:1990
RigidPVCconduits	IS9537:Part-III
Switchsocketoutlets	IS4615:1990
Switchesfordomesticandsimilarpurposes	IS3854:1997
Boxesfortheenclosureofelectricalaccessories	IS5133:Partsl&II1969
Code of practice for personal hazard	IS1644:1998
fire safety of buildings	
Code of practice for electrical installation	IS1646:1997
fire safety of buildings	
Codeofpracticeforelectricalwiringinstallations	IS732:1989
<u>CONDUITS/RACEWAYS</u>	

1.3.1 SteelConduits

Theseshallbeofmildsteel16gaugeupto32mmand14gaugeforsizesabove32mm, electric resistancewelded (ERW), electric threaded type having perfectly circular tubing. Conduits shall be

precession welded ERW and shall be fabricated from tested steel strips of thickness as per ISS by high frequency induction weld process. Weld shall be smooth and of consistent of high quality to ensure crack proof bending. The conduits shall be black enamel painted inside and outside in its manufacturedform. Whereversospecified, the conduit shall be galvanized. All conduits used in this work shall be ISI embossed.

1.3.2 PVC Conduits

Conduitsshallbe heavygaugerigidPVCofminimum thicknessof2mm.ConduitsshallbelSImarked confirming to IS : 9537 (Part-3)-1983.All conduit and conduit accessories shall be of PVC.Conduits shallbejoinedtogetherbyavinyletypecement/solvents.Minimumsizeofconduitshallbe25mm. Conduitshallbefixedonceilingorwall.Allconduitsshallbeconcealedinwallceilingetc.orfixedon surface of wall with clamps at regular interval as called for elsewhere.For termination of PVC conduitsintoswitchoutletboxes,PVCfemaleadoptersshallbeused.Whereverconduitrunexceeds 10 metre, circular junction boxes shall be provided to facilitate pulling & inspection of wires. Inspection boxes shall be suitable located in co-ordination with the Management committee. Conduitsshallbebendusingsuitablesizesprings.Longradiusbendsshallbeprovided.Heatingshall notbeusedtobendtheconduits.Sizeofconduitshalldependuponnumberandsizeofwirestobe drawn.

1.3.3 SteelConduitConnections

Connections between steel conduits shall be with screwed couplers of approved quality and finish, ensuring screwed metal to metal contact. Length of threads shall be as per ISS and sufficient to accommodate pipes to full threaded portion of couplers or accessories. Threads and sockets shallbe free from grease and oil. Conduits shall be connected to outlet boxes by means of M.S. hexagon check-nuts fixed both inside and outside the box. Conduit edges shall be free of burrs and provided with screwed PVC bushes to avoid damage to insulation of conductors while pulling them through the conduits. Connections between M.S. and PVC conduits, if required, shall be through a junction box and never directly.

1.3.4 Bends

Large right angle bends (more than 75 mm radius) or non right angle bends in conduit runs shall be made by means of conduits bending machines carefully so as not to cause any crack in the conduit. Small right angle bends in conduits runs can be made by standard conduit accessories (solid/inspection bends/elbows) no run of conduits shall have more than four right angle bends from outlet to outlet. Bends in multi runs of conduits shall be parallel to each other and neat in appearance, maintaining the same distance as between straight runs of conduits.

1.3.5 ConduitAccessories.

1.3.5.1 Standardaccessories

Heavydutyblackenamelpaintedstandardconduitfittingsandaccessorieslikestandard/extra-deep circular boxes, looping in boxes, junction boxes, normal/ inspection bends, solid/inspection elbows, solid/inspection tees, couplers, nipples, saddles, check nuts, earth clips, ball socket joints etc. shall be of superior quality and of approved makes. Heavy duty covers screwed with approved quality screws shall be used. Superior quality screwed PVC bushes shall be used Samples of all conduits fittings and accessories shall be got approved by the Management committee before use.

1.3.5.2 Fabricatedaccessories

Wherever required, outlet/junction boxes of required sizes shall be fabricated from 1.6 mm thick MS sheets excepting ceiling fan outlet boxes which shall be fabricated from minimum 2 mm thick sheets. The outlet boxes shall be of approved quality, finish and manufacture. Suitable means of fixing connectors etc., if required, shall be provided in boxes. The boxes shall be protected from rust by zinc phosphate primer process. Boxes shall be finished with minimum 2 coats of enamel paint of approved colour. A screwed brass stud shall be provided in all boxes as earthing terminal.

1.3.5.2.1 OutletBoxesForLightFittings

These shall be minimum 75mm x 75mm x 50mm deep and provided with required number of threaded collars for conduit entry. For ceiling mounted florescent fittings, the boxes shall be provided 300 mm off centre for a 1200 mm fitting and 150 mm off centre for a 600 mm fitting so that the wiring is taken directly to the down rod. 3mm thick Perspex / hylam sheet cover of matching colour shall be provided.

1.3.5.2.2 OutletBoxesForCeiling

Outlet boxes for ceiling fans shall be fabricated from minimum 2 mm thick MS sheet steel. The boxes shall be hexagonal in shape of minimum 100 mm depth and 60 mm sides. Each box shall be provided with a recessed fan hook in the form of one 'U' shaped 15 mm dia rod welded to the box and securelytiedtothetop reinforcementoftheconcreteslabfor alengthofminimum150mmon either side. 3 mm thick Perspex/hylam sheet cover of matching colour shall be provided.

1.3.5.3 BoxesForModularWiringAccessories

1.3.5.3.1 SwitchBoxes-Modular Type

Switch boxes suitable to house modular type switches of required ratings, and fan regulators as required shall be provided. In case the number of switches in one box is not tallying with that available in standard manufacture, the box accommodating the next higher number of switches shall be provided without any extra cost. In case fan regulator/regulators is /areto be provided ata laterdated, suitable provision for accommodating such regulators shall be made in the switch boxes and blank off covers shall be provided without any extra cost.

Switch boxes shall be so designed that accessories are mounted on a grid plate with tapped holes for brass machine screws leaving ample space at the back and on the sides for accommodating conductors, check-nuts and screwed bushes at conduit entries etc... The grid plates and M.S. boxes shall be fitted with a brass earth terminal. Boxes shall be attached to conduits by means of check-nuts on either sides of their walls. Moulded front covers made from high impact resistant, flame retardant and ultra violet stabilised engineering plastics shall be fixed by means of counter sunk chromium plated brass machine screws. No timber shall be used for any supports. Switch boxes shall be located with bottom at 1200 mm above floor level unless otherwise indicated.

1.3.5.3.2 ModularTypeBoxesForSocket/Telephone/CallBellOutlets

Outlet boxes shall be suitable for housing modular type switched socket outlets/ telephone outlets/ buzzers and any other outlet as required. These shall be so designed that accessories are mounted on a grid plate with tapped holes for brass machine screws leaving ample space at the back and on thesides for accommodatingconductors, check nuts andscrewed bushes at conduit entries etc. The gridplatesandM.S.boxesshallbefittedwithabrassearthterminal.Theseshallbeattachedto

conduits by means of check nuts on either sides of their walls. Moulded front covers made from high impact resistant, flame retardant and ultra violet stabilized engineering plastics shall be used to mount the outlets and shall be fixed to the outlet M.S. boxes by means of counter sunk chromium plated brass machine screws. No timber supports shall be used. Boxes shall be located at skirting level or bottom at 1200 mm from floor or inside raceways on laboratory work tables. as indicated in drawings and/or as directed.

1.3.6 CrossSection

The conduits shall beofample sectional area to facilitate simultaneous drawingofwiresandpermit future provision also. Total cross section of wires measured overall shall not normally be more than half the area of the conduit. Maximum number of PVC insulated 660/1100 Voltage grade copper conductor cable conforming to IS - 694 - 1990 as per table give below.

MaximumnoofPVCinsulated660/1100Vgrade aluminium/copper

Normal Cross Sectional	20mm		25mm		32mm		38mm		51mm		64mm	
area of conductorin sq. mm	S	В	0	В	S	В	S	В	S	В	S	В
1	2	3	4	5	6	7	8	9	10	11	12	13
1.50	5	4	10	8	18	12	-	-	-	-	-	-
2.50	5	3	8	6	12	10	-	-	-	-	-	-
4	3	2	6	5	10	8	-	-	-	-	-	-
6	2	-	5	3	4	8	7	-	-	-	-	-
10	2	-	4	3	6	5	8	6	-	-	-	-
16	-	-	2	2	3	3	6	5	10	7	12	8
25					3	2	5	3	8	6	9	7
35							3	2	6	5	8	6
50									5	3	6	5
70									4	3	5	4

ConductorcableconformingtoIS:694-1990

Note:

- 1. The above table showsthemaximumcapacityofconduits for simultaneousdrawinginof cables.
- 2. The columns headed 'S' apply to runs of conduits which have distance not exceeding 4.25 m between draw boxes and which do not deflect form the straight by an angle of more than 15 degrees. The columns headed 'B' apply to runs of conduit which deflect form the straight by an angle of more than 15 degrees.
- 3. Conduitssizesarethenominalexternaldiameters.

1.4 <u>WIRES</u>

Wiring shall be carried out with PVC insulated 660/1100 volt grade unsheathed single core wires with electrolytic annealed stranded copper (unless otherwise stated) conductors and conforming to IS 694/1990. All wire rolls shall be ISI marked. All wires shall bear manufacturer's label and shall be brought to site in new and original packages. Manufacturer's certificate, certifying that wires brought to site are of their manufacture shall be furnished as required.

1.5 <u>COAXIALCABLES</u>

The coaxial cables shall be of wideband type with operation up to 300 MHz capability. Aging resistanceshallcomplywithDIM472.52part2e.i.maximum5%increaseinattenuationat200

MHzmeasuredbyartificialaging (14 days at 80 °C) cables shall meet all exceed following specifications

CentercoreDia	0.8mm		
Diaelectric Dia	4.8mm		
Dielectric	PE		
Outer Conductor Dia	5.4mm		
OuterDia	7.0mm		
Bendingradius	morethan30mm		
Impedance	75 ohms		
D.CResistance	50 ohms/KM		
Screening factor	morethan50		
Attenuation			
50Mhz	6.5		
100Mhz	9		
200Mhz	13		
300Mhz	16		

1.6 LAYINGOFCONDUITS

- Conduitsshallbelaideitherrecessedinwallsandceilingsoronsurfaceonwallsandceilingsor partly recessed and partly on surface, as required.
- Samerateshallapplyforrecessedandsurfaceconduitinginthiscontract.
- Stranded copper conductor insulatedwire ofsize as per scheduleofquantities shall be provided in entire conduiting for loop earthing.
- GI wireof suitable sizeto serveas a fish wire shall beleft in all conduit runs to facilitate drawing of wires after completion of conduiting.

1.6.1 **RecessedConduiting**

Conduits recessed in concrete members shall be laid before casting, in the upper portion of slabsor otherwise as may be instructed, so as to embed the entire run of conduits and ceiling outlet boxes with a cover of minimum 12 mm concrete. Conduits shall be adequately tied to the reinforcement to prevent displacement during casting at intervals of maximum one metre. No reinforcement bars shall be cut to fix the conduits. Suitable flexible joints shall be provided at all locations where conduits cross expansion joints in the building.

Conduits recessed in brick work shall be laid in chases to be cut by electrical Contractor in brick work before plastering. The chases shall be cut by a chase cutting electric machine. The chasesshall be of sufficient width to accommodate the required number of conduits and of sufficient depthtopermitfullthicknessofplasteroverconduits.Theconduitsshallbesecuredinthechase by means of heavy duty pressed steel clamps screwed to MS flat strip saddles at intervals of maximumonemetre.Thechases shallthenbefilledwithcementandcoarsesandmortar(1:3)and properly cured by watering.

Entire recessed conduit work in concrete members and in brick work shall be carried out in close coordination with progress of civil works. Conduits in concrete members shall be laid beforecasting and conduits in brick work shall be laid before plastering. Should it become necessary to embedded conduits in already cast concrete members, suitable chase shall be cut in concrete for the purpose. For minimizing this cutting, conduits of lesser diameter than25 mm and outlet boxes of lesser depth than 50 mm could be used by the Contractor for such extensions only after obtaining specific approval from the Management committee. For embedding conduits in finished and plastered brick work, the chase would have to be made in the finished brick work. After fixing conduit in chases, chases shall be made good in most workmanlike manner to match with the original finish.

Cutting chases in finished concrete or finished plastered brick work for recessing conduits and outlet boxes etc shall be done by the Contractors without any extra cost.

1.6.2 SurfaceConduiting

Wherever so desired, conduit shall be laid in surface over finished concrete and/or plastered brickwork. Suitable spacer saddles of approved make and finish shall be fixed to the finished structural surface along the conduit route at intervals not exceeding 600 mm. Holes in concrete or brick work for fixing the saddles shall be made neatly by electric drills using masonry drill bits. Conduits shall be fixed on the saddles by means of good quality heavy duty MS clamps screwed to the saddles by counter sunk screws. Neat appearance and good workmanship of surfaceconduiting work is of particular importance. The entire conduit work shall be in absolute line and plumb.

1.6.3 **Fixingofconduitfittingsandaccessories**

For concealed conduiting work, the fittings and accessories shall be completely embedded in walls/ceilings leaving to psurface flush with finished wall/ceiling surface in a work man like manner.

Loopearthingwireshallbeconnected to ascrewe dearthstead inside outlet boxes to make an effective contact with the metal body.

1.6.4 PaintingandColourcodingof conduits

Beforelaying, conduits shall be painted specially at such places where pain thas been damaged due to vice or wrench grip or any other reason.

If so specified, surface conduits shall be provided with 20 mm wide and 100 mm long colour coding strips as below

Use	Codecolour
LowVoltage	Grey
Firealarm	Red
Telephone	Black

PA system	Brown
Earthingsystem	Green
Controlsystem lighting	Purple

1.6.5 **ProtectionofConduits**

To safeguard against filling up with mortar/plaster etc. all the outlet and switch boxes shall be provided with temporary covers and plugs which shall be replaced by sheet/plate covers as required. All screwed and socketed joints shall be made fully water tight with white lead paste.

1.6.6 <u>CleaningofConduitRuns</u>

The entire conduits ystem including outlets and boxess hall be thoroughly cleaned after completion of erection and before drawing in of cables.

1.6.7 **ProtectionAgainstDampness**

Alloutletsinconduitsystemshallbeproperlydrainandventilatedtominimizechancesofcondensation/sweatin g.

1.6.8 ExpansionJoints

When crossing through expansion joints in buildings, the conduit sections across the joint shall be through approved quality heavy duty metal flexible conduits of the same size as the rigid conduit.

1.6.9 LoopEarthing

Loop earthing shall be provided by means of insulated stranded copper conductor wires of sizes as per Schedule of Quantity laid alongwith wiring inside conduits for all wiring outlets and sub-mains. Earthing terminals shall be provided inside all switch boxes, outlet boxes and draw boxes etc.

1.7 LAYINGANDDRAWINGOFWIRES

1.7.1 BunchingofWires

Wires carrying current shall be so bunched in conduits that the outgoing and return wires are drawn into the same conduit. Wires originating from two different phases shall not be run in the same conduit.

1.7.2 DrawingofWires

 $\label{eq:theorem:th$

- No wire shall be drawninto anyconduit, until allwork of any nature, that may cause injury to wire is completed. Burrs in cut conduits shall be smoothen before erection of conduits. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire. Approved type bushes shall be provided at conduit terminations.
- Before the wires are drawn into the conduits, conduits shall be thoroughly cleaned of moisture, dust, dirt or any other obstruction by forcing compressed air through the conduits if necessary..
- While drawing insulatedwires into the conduits, careshall be takento avoidscratches and kinks which cause breakage of conductors.

- Thereshallbenosharpbends.
- The Contractor shall, after wiring is completed, provide a blank metal/sunmica plate on all switch / outlet / junction boxes for security and to ensure that wires are not stolen till switches / outlets etc.. are fixed at no extra cost the contractor shall be responsible to ensure that wires and loop earthing conductors are not broken and stolen. In the event of the wire been partly / fully stolen , the contractor shall replace the entire wiring alongwith loop earthing at no extra cost to the Society. No joint of any nature whatsoever shall be permitted in wiring and loop earthing .

1.7.3 <u>Termination/JointingofWires</u>

- Sub-circuit wiring shall be carried out in looping system. Joints shall be made only at distribution board terminals, switches/buzzers and at ceiling roses/connectors/lamp holders terminals for lights/fans/socket outlets. No joints shall be made inside conduits or junction/draw/inspection boxes.
- Switches controlling lights, fans or socket outlets shall be connected in the phase wire of the final sub circuit only. Switches shall never be connected in the neutral wire.
- Wiring conductors shall be continuous from outlet to outlet. Joints where unavoidable, due to any special reasonshall be made by approved connectors. Specific prior permission from the Management committee in writing shall be obtained before making such joint.
- Insulation shall be shaved off for a length of 15 mm at the end of wire like sharpening of a pencil and it shall not be removed by cutting it square or wringing.
- Strandsofwiresshallnotbecutforconnectingterminals.Allstrandsofwiresshallbe twisted round at the end before connection..
- Conductorshavingnominalcrosssectionalareaexceeding4sq.mmshallalwaysbe provided with crimping sockets.
- At all bolted terminals, brass flat washer of large area and approved steel spring washers shall be used.
- Brassnutsandboltsshallbeusedforallconnections.
- The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less.
- Switchescontrolling lights, fans, socketoutletsetc. shall beconnected to the phase wire of circuits only.
- Onlycertifiedvalidlicenseholderwiremenshallbeemployedtodowiring/jointingwork.

1.7.4 LoadBalancing

Balancingofcircuitsinthreephaseinstallationshallbeplannedbeforethecommencementof wiring and shall be strictly adhered to.

1.7.5 <u>ColourCodeof Conductors</u>

Colourcodeshallbemaintainedfortheentirewiringinstallation-red, yellow, blueforthree phases, black for neutral and green for earth.

2 <u>Wiring</u>

Allthewiringinstallationshall be as per IS:694/IS:732 with latest amendment. FRLS PVC insulated copper conductor cables as specified in billof quantities shall be used for sub-circuit runs from the distribution boards to the points and shall be pulled into conduits. They shall be twisted copper conductors with thermoplastic insulations of 660/1100 volts grade. Colour Code for wiring shall be followed.

Looping system of wiring shall be used, wires shall not be jointed. Where joints are unavoidable, they shall be made through approved mechanical connectors with prior permission of the Management committee.Noreductionofstrandsarepermittedatterminations.Nowiresmaller

than 2.5 sq.mm shall be used. Wherever wiring is run through trunkings or raceways, the wires emerging from individual distributions shall be bunched together with cable straps at requiredregular intervals. Identification ferrules indicating the circuit and DB number shall be used for submains, sub-circuit wiring. The ferrules shall be provided at both ends of each submain and sub- circuit.

Where single phase circuits are supplied from a three phase and a neutral distribution board, no conduit shall contain the wiring fed from more than one phase. In any one room in the premises where all or part of the electrical load consists of lights, fans and/or other single phase current consuming devices, all shall be connected to the same phase of the supply. Circuits fed from distinctsourcesof supplyorfrom different distribution boards or throughswitches or MCBsshallnot be bunched in one conduit. In large areas and other situations where the load is divided between two or three phase, no two single phase switches connected to different phase shall be mounted within two meters of each other.

All splicing shall be done by means of terminal blocks or connectors and no twisting connection between conductors shall be allowed.

Metal clad sockets shall be of die-cast non-corroding zinc alloy and deeply recessed contact tubes. Visible scraping type earth terminal shall be provided. Socket shall have push on protective cap. Socket shall have MCB/ELCB/RCCB as specified in the schedule of work.

3 <u>Luminaries/Fans</u>

General

All the materials used in the construction of luminaires shall be of such quality, design and construction that will provide adequate protection in normal use, against mechanical, electrical failures/faults and exposure to the risk of injury or electric shock and shall withstand the effect of exposure to atmosphere.

Fluorescent/CFLLampLuminaries

Luminarie shall be supplied as per the design approved by the Management committee. Luminaries shall be complete in all respects with basic mounting channel, shock proof insert contact rotor lamp holders, starter with holder for fl. lamp luminaries/standard holder for CFL, low watt loss copper wound polyester filled ballast, connector block, internal wiring and decorative attachments, if any. The mounting channel shall be made of CRCA steel sheets suitably rust inhabited and stove enameled. A dustproofcover stove enameled towhiteshadeshall beprovidedtoformthechannel to protect the accessories and wiring from dust and vermin and to act as reflector. Ballast shall be silent in operation, ballast shall have a long life and shall be highly reliable. A suitable capacitor to improve the power factor of luminarie to atleast 0.9 lag shall be provided. Capacitors shall be hermetically sealed.

Diffusers, louvers, etc. shall be of opal acrylic or polystyrene diffusers, louver and similar decorative attachments. The attachments shall be guaranteed against discolourisation, warping and deformation under continuous operation. Fluorescent lamps shall conform to BS:1853 in all respects. Fluorescent lamps shall be of bi-pin pattern. The colour of the light shall be white or cool day light as required. Unless otherwise specified, the lamps shall be of 40W or 36W and 1200mm long. Luminaries shall be installed as specified on the drawings. Wherever luminaries are fixed on thefalseceiling, suitablesupporting andfixingarrangements independent of theframework offalse ceiling shall be provided. Suspended luminaries shall be provided with swivel type hangers, comprising of suspension pipes, swivel sockets, screws, bolts etc. for installing the luminaries.

Luminariesshallbesuspendedtruetoalignment,plumbandlevelandcapableof resistingalllateral and vertical forces Lead-in-wires shall be protected from abrasion. Erection of the fixtures shall include assembling of all components of the fixtures such as chokes, condensers, starters, decorative attachments etc. Where suspended ceiling are installed the contractor shall cooperate with the ceiling installer to ensure that the luminaries layout is compatible with the ceiling panel layout.

IncandescentLamp Luminaries

Incandescent lamp luminaries shall be supplied as per the design and type mentioned approved by the Management committee. Incandescent lamp luminaries shall be provided with lamp holders suitableforlampswithstandardbayonetcapupto200watts.Incandescentlampluminariesshall

becompletewithreflectorshade, decorative attachment (if any) and coveras specified and required. Incandescent lamps shall conform in all respects to BS:161.

Fans(CeilingFans)

Ceiling fans shall conform to IS:374 (latest edition) all respects and shall be smooth and silent in operation. The fan motor shall be a capacitor type motor with internal stator and external rotor pattern. The blades shall be made of aluminum sheets painted in white shade. The design and construction of blades shall be such that maximum quantity of air is displaced in smooth manner. The motor and blades shall be statically and dynamically balanced. The fans shall be provided with ball bearing only which are accessible for lubrication. The ceiling fan shall be provided with rubber shackle and a down rod shall be as per requirements. The suspension arrangement shall be jointed to the fan motor by means of a thread joint and a safety locking arrangement. Fans shall beprovided with bottom cover and top canopy. Electronic stepless regulators shall be provided, with everyfan. Ceilingfans shallbesuspendedfromthespecialhooksor specialfanhookboxes. Where hooks are used the wiring to the fan shall be from a ceiling rose. Wherever special fan hook boxes are used, the fan wiring shall be terminated in porcelain/PVC three way connector. Lead-in-wires shall have cross-section area of not less than 23/.0076 (copper).

Exhaust Fan

PropellertypeexhaustfanshallconformtolS:2312(latestedition)inallrespects. Themotorshallbe of diecast aluminum case. The fan motor shall be of squirrel cage induction type single phase motors shall be capacitor start and run type.

Exhaust fans be provided with a special anticorrosive treatment to withstand normal concentrations of chemical fumes in the environment.

The fan shall be designed to withstand the effects of moisture under normal conditions of use. The design of motor and its windings shall be such that moisture in surrounding is not absorbed by the windings.Exhaust fans shall be complete with mounting rings, ring armsand a resilient suspension. The motor and blades shall be of mildsteel and so designed that they operate smoothly with minimum noise.The fans shall be finished to be a glossy grey shade with an approved enamel paint.The fans shall also be provided with gravity louvers for exhaust arrangement or bird screen for inlet arrangement.

Exhaust fans shall be fixed at the locations shown on the drawings. The fans shall be fixed by means of rag bolts grouted in wall.Exhaust fan be connected to the exhaust fan point by means of a 3 core flexible cord.

3 MEDIUMVOLTAGEDISTRIBUTIONBOARDS

GENERAL

Thissectioncoversspecification of DBs.

STANDARDSANDCODES

The followingIndianStandardSpecificationsand CodesofPracticewillapplytothe equipmentand the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

BIS certified equipment shall be used as a part of the Contract in line with Governmentregulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.

It is to be noted that updated and current Standards shall be applicable irrespective of those listed below.

Miniature Air Circuit Breakers for AC circuits	IS8828:1978
Degrees of Protection provided by enclosures	IS2147:1962
for low voltage switchgear	
Code of Practice for installation and maintenance	IS10118:1982
of switchgear not exceeding 1000 volts	
General requirements for switchgear and controlgear	IS4237:1982

for voltages not exceeding 1000 volts

MINIATURECIRCUITBREAKERS

- The MCB's shall be of the completely moulded design suitable for operation at 240/415 Volts 50 Hz system.
- TheMCB'sshallhavearupturingcapacityof10KAat0.5p.f.
- The MCB's shall have inverse time delayed thermal overload and instantaneous magnetic short circuit protection. The MCB time current characteristic shall coordinate with H.R.C. fuse/PVC cable characteristic.
- Typetestcertificatesfromindependentauthoritiesshallbesubmittedwiththetender.

FINALDISTRIBUTIONBOARDS

- Final distribution boards shall be flush mounting, totally enclosed, dust and vermin proof andshallcompriseofminiaturecircuitbreakers,earthleakagecircuitbreakers,neutrallink etc as detailed in the schedule of quantities.
- The distribution equipment forming a part of the Distribution Boards shall comply to the relevant Standards and Codes of the Bureau of Indian Standards and as per detailed specifications included in this tender document.
- The board shall be fabricated from 14 gauge CRCA sheet steel and shall have a hinged lockable spring loaded cover. All cutouts and covers shall be provided with syntheticrubber gaskets. The entire construction shall give a IP 42 degree of protection.
- The bus-bar shall be of electrical grade copper having a maximum current density of 1.6 ampere per square mm and PVC insulated throughout the length.
- All the internal connections shall be with either solid copper PVC insulated or copper conductor PVC insulated wires of adequate rating.
- All the internal connections shall be concealed by providing a hinged protective panel to avoid accidental contact with live points.
- All outgoing equipment shall be connected direct to the bus bar on the live side. The equipment shall be mounted on a frame work for easy removal and maintenance.
- The sheet steel work shall undergo a rigorous rust proofing process, two coats of filler oxide primer and final powder coated paint finish.
- All the circuits shall have an independent neutral insulated wire, one per circuit, and shall be numbered and marked as required by the Society.
- A sample of the completed board is to be got approved by the architects/owners before commencement of supply and erection.

SHEETSTEELTREATMENTANDPAINTING

• Sheet Steel materials used in the construction of these units should have undergone a rigorous rust proofing process comprising of alkaline degreasing, descaling in dilute sulphuricacidandarecognisedphosphatingprocess.Thesteelworkshallthenreceivetwo

costsof oxide filler primerbefore final painting. Castings shall be scrupulously cleaned and fettled before receiving a similar oxide primer coat.

• All sheet steel shall after metal treatment be given powder coated finish painted with two coats of shade 692 to IS 5 on the outside and white on the inside. Each coat of paint shall be properly stoved and the paint thickness shall not be less than 50 microns.

NAMEPLATESAND LABELS

• Suitable engraved white on black name plates and identification labels of metal for all Switch Boards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

ROUTINEANDCOMPLETIONTESTS

INSTALLATIONCOMPLETIONTESTS

Atthecompletionofthework, the entire installation shall be subject to the following tests:

- 1. Wiringcontinuitytest
- 2. Insulationresistancetest
- 3. Earthcontinuitytest
- 4. Earthresistivitytest

Besides theabove, any other testspecified by the localauthority shall alsobecarried out. Alltested and calibrated instruments for testing, labour, materials and incidentals necessary to conduct the above tests shall be provided by the contractor at his own cost.

WiringContinuityTest

All wiring systems shall be tested for continuity of circuits, short circuits, and earthing after wiring is completed and before installation is energized.

InsulationResistanceTest

The insulation resistance shall be measured between earth and the whole system conductors, or any section thereof with all fuses in place and all switches closed and except in concentric wiring all lamps in position of both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it does not exceed 1100 volts for medium voltage circuits. Where the supply is derived from AC three phase system, the neutral pole of which isconnected to earth, either director through added resistance, pressure shall be deemed to be that which is maintained between the phase conductor and the neutral. The insulation resistance measured as above shall not be less than 50 megohms divided by the number of points provided on the circuit the whole installation shall not have an insulation resistance lower than one megohm.

The insulation resistance shall also be measured between all conductors connected to one phase conductor of the supply and shall be carried out after removing all metallic connections between he two poles of the installation and in those circumstances the insulation shall not be less than that specified above.

The insulation resistance between the frame work of housing of power appliances and all live parts of each appliance shall not be less than that specified in the relevant Standard specification or where there is no such specification, shall not be less than half a megohm or when PVC insulated cables are used for wiring 11.5 megohms divided by the number of outlets. Where a whole installation is being tested a lower value than that given by the above formula subject to a minimum of 1 Megohms is acceptable.

TestingofEarthContinuityPath

The earth continuity conductor including metal conduits and metallic envelopes of cable in all cases shallbetestedforelectriccontinuityandtheelectricalresistanceofthesamealongwiththeearthing

lead but excluding any added resistance of earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

TestingofPolarityofNon-LinkedSinglePoleSwitches

In a two wire installation a test shall be made to verify that all non-linked single pole switches have been connected to the same conductor throughout, and such conductor shall be labeled or marked for connection to an outer or phase conductor or to the non-earthed conductor of the supply. In the three of four wire installation, a test shall be made to verify that every non-linked single pole switchis fitted to one of the outer or phase conductor of the supply. The entire electrical installation shallbe subject to the final acceptance of the Management committee as well as the local authorities.

EarthResistivityTest

 ${\sf Earth resistivity test shall be carried out in accordance with ISC ode of {\sf Practice for earthing IS3043}.$

Performance

Should the above tests not comply with the limits and requirements as above the contractor shall rectify the faults until the required results are obtained. The contractor shall be responsible for providing the necessary instruments and subsidiary earths for carrying out the tests. The above tests are to be carried out by the contractor without any extra charge.

TestsandTestReports

The Contractor shall furnish test reports and preliminary drawings for the equipment to the Management committee for approval before commencing supply of the equipment. The Contractor should intimate with the tender the equipment intended to be supplied with its technical particulars. Any test certificates etc., required by the local Inspectors or any other Authorities would be supplied by the Contractor without any extra charge.

4 MEDIUMVOLTAGECABLES

GENERAL

Technicalspecificationsinthissectioncoverssupplyingandlayingof:

• Mediumvoltagecables.

STANDARDSANDCODES

All equipments, components, materials and entire work shall be carried out in conformity with applicable and relevant Bureau of Indian Standards and Codes of Practice, as amended upto date and as below. In addition, relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 asamended upto date shall also apply.Wherever appropriate Indian Standards are not available, relevant British and /or IEC Standards shall be applicable.

Equipments certified by Bureau of Indian Standards shall be used in this contract in line with government regulations. Test certificates in support of this certification shall be submitted, as required.

It is to be noted that updated and current standards shall be applicable irrespective of dates mentioned along with ISS's in the tender documents.

PVCinsulatedheavydutycables	IS1554-1988
CrosslinkpolyethyleneinsulatedPVC	IS7098-1985

(sheathedXLPEcables)	
Code of practice for installation and maintenance	IS1255-1983
of power cables	
Conductorsforinsulated electrical cables	IS8130-1984
Drumsforelectricalcable	IS10418- 1982
Methodsoftestfor cables	IS10810- 1988
Recommended current rating	IS3961-1987
Recommended short circuit rating of high voltage	IS5891-1970
PVC cables	

CABLES

MediumVoltageCables

Medium voltage cables shall be aluminium conductor XLPE insulated, PVC sheathed armoured conforming to IS 7098. Cables shall be rated for a 1100 Volts. The conductor of cables from 16 Sq. mm. to 50 Sq. mm. shall be stranded. Sector shaped stranded conductors shall be used for cables of 50 sq. mm and above. Conductors shall be made of electrical purity aluminium 3/4 H or H temper. Conductors shall be insulated with high quality PVC base compound. A common covering (bedding) shall be applied over the laid up cores by extruded sheath of unvulcanised compound. Armouring shall be applied over outer sheath of PVC sheathing. The outer sheath shall bear the manufacturer'snameandtrademarkateverymetrelength.Coresshallbeprovidedwithfollowing colour scheme of PVC insulation.

1Core	:	Red/Black/Yellow/Blue
2 Core	:	RedandBlack
3Core	:	Red, Yellowand Blue
3 1/2 /4 Core	:	Red,Yellow,BlueandBlack

Current ratings shall be based on the following conditions.

a)	Maximumconductortemperature	70°C
b)	Ambientairtemperature	45°C
c)	Groundtemperature	30°C
d)	Depth of laying	1000 mm

ShortcircuitratingofcablesshallbeasspecifiedinIS7098.

Cables have been selected considering conditions of maximum connected loads, ambient temperature, grouping of cables and allowable voltage drop. However, the contractor shall recheck the sizes before cables are fixed and connected to service.
Delivery, Storageand Handling

Cable drum shall be stored on a well drained, hard surface, preferably of concrete, so that the drums do not sink in ground causing rot and damage to the cable drum. The cable drum shall conform to IS 10418. During storage, periodical rolling of drums, in the direction of arrow marked on the drum, shall be done once in 3 month through 90°C. Both ends of cables shall be properly sealed to prevent moisture ingress. Drums shall be stored in well ventilated area protected from sun and rain. Drums shall always be rested on the flanges and not on flat sides. Damaged battensof drums etc. shall be replaced. Movement of drums shall always be in direction of the arrow marked on the drum. For transportation over long distance, the drums shall either be mounted on drum wheelsandpulledbyropesortheyshallbemountedontrailersetc.drumsshallbeunloaded preferably by crane otherwise they shall be rolled down carefully on suitable ramps. While transferringcableform 1 drum to another, thebarrelofthenewdrum shallhavediameternotless than the original drum. Cables with kinks or similar visible defects like defective armouring etcshall be rejected. Cables shall be supplied at site in cut pieces as per actual requirements.

LAYINGOFCABLES

Cables shall be so laid that the maximum bending radius is 12 times the overall diameter of the cable for medium voltage cables. Cables shall be laid in masonry trenches, directly on walls/cable trays, directly buried in ground or in pipes/ducts as elaborated below. Cables of different voltages and also power and control cables shall be laid in different trenches with adequate separation. Wherever available space is restricted such that this requirement cannot be met, medium voltage cables shall be laid above HT cables.

InMasonryTrenches

Wherever so specified, cables shall be laid in indoor/outdoor masonry/RCC trenches to beprovided by Contractor.Cables shall be laid on MS supports fabricated from minimum 38mm x 38mm x 6mm painted / galvanized angle iron supports grouted in trench walls at intervals not exceeding 600 mm. If required, cables shall be arranged in tier formation inside the trench.Suitable clamps, hooks and saddles shall be used for securing the cables in position and dressing properly so that the clear spacing between the cables shall not be less then the diameter of the cable. Trenches shall be provided with chequered plate/RCC covers. Wherever so specified, trenches shall be filled with fine sand.

On Trays/Walls

Wherever so specified, cables shall be laid along walls/ceiling or on cable trays. Cable shall be secured in position and dressed properly by means of suitable clamps, hooks, saddles etc. such that the minimum clear spacing between cables is diameter of the cable. Clamping of cables shall be at minimum intervals as below.

Typeof cables	Size	Clampingby	Fixing intervals
MV	Uptoandincluding25sq mm	Saddles1mmthick	45cm
MV&HV	35sqmmto120sqmm	Clamps3mmthick25mmwide	60cm
MV&HV	150sqmmandabove	Clamps3mmthick40mmwide	60cm

Note : The fixing intervals specified apply to straightruns. In the case of bends, additional clamping shall be provided at 30 cm from the centre of the bend on both sides.

Cable trays, of sizes as per drawings approved by the Management committee shall be of perforated doubled bend channel/ladder design unless otherwise stated. Cable trays shall be fabricated from minimum 2 mm thick sheet steel and shall be complete with tees, elbows, risers, and all necessary hardware. Cable trays shall comply with the following:

Trays shall have suitable strength and rigidity to provide proper support for all contained cables.. Trays shall include fittings for changes in direction and elevation. Cable trays and accessories shall be painted with one shop coated of red oxide zinc chromate primer and two side coats of aluminium alkyd paint or approved equivalent. Cable trays shall not have sharp edges, burrs or projection that may damage the insulation jackets of the wiring. Cable trays shall have side rails or equivalent structural members.

Unless otherwise specifically noted on the relevant layout drawing, all cable tray mounting works to be carried out ensuring the following :

Cable tray mounting arrangement type to be as marked on layout drawing. Assembly of tray mounting structure shall be supplied fabricated, erected & painted by the contractor. Tray mounting structures shall be welded to plate inserts or to structural beams as approved by the Management committee. Wherever embedded plates & structural beams are not available for welding the tray mounting structure contractor to supply the MS plates & fix them to floor slab by four anchor fasteners of minimum 16 mm dia having minimum holding power of 5000 Kg at no extra cost. Maximum loading on a horizontal support arm to be120 Kg. metre of cable run.Width of the horizontal arms of the tray supporting structures to be same as the tray widths specified in tray layout drawings, plus length required, for welding to the vertical supports. The length of vertical supporting members for horizontal tray runs shall be to suit the number of tray tiersshown in tray layout drawings. Spacing between horizontal supports arms of vertical tray runs tobe 300 mm. Cable trays will be welded to their mounting supports. Minimum clearance between the top most tray tier and structural member to be 300 mm. Cables in vertical race ways to be clamped by saddle type clamps to the horizontal slotted angels. Clamps to be fabricated from 3mm thick aluminium strip at site by the contractor to suit cable groups. The structural steel (standard quality) shall be according to latest revision of IS: 226 & 808. Welding shall be as per latest revisions of IS: 816.All structural steel to be painted with one shop coatof red oxide and oil primer followed by a finishing coat of aluminium alkyd paint where any cuts or holes are made on finished steel work these shall be sealed against oxidation by red oxide followed by the same finishing paint. Steel sheet covers wherever indicated to be similarly painted. Trays shall beerected properly to present a neat and clean appearance. Trays shall be installed as a complete system. Trays shall be supported adequately by means of painted MS structural members secured to the structure by dash fasteners or by grouting. The entire cable tray system shall be rigid. Each runofcabletrayshallbecompletedbeforelayingofcables.Cabletraysshallbe erectedso asto be exposed and accessible.

BuriedDirectlyInGround

General

Cables shall be so laid that they will not interfere with underground structures. All water pipes, sewage lines orotherstructures whichbecomeexposed by excavation shall be properlysupported and protected from injury until the filling has been rammed solidly in places under and around them. Any telephone or other cables coming in the way are to be properly shielded as directed by the Management committee. Surface of the ground shall be made good so as to conform in all respects to the surrounding ground to the satisfaction of the Management committee.

Routingofcables

Before cable laying work is undertaken, the route of the cables shall be decided with the Management committee. While shortest practicable route shall be preferred, cable runs shall follow fixed development such as roads, footpaths etc with proper off-sets so that future maintenance and identification are rendered easy. Whenever cables are laid along well demarcatedorestablishedroads,theLV/MV cables shallbelaidfurtherfrom thekerblinethanHV cables. Cables of different voltages and also power and control cables shall be kept in different trenches with adequate separation. Where available space is restricted, LV/MV cables shall be laid above HV cables. Where cables cross one another, the cables of higher voltage shall be laid at a lower level than the cables of lower voltage. Power and communication cables shall as far as possible cross at right angles. Where power cables are laid in proximity to communications cables the horizontal and vertical clearances shall not normally be less than 60 cm.

WidthofTrench

The width of trench shall be determined on the following basis. The minimum width of trench for layingsinglecablesshallbe350mm. Wheremore than one cable is to belaid in the same trench in horizontal formation, the width of trench shall be increased such that the inter-axial spacing between the cables except where otherwise specified shall be at least 200 mm. There shall be a clearance of at least 150 mm between axis of the end cables and the sides of the trench.

Depthof Trench

Thedepthoftrenchshallbedeterminedonthefollowingbasis:

- Where cables are laid in single tier formation, the total depth of the trench shall not be less than 750 mm for cables upto 1.1 kV and 1250 mm for cables above 1.1 kV.
- When more than one tier of cables is unavoidable and vertical formation of laying is adopted, the depth of trench shall be increased by 300 mm for each additional tier to be formed.

ExcavationofTrenches

The trenches shall be excavated in reasonably straight lines. Wherever there is a change in direction, suitable curvature of 12 times the overall diameter of the large stcable shall be provided. Where gradients and changes in depths are unavoidable these shall be gradual. Excavation should be done by any suitable manual or mechanical means. Excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench. Adequate precautions shall be taken not to damage any existing cables, pipes or other such installations during excavation. Wherever bricks, tiles or protected covers or bare cables are encountered, further excavation shall

not be carried out withoutthe approval of the Management committee. Existingproperty exposed during trenching shall be temporarily supported or propped adequately as directed by the Management committee. The trenching in such cases shall be done in short lengths, necessary pipes laid for passing cables therein and the trench refilled as required. If there is any danger of a trench collapsing or endangering adjacent structures the sides shall be well shored up with timbering and/or sheathing as the excavation proceeds. Where necessary these may even be leftin place when back filling the trench. Excavation through lawns shall be done in consultation with the Management committee. Bottom of the trench shall be level and free from stone, brick, etc. The trench shall then be provided with a layer of clean dry sand cushion of not less than 80 mm in depth.

LayingofCableInTrench

The cable drum shall be properly mounted on jacks or on a cable wheel at a suitable location. It should be ensured that the spindle, jack etc are strong enough to carry the weight of the drum without failure and that the spindle is horizontal in the bearings so as to prevent the drumcreeping to oneside whilerotating. Thecable shall bepulled over rollers in the trench steadily and uniformly without jerks or strains. The entire cable length shall, as far as possible, be laid in one stretch. However when this is not possible the remainder of the cable shall be removed by flaking i.e. making one long loop in the reverse direction. After the cable is uncoiled and laid over the rollers, the cableshall be lifted slightly over the rollers beginning from one end by helpersstanding about 10 metres apart and drawn straight. The cable should then be taken off the rollers by additional helpers lifting the cables and then laid in the trench in a reasonably straight line. For short runs and cable sizes upto 50 sq mm 1.1 kV grade the alternative method of direct handling can be adopted with the prior approval of the Management committee. If two or more cables are laid in the same trench care should be taken to preserve relative position. All the cables following the same routes shall be laid in the same trench. Cables shall not cross each other as far as possible. When the cable has been properly straightened the cores shall be tested for continuity and insulation resistance. The cable shall be measured thereafter. Suitable moisture sealing compound/tape shall be used for sealing of the ends. Cable laid in trenches in a single tier formation shall have a covering of clean dry sand of not less than 170 mm above the base cushion of sand before the protective cover is laid. In the case of vertical multi-tier formation after the first cable has been laid a sand cushion of 300 mm shall be provided over the initial bed before the second tier is laid. If additional tiers are formed each of the subsequent tiers also shall have a sand cushion of 300 mm. The top most cable shall have a final sand covering not less than 170 mm before the protective cover is laid. A final protection to cables shall be laid to provide warning to future excavators of the presence of the cable and also to protect the cables against accidental mechanical damage. Such protection shall be with second class bricks of not less than 200 mm x 100 mm x 100mm (normalsize) laidbreadth wise forthe fullength of the cableto the satisfaction of the Management committee. Where more than one cable is to be laid in the same trench this protective covering shall cover all the cables and project at least 50 mm over the sides of the end cables. In addition bricks on edge shall be placed along the entire run on either side of the cable run. The trenches shall then be back filled with excavated earth free from stones or other sharp edged debris and shall berammed and watered insuccessive layersnot exceeding 300mm. Unless otherwise specified a crown of earth not less than 50 mm in the centre and tapering towards the side of the trench shall be left to allow for subsidence. The crown of earth should however not

exceed 100 mms oas not to be a hazard to vehicular traffic. Where road berms or lawnshave been with the second s

cut or kerb stones displaced the same shall be repaired and made good to the satisfaction of the Management committee and all surplus earth and rocks removed to places as specified.

LayingInPipes/ClosedDucts

In locations such as road crossings, entry to buildings/poles in paved areas etc., cables shall be laid in pipes or closed ducts. Spun reinforced concrete pipes shall be used for such purposes and the pipe shall not be less than 100 mm in diameter for a single cable and not less than 150 mm for more than one cable. These pipes shall be laid directly in ground without any special bed. Sand cushioning and/or brick tiles need not be used in such installations. Unless otherwise specified the top surface of pipes shall be at a minimum depth of 1000 mm from the ground level when laid underroads,pavementsetc.Thepipesforroadcrossingsshallpreferablybeontheskewtoreduce the angle of bend as the cable enters and leaves the crossing. Pipes shall be continuous and clearof debris or concrete before cable is drawn. Sharp edges at ends shall be smoothened to prevent injury to cable insulation or sheathing. No deduction shall be made for sand and bricks not usedfor cables passing through RCC Hume pipes or for parts of vertical cables at the lighting poles.

LayingofCablesIn Floors

Laying of cables directly in floors shall be avoided and GI pipes of adequate size shall be used wherever necessary. However if the cables have to be laid direct in the floor specific written approval of the Management committee shall be obtained and the Contractor shall cut chases, lay the cables and make good the chases to original finish.

CableEntryIntoBuildings

Cable entry into buildings shall be made through RCC pipes recessed in the floor. RCC Hume pipes shall be provided well in advance for service cable entries. The pipe shall be filled with sand and sealed at both ends with bitumen mastic to avoid entry of water. Suitable size manholes shall be provided wherever required to facilitate drawing of cables as per requirements.

TERMINATION/JOINTINGOFCABLES

Soldered jointing/termination shall be totally avoided. Solderless terminations by using Dowel crimping tools and suitable legs shall be adopted for all cable terminations. Any terminations may without use of proper crimping tool is/shall be liable to be rejected. In the case of aluminium conductors, it is to be ensured that the conductor oxidation is cleaned by means of emery paper andthenathincoatoftinisappliedbeforepinchingintoanyequipment.HeatshrinkableRaychem type or approved equivalent terminations shall be provided for High Voltage cables and Siemens make or approved equivalent make brass double compression glands shall be provided forMedium Voltage cable terminations. Straight through jointing of Medium Voltage or High Voltage cable shall normally be totally avoided. If absolutely unavoidable, such jointing shall be carried out as per procedure to be got specifically approved from the Management committee.

MEASUREMENTOFCABLERUNS

The cable runs shall be measured up to the outer end of the boxes without any allowances for overlap in joints. The actual run of the cables shall be measured and the rate shall include all the above mentioned material, labour etc for laying as required.

CABLELOOPS

 $\label{eq:linear} At the time of the installation approximately 3 metres of surplus cables hall be left$

- ateachendofthecable
- oneachsideofundergroundstraightthrough/tee/terminationjoints.
- atentriestobuildings
- and such other places as may be decided by the Management committee.

Thiscableshallbeleftintheformofa loop.

Whereverlongrunsofcablelengthareinstalledcableloopsshallbeleftatsuitableintervalsas specified by the Management committee.

BONDINGOFCABLES.

Where a cable enters any piece of apparatus it shall be connected to the casting by means of an approved type of armoured clamp or gland. The clamps must grip the armouring firmly to thegland or casting, so that in the event of ground movement no undue stress is placed on to thecable conductors.

TESTING

TestsAtManufacturer's Work

The cables shall be subjected to shop test in accordance with relevant standards to prove the design and general qualities to the cables as below (as per IS 10810):

- Routinetestoneachdrumofcables.
- Acceptancetestsondrumschosenatrandomforacceptanceofthelot.
- Typetestoneachtypeofcables,inclusiveofmeasurementofarmourDCresistanceofpower cables.

SiteTesting

- All cables before laying shall be tested with a 500 V megger for 1.1 kV grade or with a 2500/5000 V meggerforcablesof higher voltages. The cables coress hall be tested for continuity, absence of cross phasing, insulation resistance to earth/sheath/armour and insulation resistance between conductors.
- All cables shall be subject to above mentioned test during laying, before covering the cables by protective covers and back filling and also before the jointing operations.
- Afterlayingandjointing,thecableshallbesubjectedtoa1.5minutesAC/DCpressure test.
- In the absence of facilities for pressure testing in accordance with clause above it is sufficient to test for one minute with 1000 V megger for cables of 1.1 kV grade and with 2500/5000 V megger for cables of higher voltages.

TestWitness

TestsshallbeperformedinpresenceoftheManagement committee.TheContractorshallgiveat least fifteen (15) days advance notice of the date when the tests are to be carried out.

MEDIUMVOLTAGESWITCHGEAR

GENERAL

This section covers specification of Medium Voltage Switchboards incorporating items of switchgear like Circuit Breakers, SFUs, metering and protection

STANDARDSANDCODES

The following Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

BIS certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.

It is to be noted that updated and current Standards shall be applicable irrespective of those listedbelow.

Low Voltage switchgear & controlgearIS13947:1993			
Part I	:	General rules	
Part II	:	Circuit Breakers	
Part III	:	Switches, disconnectors, switch disconnectors	
Part IV	:	ContactorsandMotorstarters	
Part V	:	Controlcircuitdevicesandswitchingelements	
Marking of Switchgear busbars IS11353:1985			
Degree of Protection of Enclosures for low voltage IS 2147 : 1962			IS 2147 : 1962
switchgear.			
Electrical relays for power system protection IS3231:1986			IS3231:1986
CodeofPracticeforselection, installation and IS10118:1982 Maintenanceofswitchgear&controlgear			
Lowvoltageswitchgear&controlgearassemblies IS8623:1993			
SWITCHGEAR			

MediumVoltageAirCircuitBreakers

TechnicalParameters

• The circuit breaker shall be of the air break type, robust and compact design suitable for indoor mounting and shall comply with the requirement of IS: 13947 : 1993. Rupturing capacity shall be25 MVA at 415 Volts or as per schedule of quantities.

ConstructionalFeatures

- The Circuit Breaker shall be flush front, metal clad, horizontal draw-out pattern; three/four pole as required and fully interlocked. Each Circuit Breaker shall be housed in a separate compartment enclosed on all sides.
- The Circuit Breaker cradle shall be designed and constructed to permit smooth withdrawal and insertion. The movement shall be free of jerks, easy to operate and positive.
- All current carrying parts in the breaker shall be silver plated and suitable arcing contacts shall be provided to protect the main contacts which shall be separate from the main contacts and easily replaceable. In addition, Arc chutes shall be provided for each pole, and these shall be suitable for being lifted out for the inspection of the main and the arcing contacts.
- Self aligning cluster type isolating contacts shall be provided for the Circuit Breaker, with automatically operated shutters to screen live cluster contacts when the Breaker is withdrawn from the cubicle. Sliding connections including those for the auxiliary contacts and control wiring shall also be of the self aligning type. The fixed portion of the sliding connections shall have easy access for maintenance purposes.
- The cubicle for housing the Breaker shall be free standing dead front pattern, fabricated from the best quality sheet steel.

OperatingMechanism

- The Circuit Breaker shall be trip free with independent manual spring operated or motor wound spring operated mechanism as specified and with mechanical ON/OFF indication. The operating mechanism shall be such that the circuit breaker is at all times free to open immediately the trip coil is energised.
- Theoperatinghandle and mechanical trippush button shall beat the front of and integral with the Circuit Breaker.
- The Circuit Breaker shall have the following four distinct and separate positions which shall be indicated on the face of the panel.

"Service"--Bothmainandsecondaryisolatingcontactsclosed

"Test"--Mainisolatingcontactsopenandsecondaryisolatingcontactsclosed

"Isolated" -- Both main and secondary isolating contacts open

"Maintenance"--CircuitBreakerfullyoutsidethepanelreadyformaintenance

CircuitBreakerInterlocking

- Sequencetypestrainfreeinterlocksshallbeprovidedtoensurethefollowing:
- It shall not be possible for the Breaker to be withdrawn from the cubicle when in the "ON" position. To achieve this, suitable mechanism shall be provided to lock the Breaker in the tripped position before the Breaker is isolated.
- ItshallnotbepossiblefortheBreakertobeswitched"ON"untilitiseitherinthefullyinserted position or, for testing purposes, it is in the fully isolated position.
- ItshallnotbepossiblefortheCircuitBreakertobepluggedinunlessitisintheOFFposition.
- A safety catch shall be provided to ensure that the movement of the Breaker, asit is withdrawn, is checkedbeforeitiscompletelyout of the cubicle, thus preventing its accidental fall due its weight.

• MechanicalandelectricalantipumpingdevicesshallbeincorporatedintheACB'sasrequired.

CircuitBreakerAuxiliaryContacts

The CircuitBreaker shall haveminimum 6 N.O. and6N.C. auxiliary contacts rated at 16 amps415 volts50Hz.Thesecontactsshallbeapproachablefromthefront.Theyshallclosebeforethemain contacts when the Circuit Breaker is plugged in and vice versa when the Circuit Breaker is Drawn Out of the cubicle.

ProtectiveDevices

- The Circuit Breaker shall have protective devices as specified in the drawing and approved by the Management committee . These will in general be:
- C.T. operated thermal overload releases with magnetic instantaneous short circuit release. The overload releases shall be such that each phase can be individually set depending on the phase unbalanced currents. The releases shall have inverse time current characteristicsand themagnetic release shall be time delayed with a minimum setting of 25 ms varying upto 300 ms for discrimination without effecting the breaking current capacity of the ACB.
- Overvoltage relay.
- Under/novoltagetripcoilorRelayasrequired.
- OvercurrentandearthfaultIDMTrelayswithshunt/seriestripcoiloperationasspecified.
- The Circuit Breakers shall be suitable to accommodate one or more types of protection asspecified.

InstrumentTransformers

The Circuit Breaker shall have the required Current Transformers as specified for metering and protectionmountedoutside the Circuit Breaker compartment but within the free standing cubicle. The transformers shall comply to the relevant Indian Standards and the Class of Accuracy required for metering and protection. Separate sets of Current transformers shall be provided.

Metering

The metering required to be provided for each Circuit Breaker shall be approved by the Management committee. Such metering shall not be provided on the front panel of the Circuit Breaker compartment. A separate compartment shall be provided for the metering and Protective relays as required.

Square pattern flush mounting meters complying with the requirements of the relevant Indian Standards shall only be used.

Selector switches of the three way and OFF pattern complying to the relevant Indian Standards shall be used.

IndicatingLamps

 ${\tt LEDtypeindicating} lamps shall be provided for indication of phases and {\tt Breaker position} as required.$

ControlWiring

All wiring for relays and meters shall be of copper conductor PVC insulated and shall be colour coded and labelledwith appropriate plastic ferrules for identification. The minimum size of control wires to be used shall be 1.5 sq mm.

All control circuits shall be provided with protective H.R.C. fuses. Instrument testing plugs shall be provided for testing the meters.

Earthing

The frame of the Circuit Breaker shall be positively earthed when the Circuit Breaker is racked into the cubicle.

TypeTestCertificates

TheContractorshallsubmittypetestcertificatesfromarecognisedtesthousefortheCircuit Breakers offered.

SwitchFuseUnits

Switch fuse units, incorporated in switchboards wherever required shall conform in all respects to IS 13947 : 1993. Switch fuse units shall be suitable for 415 Volts 3 Phase 40 Hz AC supply.

Unithousingshallbeofrobustconstructiondesignedtowithstand arduousconditions. Sheetsteel used shall be given rigorous rust proofing treatment before fabrication and painting . Units shall have double break per phase in order to isolate fuse links when the switch is in OFF position.

Operating mechanism of units shall be crisp and positive in action with quick- make and quick- break silver plated contacts. Operating handle shall be suitable for rotary operation unless otherwise specified. Position of handle such as ON and OFF shall be clearly indicated.

 $\label{eq:alliveparts} All live parts inside the switch fuse units shall be shrouded to prevent any accidental contact.$

All the terminals shall be liberally designed. All units above 100 A shall be provided with integral cable sockets.

All switch units shall be provided with suitable interlocks such that the door of the switchboard panel shall notopen unless witch in OFF position. Provision for padlocking the switch in OFF position shall also be provided.

Routine and type tests as per IS 13947: 1993 shall be conducted at works and test certificates furnished.

MouldedCaseCircuitBreakers

Moulded case circuit breakers (MCCB) or fuse free breakers, incorporated in switchboards wherever required, shall conform to IS 13947 : 1993 in all respects. MCCBs shall be suitable either for single phase 240 Volts or 3 Phase 415 Volts AC 50 Hz supply.

MCCB cover and case shall be made of high strength heat resisting and flame retardant thermosetting insulating material. Operating handle shall be quick make/break, trip - free type. OperatinghandleshallhavesuitableON,OFFandTRIPPEDindicators.ThreephaseMCCBsshall

have a common handle for simultaneous operation and tripping of all the three phases. Suitable arc extinguishing device shall be provided for each contact. Tripping unit shall be of thermal/magnetic type provided on each pole and connected by a common tripe bar such that tripping of any one pole causes three poles to open simultaneously. Thermal/magnetic tripping device shall have IDMT characteristics for sustained over loads and short circuits.

Contact trips shall be made of suitable arc resistant sintered alloy. Terminals shall be of liberal design with adequate clearances.

MCCBs shall be provided with following accessories, if specified in drawings/ schedule of quantities :

- Undervoltage trip
- Shunttrip
- Alarmswitch
- Auxiliaryswitch

MCCBs shall be provided with following interlocking devices for interlocking the door a switch board.

- Handleinterlocktopreventunnecessarymanipulationsofthebreaker.
- DoorinterlocktopreventdoorbeingopenedwhenthebreakerisinONposition
- DeinterlockingdevicetoopenthedoorevenifthebreakerisinONposition. MCCBs shall have rupturing capacity as specified in drawings.

AllMCCBshallbeprovided with a dapter terminal for facilitates higher sizes of cable/links

Metering, InstrumentationAndProtection.

Ratings, type and quantity of meters, instruments and protective devices shall be as per drawings and schedule of quantities.

CurrentTransformers

C/Ts shall confirm to IS 2705 (part -I, II and III) in all respects. All C/Ts used for medium voltage application shall be rated for 1 kV. C/Ts shall have rated primarycurrent, rated burden and class of accuracy as specified drawings. Rated secondary current shall be 5A unless otherwise stated. Minimum acceptableclassformeasurementshallbeclass0.5to 1 andforprotectionclass10.C/Ts shall be capable of withstanding magnetic and thermal stresses due to short circuit faults of 31 MVA on medium voltage. Terminals of C/Ts shall be paired permanently for easy identification of poles. C/Ts shall be provided with earthing terminals for earthing chassis, frame work and fixed part of metal casing (if any). Each C/T shall be provided with rating plate indicating :

- Nameand make
- Serialnumber
- Transformationratio
- Ratedburden
- Ratedvoltage
- Accuracyclass

CTs shall be mounded such that they are easily accessible for inspection, maintenance and replacement. Wiring for CT shall be with copper conductor PVC insulated wires with proper termination works and wiring shall be bunched with cable straps and fixed to the panel structure a neat manner.

PotentialTransformer

PTsshallconfirmtoIS3156(Part-I,IIandIII)inallrespects.

MeasuringInstruments

Direct reading electrical instruments shall conform to IS 1248 or in all respects. Accuracy of direct reading shall be 1.0 of voltmeter and 1.5 for ammeters. Other instruments shall have accuracy of 1.5. Meters shall be suitable for continuous operation between -10° C to $+50^{\circ}$ C. Meters shall be flush mounting and shall be enclosed in dust tight housing. The housing shall be of steel orphenolic mould. Design and manufacture of meters shall ensure prevention of fogging of instrument glass. Pointer shall be black in colour and shall have Zero position adjustment device operable from outside. Direction of deflection shall be from left to right. Selector switches shall be provided for ammeters and volt meters used in three phase system.

Ammeters

Ammeters shall be of Digital type. Moving part assembly shall be with jewel bearings. Jewel bearings shall be mounted on a spring to prevent damage to pivot due to vibrations and shocks. Ammeters shall be manufacture and calibrated as per IS 1248.

Ammeters shall normally be suitable for 5 A secondary of current transformers.

Ammetersshallbecapableofcarryingsubstantialoverloadsduringfaultconditions.

Voltmeters

Voltmeters shall be Digital type range of 3 phase 415 volt voltmeters shall be 0-500.Volt metersshall be provided with protection fuse.

<u>Wattmeter</u>

Wattmetershallbeof3phaseDigitaltypeandshallbeprovidedwithamaximumdemand indicator if required.

Powerfactormeters

3 phase power factor meters shall be of Digital type with current and potential coils suitable for operation with current and potential transformers provided in the panel. Scale shall be calibrated for 50% lag - 100% - 50% loading. Phase angle accuracy shall be +40.

Energyandreactivepowermeters

Trivector meters shall be two element, integrating type, KWH, KVA, KVA hour reactive meters. Meters shall confirm to IEC 170 in all respects. Energy meters, KVA, and KVARH meters shall be provided with integrating registers. The registers shall be able to record energy conception of 500 hours corresponding to maximum current at rated voltage and unity power factor. Meters shall be suitable for operation with current and potential transformers available in the panel.

<u>Relays</u>

 $\label{eq:protection} Protection relays shall be provided with flag type indicators to indicate cause of tripping. Flag indicators shall remain in position till they are reset by hand reset. Relays shall be designed to the state of the s$

make or break the normalcircuit currentwithwhich they areassociated. Relay contacts shall be silver or platinum alloy and shall be designed to withstand repeated operation without damage. Relays shall be of draw out type to facilitate testing and maintenance. Draw out case shall be dust tight. Relays shall be capable of disconnecting faulty section of network without causing interruption to remaining sections. Analysis of setting shall be made considering relay errors, pickup and overshoot errors and shall be submitted to the Management committee for approval.

Overcurrentrelays

Over current relays shall be induction type with inverse definite minimum time lag characteristics. Relays shall be provided with adjustable current and time settings. Setting for current shall be 50to 200 % insteps of 25%. The IDMT relay shall have time lag (delay) of 0 to 3 seconds. The time setting multiplier shall be adjustable from 0.1 to unity. Over current relays shall be fitted with suitable tripping device with trip coil being suitable for operation on 5 Amps.

Earthfaultrelay

Same as over current relay excepting the current setting shall be 10% to 40% insteps of 10%.

Undervoltagerelay

Undervoltagerelaysshallbeofinductiontypeandshallhaveinverselimitoperationcharacteristics with pickup voltage range of 50 to 90% of the rated voltage.

PowerFactorCorrectionCapacitors

Power factor correction capacitors shall conform to IS 2834 in all respects. Approval of insurance associationofIndiashallbeobtainifcalledfor.Capacitorsshallbesuitablefor3phase415volts50 Hz supply and shall be available in single and three phase units of5,10,15,20,25and 50 kVAR sizes. Capacitor shall be usable for indoor use, permissible overloads being as below.

- Voltageoverloadsshallbe10%forcontinuousoperationand15%forsixhoursina24 hours cycle.
- Current overloadsshall be 15 % for continuous operations and 50% for six hours in a 24 hours cycle.
- Overloadof30%continuouslyand45%forsixhoursina24hourscycle.

Capacitors shall be hermetically sealed in sturdy corrosion proof sheet steel containers and inpregnated with non inflammable synthetic liquid. Every element of each capacitory unit shall be provided with its own built in silvered fuse. Capacitors shall have suitable discharge device to reduce the residual voltage from crest value of the rated voltage to 50 volts or less within one minute after capacitor is disconnected from the source of supply. The loss factor of capacitor shall not exceed 0.005 for capacitors with synthetic impregnates The capacitors shall withstand power frequency test voltage of 2500 volts AC for one minute. Insulation resistance between capacitors terminals and containers when a test voltage of 500 volts DC is applied shall not be less than 50 megaohms.

MEDIUMVOLTAGESWITCHBOARDS

<u>General</u>

- Allmediumvoltageswitchboardsshallbesuitableforoperationatthreephase/threephase4wire, 415 volt, 50 Hz, neutral grounded at transformer system with a short circuit level withstand of 25 MVA at 415 volts or as per schedule of quantities.
- The Switch Boards shall comply with the latest edition with upto date amendments of relevant Indian Standards and Indian Electricity Rules and Regulations.

SwitchBoardConfiguration

- The Switch Board shall be configured with Air Circuit Breakers, MCCB's, and other equipment asdrawings approved by the Management committee.
- TheMCCB'sshallbearrangedinmulti-tierformationwhereastheAirCircuitBreakersshallbe arranged in Single or Double tier formation only to facilitate operation and maintenance.
- The Switch Boards shall be of adequate size with a provision of 25% spare space to accommodate possible future additional switch gear.

EquipmentSpecifications

All equipment used to configure the Switch Board shall comply to the relevant Standards and CodesoftheBureauofIndianStandardsandtothedetailedtechnicalSpecificationsasincludedin this tender document.

ConstructionalFeatures

- The Switch Boards shall be metal enclosed, sheet steel cubicle pattern, extensible, dead front, floor mounting type and suitable for indoor mounting.
- The Switch Boards shall be totally enclosed, completely dust and vermin proof. Synthetic rubber gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust and vermin proofto provide a degree of protection of IP 54. All doors and covers shall also be fully gasketed with synthetic rubber and shall be lockable.
- The Switch Board shall be fabricated with CRCA Sheet Steel of thickness not less than 2.0 mm and shall be folded and braced as necessary to provide a rigid support for all components. The doors and covers shall be constructed from CRCA sheet steel of thickness not less than 1.6 mm. Joints of any kind in sheet metal shall be seam welded and all welding slag ground off and welding pits wiped smooth with plumber metal.
- All panels and covers shall be properly fitted and square with the frame. The holes in the panel shall be correctly positioned.
- Fixing screws shall enter holes tapped into an adequate thickness of metal or provided with hank nuts. Self threading screws shall not be used in the construction of the Switch Boards. Panelmountedlocktobeprovedoneachcompartment.

SwitchboardDimensionalLimitations

- Abasechannel75mmx40mmx5mmshallbeprovidedatthe bottom.
- A minimum of 200 mm blank space between the floor of switch board and bottom most unit shall be provided.
- TheoverallheightoftheSwitchBoardshallbelimitedto2300mm
- Theheightoftheoperatinghandle,pushbuttonsetcshallberestrictedbetween300mmand 2000 mm from finished floor level.

SwitchBoardCompartmentalisation

TheSwitchBoardshallbedividedintodistinctseparatecompartmentscomprising

- A completely enclosed ventilated dust and vermin proof bus bar compartment for the horizontal and vertical busbars.
- Eachcircuitbreaker, and MCCBshallbehoused inseparate compartments enclosed on all sides.
- Sheet steel hinged lockable doors for each separate compartment shall be provided and duly interlocked with the breaker/switch fuse unit in "on" and "off" position.
- For all Circuit Breakers separate and adequate compartments shall be provided foraccommodating instruments, indicating lamps, control contactors and control fuses etc. Theseshall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker, busbars and connections.
- A horizontal wire way with screwed cover shall be provided at the top to take interconnecting control wiring between vertical sections.
- Separate cable compartments running the height of the Switch Board in the case of front access Boards shall be provided for incoming and outgoing cables.
- Cable compartments shall be of adequate size for easy termination of all incoming and outgoing cables entering from bottom or top.
- Adequateandpropersupportshallbeprovidedincablecompartmentstosupportcables.

SwitchBoardBus Bars

- The Bus Bar and interconnections shall be of Aluminium and of rectangular cross sections suitable for full load current for phase bus bars and half rated current for neutral bus bar. Aluminium shall be 1/1 amp per Sq. mm. and suitable to withstand the stresses of a 25 MVA fault level or at 415 volts for 1 second or as per schedule of quantities.
- Thebusbarsandinterconnectionsshallbeinsulatedwithinsulationtape/fibre glass.
- ThebusbarsshallbeextensibleoneithersideoftheSwitch Board.
- The bus bars shall be supported on non-breakable, non-hygroscopic insulated supports at regular intervals, to withstand the forces arising from a fault level of 31 MVA at 415 volts for 1 second.
- Allbusbarsshallbecolourcoded.
- All bus bar connections inSwitch Boards shall be bolted with brass bolts and nuts. Additional cross section of bus bars shall be provided wherever holes are drilled in the bus bars.

SwitchBoardInterconnections

- All connections between the bus bars/Breakers/cable terminations shall be through solid copper strips of adequate size to carry full rated current and PVC/fibre glass insulated.
- For unit ratings upto 100 amps PVC insulated copperconductor wires of adequate size to carry full load current shall be used. The terminations of all such interconnections shall be crimped.

DrawoutFeatures

Air Circuit Breakers shall be provided in fully drawout cubicles. These cubicles shall be such that drawout is possible without disconnection of the wires and cables. The power and control circuits shall have self aligning and self isolating contacts. The fixed and moving contacts shall be easily accessibleforoperationandmaintenance.Mechanicalinterlocksshallbeprovidedonthe drawout

cubicles to ensure safety and compliance to relevant Standards. The MCCB's shall be provided in fixed type cubicles.

InstrumentAccommodation

- Instruments and indicating lamps shall not be mounted on the Circuit Breaker Compartment door for which a separate and adequate compartment shall be provided and the instrumentation shall be accessible for testing and maintenance without danger of accidental contact with live parts of the Switch Board.
- ForMCCB'sinstrumentsandindicatinglampscanbeprovidedonthecompartmentdoors.
- The current transformers for metering and for protection shall be mounted on the solid copper/aluminium busbars with proper supports.

Wiring

All wiring for relays and meters shall be with PVC insulated copper conductor wires. The wiring shall be coded and labelled with approved ferrules for identification. The minimum size of copper conductor control wires shall be 1.5 sq. mm.

CableTerminations

- KnockoutholesofappropriatesizeandnumbershallbeprovidedintheSwitchBoardin conformity with the location of incoming and outgoing conduits/cables.
- ThecableterminationsoftheCircuitBreakersshallbebroughtouttoterminalcablesockets suitably located at the rear of the panel.
- The cable terminations for the MCCB's shall be brought out to the rear in the case of rear accessswitchboards or in the cable compartment in the case of front access Switch Boards.
- The Switch Boards shall be complete with tinned brass cable sockets, tinned brass compression glands, gland plates, supporting clamps and brackets etc for termination of 1100 volt grade aluminium conductor PVC/PVCA cables.

SpaceHeaters

TheSwitchBoardshallhaveineachpanelthermostaticallycontrolledspaceheaterswithacontrolling 15 amp 230 volt switch socket outlet to eliminate condensation.

Earthing

AmainearthbarofG.I./copperasrequiredshallbeprovidedthroughoutthefullengthofthe Switch Board with a provision to make connections to the sub-station earths on both sides.

SheetSteelTreatmentAndPainting

- Sheet Steel materials used in the construction of these units should have undergone a rigorousrust proofing process comprising of alkaline degreasing, descaling in dilute sulphuric acid and a recognised phosphating process. The steel work shall then receive two costs of oxide filler primer before final painting. Castings shall be scrupulously cleaned and fettled before receiving a similar oxide primer coat.
- All sheet steelshall aftermetal treatment be sprayorpowder painted with two coatsof shade692 to IS 5 on the outside and white on the inside. Each coat of paint shall be properly stoved and the paint thickness shall not be less than 50 microns.

NamePlatesAndLabels

Suitable engraved white on black name plates and identification labels of metal for all Switch Boards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

Installation

The foundations prepared as per the manufacturers drawings shall be levelled, checked for accuracy and the Switch Board installed. All bus bar connections shall be checked with a feeler gauge after installation. The able end boxes shall be sealed to prevent entry of moisture. The main earth bar shall be connected to the sub-station earths.

A 15mm thick rubber matting of approved make on a 100 mm high timber platform shall be provided infront of and along the full length of the Switch Board. The width of the matting shall be 1000 mm. The rubber mat shall with stand 15 KV for 1 minute and leakage current shall not exceed 160 mA/sq. metre.

 $\label{eq:approximation} After installation the Switch Board shall be tested as required prior to commissioning.$

Testing&Commissioningatsitebythirdparty

- a) Alignmentofpanel, interconnection of Busbars and tightness of bolts and connection.
- b) Interpanelwiring
- c) Freemovementof ACB/MCCB/SFU
- d) Operationofbreakers
- e) InsulationTests
- f) Primary&secondaryinjectiontestsofrelays.
- g) Interlockingfunction.

CABLETRAYS

Cable trays, of sizes as per drawings approved by the Management committee shall be of perforated doubled bend channel/ladder design unless otherwise stated. Cable trays shall be fabricated from minimum 2 mm thick sheet steel and shall be complete with tees, elbows, risers, and all necessary hardware. Cable trays shall comply with the following:

Trays shall have suitable strength and rigidity to provide proper support for all contained cables. Trays shall not have sharp edges, burrs or projections injurious to cable insulation. Trays shall include fittings for changes in direction and elevation. Cable trays and accessories shall be painted with one shop coated of red oxide zinc chromate primer and two side coats of aluminium alkyd paint or approved equivalent. Cable trays shall not have sharp edges, burrs or projection that may damage the insulation jackets of the wiring. Cable trays shall have side rails or equivalentstructural members.

Unless otherwise specifically noted on the relevant layout drawing, all cable tray mounting works to be carried out ensuring the following :

Cable tray mounting arrangement type to be as marked on layout drawing. Assembly of tray mounting structure shall be supplied fabricated, erected & painted by the electrical contractor. Tray mounting structures shall be welded to plate inserts or to structural beams as approved by the Management committee. Wherever embedded plates & structural beams are not available for welding the tray mounting structure electrical contractor to supply the MS plates & fix them to floorslabby fouranchorfastenersofminimum 16mm diahavingminimum holding powerof5000 Kg at no extra cost. Maximum loading on a horizontal support arm to be 120 Kg. metre of cable run. Width of the horizontal arms of the tray supporting structures to be same as the tray widths specified in tray layout drawings, plus length required, for welding to the vertical supports. The length of vertical supporting members for horizontal tray runs shall be to suit the number of tray tiersshown intraylayoutdrawings. Spacing betweenhorizontalsupports armsof verticaltray runs to be 300 mm. Cable trays will be welded to their mounting supports. Minimum clearancebetween the top most tray tier and structural member to be 300 mm. Cables in vertical race ways to be clamped by saddle type clamps to the horizontal slotted angels. Clamps to be fabricated from 3 mm thick aluminium strip at site by the electrical contractor to suit cable groups. The structural steel (standard quality) shall be according to latest revision of IS : 226 & 808. Welding shall be as per latest revisions of IS : 816. All structural steel to be painted with one shop coat of red oxide and oil primer followed by a finishing coat of aluminium alkyd paint where any cuts or holes are made on finished steel work these shall be sealed against oxidation bv red oxidefollowedbythesamefinishingpaint.Steelsheetcoverswhereverindicatedtobesimilarlypainted. Trays shall be erected properly to present a neat and clean appearance. Traysshall be installed asa complete system. Trays shall be supported adequately by means of painted MS structural members secured to the structure by dash fasteners or by grouting. The entire cable tray system shall be rigid. Each run of cable trayshall be completed before laying of cables. Cable trayshall be erected so as to be exposed and accessible.

MEDIUMVOLTAGEDISTRIBUTIONBOARDS

GENERAL

Thissectioncoversspecification of DBs.

STANDARDSANDCODES

The following Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

BIS certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.

It is to be noted that updated and current Standards shall be applicable irrespective of those listedbelow.

Miniature Air Circuit Breakers for AC circuits	IS8828:1978
Degrees of Protection provided by enclosures	IS2147:1962

forlowvoltageswitchgear

Code of Practice for installation and maintenance IS10118:1982

of switchgear not exceeding 1000 volts

General requirements for switchgear and controlgear IS4237:1982

for voltages not exceeding 1000 volts

MINIATURECIRCUITBREAKERS

- The MCB's shall be of the completely moulded design suitable for operation at 240/415 Volts 50 Hz system.
- TheMCB'sshallhavearupturingcapacityof10KAat0.5p.f.
- The MCB's shall have inverse time delayed thermal overload and instantaneous magnetic short circuit protection. The MCB time current characteristic shall coordinate with H.R.C. fuse/PVC cable characteristic.
- Typetestcertificatesfromindependentauthoritiesshallbesubmittedwiththetender.

FINALDISTRIBUTIONBOARDS

- Final distribution boards shall be flush mounting, totally enclosed, dust and vermin proof and shall comprise of miniature circuit breakers, earth leakage circuit breakers, neutral link etc as detailed in the schedule of quantities.
- The distribution equipment forming a part of the Distribution Boards shall comply to the relevant Standards and Codes of the Bureau of IndianStandards and as per detailed specifications included in this tender document.
- Theboardshallbefabricatedfrom14gaugeCRCAsheetsteelandshallhaveahingedlockablespring loaded cover. All cutouts and covers shall be provided with synthetic rubber gaskets. The entire construction shall give a IP 42 degree of protection.
- The bus-bar shall be of electrical grade copper having a maximum current density of 1.6 ampere per square mm and PVC insulated throughout the length.
- All the internal connections shall be with either solid copper PVC insulated or copper conductor PVC insulated wires of adequate rating.
- All the internal connections shall be concealed by providing a hinged protective panel to avoid accidental contact with live points.
- Alloutgoingequipmentshallbeconnecteddirectto thebusbarontheliveside.Theequipmentshall be mounted on a frame work for easy removal and maintenance.
- The sheet steel work shall undergo a rigorous rust proofing process, two coats of filler oxide primer and final powder coated paint finish.
- All the circuits shall have an independent neutral insulated wire, one per circuit, and shall be numbered and marked as required by the Owners.
- A sample of the completed board is to be got approved by the Management committee before commencement of supply and erection.

SHEETSTEELTREATMENTANDPAINTING

• Sheet Steel materials used in the construction of these units should have undergone a rigorous rust proofing process comprising of alkaline degreasing, descaling in dilute sulphuric acid and a recognised phosphating process. The steel work shall then receive two costs of oxide filler primer before final painting. Castings shall be scrupulously cleaned and fettled before receiving a similar oxide primer coat.

All sheet steel shall after metal treatment be given powder coated finish painted with two coats of shade 692 to IS 5 on the outside and white on the inside. Each coat of paint shall be properly stoved and the paint thickness shall not be less than 50 microns.

NAMEPLATESAND LABELS

Suitable engraved white on black name plates and identification labels of metalfor all Switch Boards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

ROUTINEANDCOMPLETIONTESTS

INSTALLATIONCOMPLETIONTESTS

Atthecompletionofthework, the entire installation shall be subject to the following tests: Wiring continuity test

- 1. Insulationresistancetest
- 2. Earthcontinuitytest
- 3. Earthresistivitytest

Besides the above, any other test specified by the local authority shall also be carried out. All tested and calibrated instruments for testing, labour, materials and incidentals necessary to conduct the above tests shall be provided by the contractor at his own cost.

DrawingsandDocumentation

The contractor shall submit the following shopdrawing before start of execution.

- Listofalltypesofcomponentsandequipmentstobeused.
- a) b) Descriptive installation, operational, maintenance and trouble shooting write-ups and manuals and design study material.
- Preparing of shop drawings based on Contractor basic layout drawings co-ordinating with other services C) such as Civil/Architectural, HVAC, Plumbing, Piping and Plant System Supplier and Electrification Contractors etc. and submit to the Management committee for approvals prior to commencing the work.

RISINGMAINS

1.0 **RISINGMAINSBUSTRUNKINGSYSTEM**

1.1 MATERIALS

1.1.1 Enclosure

The enclosure shall be made from CRCA sheet steel of 2m thickness for side channel and 1.6 mm thickness for the front and covers.

BustrunkingsystemshouldconformtoIEC-139Part1&2andshallbesuitablefor45KAsymmetrical fault level 415 volt 3 phase 4 wire 50 Hz supply, insulation voltage 660 volts.

1.1.2 **Busbars**

Busbars shallbemadeof electrical gradeE-9/Ealuminumbusbars. Therating of busbar shallbe as specified in drawing.

MaximumtemperaturerisingoftheRisingMainsBusTrunkingSystemshallbeasperIEC standards and temperature rise shall not exceeding 50°C above 40°C ambient.

- 1.1.3 Busbarsshallbeofsufficientcrosssectionsothatacurrentdensityof0.8A/1ASqmmisnot exceeded at nominal current.
- The cross section of the neutral busbar shall be the same as that of the phase busbar for busbarsof 1.1.4 capacities.

EachbusbarshallbeindividuallyinsulatedbymeansofheatshrinkablePVCsleeves

1.2 BUSBARSSUPPORTS

Busbar supports/insulators shall be made of thermal resistant epoxy resin as insulation material andshallbeofsuitablesizeandspacingtowithstanddynamicstressesduetoshortcircuitcurrents in the system.

1.3 <u>MOUNTINGS</u>

- 1.3.1 Tap off boxes shall be located at specified intervals and shall be installed at a height as required the floor level. These shall be plug in type connected to the busbars of the rising mains bustrunking system.
- 1.3.2 An end feed unit for connecting to the incoming cables shall be provided at the bottom end of the rising mains bus trunking system.
- 1.3.3 Tap off boxes shall be suitable for mounting over rising mains bus trunking system. The rating shall be as specified.
- 1.3.4 The tap off unit shall be complete in all respect having moulded case circuit breaker as protective switching devices with rotary handles. The rating shall be as specified in drawing and tender document.
- 1.3.5 Thetapoffunitshallbeplugintypeboltedtypeasrequired.

1.4 CONSTRUCTION

1.4.1 Enclosure

- 1.4.1 The rising mains bus trunking system shall be manufactured in convenient sections to facilitate easy transportation and installation. The sections shall be connected to form a horizontal /vertical run at site. Each section shall be provided with suitable wall strips/fixing arrangement at convenient intervals for fixing to the wall.
- 1.4.2 The enclosure shall be study so as to withstand the internal and external forces resulting from the various operating conditions.
- 1.4.3 The entire bus trunking system shall be designed for dust and vermin proof construction. The enclosure shall have degree of protection not less than IP-42 in accordance with IS-2147
- 1.4.4 Built in fire proof barriers shall be provided to restrict the spread of fire through the bus trunking system from one section to the adjacent section. The fire barriers comply with resistance class F-120.

Neoprene rubber gaskets shall be provided between the covers and channels to satisfy the operating conditions imposed by temperature, weathering durability etc.

Necessary earthing arrangement shall be made alongside the rising mains enclosure bymeans of a aluminium strip of adequate size bolted toeach section and shall be earthed at both ends. The rising mains enclosure shall be bolted type.

1.4.5 The enclosure shall be treated with anti corrosion paint and shall be coated with powder spray paint. The power spray paint shall be applied electro-statically and baked on to the enclosure.

1.5 BUSBARSANDSUPPORTS

- 1.5.1 Busbars joint shall be thoroughly cleaned and a suitable oxidizing grease shall be applied before making joints.
- 1.5.2 Therisingmainsbustrunkingshallhavefourbusbar.Busbarshallbesupportedevery250mm long the length on class B fire retardant insulating supports.
- 1.5.3 High tensile, bolts, plain and spring washers shall be provided to ensure good contacts at thejoints.
- 1.5.4 Expansion joint made of aluminium strips shall be provided wherever necessary to take care of expansion and contraction of the busbars under normal operating conditions. This shall be invariably provided wherever the length of the rising mains bus trunking exceed fifteen meter.
- 1.5.5 The busbar shall be provided with thrust pads so that the expansion of the conductor is upwards only.
- 1.5.6 The busbar clamps and insulator shall be designed to withstand the forces due to short circuit current. They shall also permit free vertical movement of the busbars during expansion and construction.

1.6 INSTALLATION

1.6.1 Installationofrisingmainsbustrunkingsystem

- 1.6.1.1 Rising Mains Bus trunking shall be installed on walls to which suitable supports / fasteners shall be provided by the contractor without extra payment.
- 1.6.1.2 All opening in floors provided by the client shall be closed by the contractor after installing rising mains bus trunking system by any suitable means as approved by the Management committee without any extra payment.

1.6.2 Mountings

The accessories used with the rising mains bus trunking system for tapping and distributionshallbe as per clause 3.3

1.6.3 Earthing

Two no. earth strip shall be provided for body earthing of the rising mains bus trunking system. Earth strip shall be terminated on the earth strip (coming from mains LT panels) at the bottom end/end feed units of the rising mains bus trunking system. Metallic body of all mounting shall be bonded to the earth strip. Earth continuity conductor for further distribution shall also be taped from the earth strip.

1.6.4 Theentireinstallationincludingmountingshallbeprovidedinsuchamannerthatthereareno chances of entry of insects into the rising mains bus trunking system.

1.6.5 Dangernoticeboard

Dangernoticeboardshallbeprovidedontherisingmainsbustrunkingsystemateveryfloorlevel.

1.6.6 Commissioning

Before connecting mains supply after installation, pre-commissioning checks comprising megger test, checking the tightness of the connections body earth connection etc. shall be carried out and recorded.

1.6.7 **Testandtest reports**

Typetestreportsfortherisingmainsshallbefurnishedalongwiththebidandroutinetest according to IS-8623 Part-II shall be given with the supply. The routing rest shall comprise of :-

- a) Heatruntest
- b) Highvoltagetest
- c) Insulationresistancetestusing1.1kVmegger
- d) AnyothervisualtestaspertherelevantlSatthetimeofinspection
- e) ImpedanceTest

TECHANICALSPECIFICATIONSFORFIREFIGHTING

The whole fire fighting system is to be designed and carried out as per Nationalbuilding code as amended from time to time till date.

SYSTEMTESTING

The Contractor shall carryout interim / stage inspection during execution of the works as and when so called for and shall carry out any rectification/modification as may be suggested by the Management committee.

Soon after the work is completed, the Contractor will get the complete system including all subsystems and instrumentation, control panels etc. thoroughly inspected and \tested for satisfactory performance from Fire Department. Any defects noticed during these tests shall be speedily rectified by the Contractor.

COMMISSIONINGOFTHESYSTEMS

Aftercompletionofthestart-uptrials, all the equipment/items in the system shall be operated to establish proper sequencing synchronization and coordinated working of the equipment/ items. Any defect noticed during this period shall be speedily rectified by the Contractor.

SECTIONFORSUPPLYOFEQUIPMENT

The Contractors hall be required to submit the performance certificate from the manufacture rof the equipment's procured by him. Individual item or batch certificates shall be provided as applicable.

EXTERNALPIPING

All underground piping shall be tested before back filling. Pipe to pipe jointing shall be by 3 phase Rectifier type Welding Set. All pipe edges shall be bevel edged before application of weld. Proper pipe to pipe gap shall be maintained before completing first weld. After application of first weld, the weld shall be cleaned with motorized grinder.

A maximum of four lengths of pipe shall be welded on the ground before being laid into the trench. The four pipes so welded shallbe flanged jointed inside the trench. Pipe to pipe jointing inside the trenchshall be flange connection. In case welding is to be undertaken extra excavation shall be undertaken such that the pipe can be welded from below. The pipe shall not be cut for welding on the lower end.

Anti corrosive treatment shall be by application of coal tar at4.5 kg/sqmts areaof pipe. Fibre glass shall be covered over the coal tar. Another layer of coal tar shall be applied on which a final coat of fibre glass / kraft paper is to be laid.

ANNUALMAINTENANCECONTRACT

After completion of the work, maintenance service for fire fighting system shall be provided by the contractor free for a period of three years including obtaining NOC from concerned Fire Authorities, all T&P, Sparesand labour required. Themaintenance serviceshall includewatch and wardofthe fire fighting system of equipments and at least monthly examination of installation during regular working hours by trained staff and shall include all necessary adjustment, overhauling and cleaning setting right of defects including replacement of defective parts with genuine standard parts only as required to keep the equipment in proper operation.

During free maintenance period complete work will have to maintained / inspected at least once in a month and as and when called due to fault / breakdown without any charges.

There shall not be delay of more than 24 hours in attending & setting right to minor breakdown / defect and 48 hours for the major breakdown / defect reported in station where tenderer has service station. Emergency repairs however will be carried out immediately.

In case the firm does not adhere to the Schedule of monthly examination and attending of complaints as mentioned above, the same shall be got done and attended to at the risk and cost of the firm and amount double the expenditure incurred will be recovered from the firm from his pending dues / security deposit.

IMPORTOFEQUIPMENT

The Contractor shall make his own arrangement for import of equipment including all certification, payment of foreign exchange etc. The Management committee shall not be involved in this process unlessa certificate is required from his end.

APPROVALBYLOCALFIRESERVICEAUTHORITY

Itshallbetheresponsibility of the contractor toget the approvaling tages and finally the Building approved from the Local fire Service Authority as required. This shall be without any liability to the Society. All Expenses in this respect will be borne by the contractor & nothing will be paid by the Society on this account.

On successful completion of work, the contractor shall prepare as built drawings which have been so approved by the Fire Service incorporating all changes that might have been effected during execution of the work.

The contractor shall also bring to the notice of the Management committee any deviations from Local Fire Service/Building Bye Laws Norms and requirements in the systems that he shall install as well as architectural features that will affect approval from the Fire Service.

NoextrachargesshallbepaidonaccountofinteractionwiththeFire Service.

CIVILWORKS

Civil works like excavation for pipe laying underground with pedestal supports or chasing in the wall / ceiling or making hole in the RCC floor / ceiling or in brick / RCC wall for piping, grouting etc. including makinggoodaftercompletion, smallsize pedestals or any other minor civil works required interconnection with the installation of the system are included in the scope of work of this contract and it shall be deemed to be included in the contractor's scope of work.

Any provision to be provided in the civil works (except for excavation) after award of work, not notified by contractor shall have to be provided by contractor without any additional cost.

1. **PUMPS**

1.1 CONSTRUCTION

PumpshallbeasperIS:1520-1660,IS:9070,IS:325andshallbethefollowingconstruction

Pump Horizontalsplitcasing

Description	DoubleSuction
-------------	---------------

a.	Casting	CastIron/Caststeel
b.	Impeller	Bronze
c.	Shaft	HighTensile steel
d.	Bearings	HeavydutyBall/RollerBearings.
e.	BasePlate	CastIron/Fabricated M.S
f.	Flanges	Conformingtol.S.S.1536/ 1960
g.	Packing	MechanicalSeal
h.	MaxSpeed	2900RPM
i.	Driver	T.E.F.C
j.	Starter	Directon line

Pump and driver shall be mounted on a single bed-plate and directly driven through flexiblecoupling in case of horizontal split casting pumps.

Thepumpsshallbeofthetypeapprovedbythe Management committee andcapableofdelivering not less than 150% of rated capacity at a head of not less than 65% of the rated head. The drive motor shall be continuous rating type and its rating shall be at least equivalent to the horsepower required to drive the pump at 150% of its rated discharge.

Drivers shall be supplied with starters unless otherwise stated, meeting the requirement of requisite and relevant fire standards.

1.2 ACCESSORIESANDFITTINGS

The following accessories shall be provided with each pump among other standard accessories required:

- a) Couplingguardforhorizontalsplitcastingpumps.
- b) Lubricationfittingsandsealpiping.
- c) Testand/orairvent cocks

1.2.1 Followingfittingsshallbeprovidedwitheachpumpamongotherstandardfittingsrequired:

- **a.** Suction and discharges hut off valves (gate type) and discharge checkvalves and vibration pads as specified under section "PIPING".
- **b.** Suctionanddischargepressuregaugesnotlessthan100mmdiaandoftheappropriaterating with gauge valves etc. Suction gauge shall be of compound type.
- **c.** 25mmGIglanddrain.

1.3 INSTALLATION

Pump shall be installed as per manufacturer's recommendations. Pump sets shall be mounted with anti vibration arrangements. The isolation arrangement, foundation bolts etc. shall be supplied by the Contractor. Contractor shall however ensure that the foundation bolts are correctly embedded.

Pump sets shall preferablybe factory aligned, wherever necessary, site alignment shall be done by competentpersons.Beforethefoundationboltsaregroutedandthecouplingsarebolted,thebed plate levels and alignment results shall be submitted to the Management committee.

1.4 TESTING

Contractor shall submit the performance curves of the pump supplied by them. They shall also check the capacity and total head requirements of each pump to match his own piping and equipment layout.

On completion of the entire installation, pumps shall be tested, wherever possible, for their discharge, head, flow rate, B.H.P. Where it is not possible at least the discharge, head and B.H.P. (as measured on the input side) shall be field tested. Test results shall correspond to the performance curves.

1.5 PAINTING

After complete installation and testing, pumps accessories and fittings shall be given two coats, three mils each of approved finishing paint with proper notations and direction arrows.

2. PIPINGSCOPE

The scope of this section comprises the Supply, Laying, Erection, Testing and commissioning of pipes required for this project.

2.1 WATERPIPING

Allpipinglaidshallbeasfollows:

PipeSize	Material	Joints& Fittings	SealingMaterial
Upto 150mm	M.S tube	i) Welded joints &	i)Nonhardening
	Medium class	Screwed fittings	
	I.S.1239part-II	ii)Unions	ii)Lubricant
		iii) Sliponflanges	iii)3mm,3ply
	rubberinsertion		

PipethreadsshallbetoIS:554andflangestoIS:1536

- **2.2** All piping shall be black steel unless otherwise stated. Pipes shall be given one primary coat of red oxide paint before being installed. Pipes shall be sloping towards drain points.
- 2.3 Fittings shall be new and from reputed manufacturers, Fittings shall be of malleable castings of pressureratingssuitableforthepipingsystem.Fittingsusedonweldedpipingshallbeoftheweld- able type.Flanges shall be new and from standard manufacturer. Supply of flanges shall include bolts, washers gaskets, etc, as required.
- **2.4** Tee off connection shall be through reducing tees, wherever possible. Otherwise ferrules welded to the main pipe shall be used. Drilling and tapping of the walls of the main pipe shall not be resorted to.
- 2.5 Allequipmentandvalveconnectionsshallbethroughflanges(Weldedorscrewedforgalvanized steel)
- **2.6** All welded piping is subject to the approval of the Management committee and sufficient number of flanges and unions shall be provided.
- **2.7** Gate valveswafer type Butterflyvalves shall be provided as requiredor as shown in the applicable shop drawings conforming to the following specifications:

Size	Construction	Ends	Туре
12mmto40mm	Gun Metal	ScrewedFemale	Gate valve
50mmand Over	Body-castiron		Butterflyvalve
Seat-Theresilientliningmoulde	dBlacknitrilerubber.		
	Disc -SG Iron to IS : 18	65	SG400/12
	& BS : 2789 Gr420/20	Nylon coated.	

Gate valves shall conform to IS : 780 / 1969, flanges to IS : 1536 or asrequired. Valves shall have non -rising spindles unless otherwise specified and shall be suitable for 21 kg / Sq. cm test pressure. Tail pieces shall be used where required.

Butterfly valves shall conform to BS : 5155, MSS SP 67 & API 609 and designed to fit without gasketsbetweenmating flanges. Thevalvesshallbe suitable for flowineither direction and seal in both directions.

2.8 Checkvalvesshallbeprovidedasrequiredorasshownonthedrawingsandconformtothe following specifications

Size	Construction	Ends
12mmto65mm	GunMetal	i)Screwed Female
75mmandOver	GunMetal/C.I	ii)Flanged

Swing check valves shall normally be used in all water services. Lift type valves may be used in horizontal runs. Air release and clean out plugs shall be provided and valves shall be suitable for 21 kg. /Sq.cm test pressure.

2.9 PIPINGINSTALLATIONANDAIRVALVES.

The drawings indicate schematically the size and location of pipes. Pipes runs and sizes may, however, be changed to meet the site conditions. The Contractor on the award of the work, shall prepare detailed working drawings showing the cross section, longitudinal section, detail of fittings, locationsofisolating drain and airvalves etc. Theymust keep inview thespecificopenings in buildings and other structures through which the pipes are designed to pass.

- a.Piping shall be properly supported on or suspended from stands, clamps, hangers etc, as specified and as required. The tenderer shall adequately design all the brackets, saddles, clamps, hangers etc. and be responsible for their structural integrity.
- **b** Pipe supports shall be of steel, adjustable for height and primer coated with rust preventive paint andfinishcoatedblack.Wherepipeandclampareofdissimilarmaterial,agasketshallbeprovided in between.Spacing of pipe supports shall not exceed the following:

<u>PipeSize(mm)</u>	Spacing(M)
3to12	1.22
19to25	1.83
32to150	2.44

150andabove

- **c** Piping work shall be carried out with minimum disturbance to the other works being done at the site. A program of work shall be chalked out in consultation with the Management committee.
- d Pipinglayoutshalltakeduecareforexpansionandcontractioninpipes.
- e All pipes using screwed fittings shall be accurately out to the required sizes and threaded in accordance with IS: 554 and burrs removed before laying. Open endsof the piping shall be locked as the pipe is installed to avoid entrance of foreign matter. Wherever reducers are to be made in horizontal runs, eccentric reducers shall be used if the piping is to drain freely, in other locations, concentric reducers may be used.
- **f** Air valves shall be provided at all high points in the piping system for venting valves shall be of the double float type, with G.M / C.I. body, vulcanite balls, rubber sealing, etc. Air valves shall be of the sizes specified and shall be associated with an equal size gate valve with rising spindle.

Mains	Air Valves
Upto100mm dia	25mmdia
100mmto300mmdia	28mmdia

Dischargefrom the airvalvess hall be piped through an equal sized G.Spipet othene are stdrain or floor waste or as shown.

- **g** All buriedpipesshallbecleaned andcoatedwithzinc chromateprimerand bituminouspaint,than wrapped with two layers of fiber glass felt each layer laid in bitumen.
- **h** Drainshallbeprovidedatalllowpointsinthepipingsystemandshallbeofthefollowingsizes:

<u>Mains</u>	<u>Drains</u>
Upto300mm dia	25mmdia
Over300mmdia	38mmdia

Drains shall be provided with gate valves of equal size with rising spindle. Drains shall be piped through equal size G.I. pipe to the nearest drain or floor waste or as shown on the drawings. Piping shall be pitched towards drain points.

2.10 PRESSUREGAUGES

- **a** Pressure gauges shall be not less than 100 mm dia dial and of appropriate range and be complete with shut off gauge valve etc. duly calibrated before installation.
- **b** Pressuregaugeshallbeprovidedatthe followinglocationsandasindicatedonthedrawings:

Suction and discharge of pumps.

Careshallbetakentoprotectpressuregaugesduringpressure testing.

2.11 VIBRATIONELIMINATION

 $\label{eq:point} Piping installation shall be carried out with vibration elimination fittings where very equired.$

2.12 <u>TESTING</u>

- a All piping shall be tested to hydrostatic test pressure of 9kg/ Sq.cm or twice the design pressure whichever is higher for a period of not less than 24 hours. All leaks and defects in joints revealed during the testing shall be rectified to the satisfaction of the Management committee.
- b Pipingrequiredsubsequenttotheabovepressuretestshallbere-testedinthesamemanner.
- c Systemmaybetestedinsectionsandsuchsectionsshallbesecurelycapped.
- d The Management committees hall be notified well in advance by the contractor of his intention to test a section of piping and all testing shall be witnessed by the Management committee.
- e The Contractor shall make sure that proper noiseless circulation of fluid is achieved through the system concerned. If proper circulation is not achieved due to air bound connections, the contractor shall rectify the defective connections. He shall bear all the expenses for carrying out the above rectification including the tarring up and re finishing of floors, walls etc. as required.
- f The Contractor shall provide all materials, tools, equipment, instruments, services and labor required to perform the test, and shall ensure that the plant room and other areas are cleaned up and spill overwater is removed.

2.13 PAINTING

After the piping has been installed, tested and run for at least ten days. The piping shall be given two finish coats, 3 mils each of approved color.

The direction of flow of fluid in the pipes shall be visibly marked in white arrows or as directed by the Management committee.

3 VALVES& ACCESSORIES

3.1 <u>VALVES</u>

- Sluice / Gate valves shall be used for isolation of flow in pipe lines for sizes upto 50 mm, gate valves shall be outside screw rising spindle type and shall be as per IS: 778 Class 1 and Class II, as applicable. For sizes 80 mm to 300 mm gate valve shall be as per IS: 780, PN = 1.0 and shall be of inside screw and non rising type and cast iron double flanged.
- **b** Gate valves shall be provided with a hand wheel, position indicator, bypass valve, draining arrangement of seat valve and locking facility (as required). Gas valves shall have back setting bush to facilitate gland renewal during full open condition.
- c The Body, bonnet, Stuffing Box, cap and hand wheel shall be of cast iron to IS:210/70, grade FG 200 / 260. The non rising spindle shall be of solid forged high tensile brass or carbon steel to AISI 304 construction. The Body seating and wedge ring shall be of solid leaded gunmetal. The Bonnet gasket shall be of high quality rubber.
- **d** The valve shall be PN 1.0 rated but shall withstand tests of upto 20 kg / cm2. The ends shall be flanged. The batch number of the valve shall be punched on the top of the flange. The spindleshall be removable type, and shall be easily rotated.

3.2 HOSEREEL

a TheHoseReelshallbedrumtype.TherubberHosepipeshallbefixedonadrumthatshallbe fixed to the wail by means of a heavy duty bracket.

- **b** The rubber tubing shall be of approved make. The wall mounted bracket shall be fixed by meansof fasteners. The Hose Reel shall have an ABS Plastic nozzle.
- **c** TheHoseReelshallbeconnectedtotheRiserbymeansof25mmdiaMSpipewiththreaded bends, union etc. A cut off Ball Valves shall also be provided.

3.4 **FIREBRIGADEINLET**

- a Fire Brigade Inlet Connection shall be taken directly to the Riser. It shall comprise of three instantaneous male inlet coupling with plug and steel chain. The Inlet shall have a wafer type non return valve and a butterfly valve on the line upto the riser. The Fire Brigade Inlet shall becomplete with necessary components like special fittings of medium quality MS bends, flanged tees etc. The plug shall be of moulded PVC.
- **b** Fire Brigade Inlet for Tank Filling by Fire Brigade shall be two way with gun metal instantaneous male inlet coupling connection for connection with Fire Brigade vehicles.
- **c** The inlets shall be provided with ABS Quality by Plastic Blank caps with chain and arrangement for attaching the bank cap & chain to the FB inlet.

3.5 <u>SYSTEMDRAINAGE</u>

The system shall be provided with suitable drainage arrangements with GI piping of 40 mm dia, complete with all accessories, and provided with 40 mm dia drain ball valve.

3.6 <u>PAINTING</u>

- a All Hydrant and Sprinkler pipes shall be painted with post office red color paint. All MS pipes shall first be cleaned thoroughly before application of primer coat. After application of primer coat two coatsofenamelpaintshallbeapplied.Eachcoatshallbegivenminimum24hoursdryingtime.NO thinner shall be used. Wherever required all pipe headers shall be worded indicating the direction of the pipe and its purpose such as "TO RISER NO. 1" etc.
- **b** Paintingshallbeexpertlyappliedintwoormorecoats,thepaintshallnotoverrunonsurfacesnot requiring painting such as walls, surfaces etc. Nuts and bolts shall be painted black, while valves shall be painted blue.

3.7 <u>COUPLINGS</u>

Couplings shall be of gun metal alloy as per IS:318, machined and polished to requirements. Both Male and female couplings shall be fitted into each other smoothly and without any unnecessary force. Coupling shall be IS:903 marked with the name of the manufacturer. The coupling shall be tested to 20 kg / cm2 test pressure. The Male coupling shall be provided with lug for inserting female coupling.

3.8 <u>BUTTERFLYVALVE</u>

- a TheButterflyValveshallbesuitableforwaterworksTheValvesshallfulfilltherequirementsofAPI 609 and MSS-SP-67.
- **b** ThebodyshallbeofcastirontolS:210incircularshapeandofhighstrength.Thediscshallbe heavy duty cast iron with anti corrosive epoxy or nickel coating.
- c The valve seat shall be of high grade elastomer or nitrile rubber. The Valve in closed position shall havecompletecontactbetweentheseatandthediscthroughouttheperimeter. The elastomer

rubbershallhavealonglifeandshallnotgiveawayoncontinuousappliedwaterpressure. The shaft shall be of EN 8 grade carbon steel.

d The Valve shall be fitted between two flanges on either side of pipe flanges. The Valve edge rubbershallbeprojectedoutsidesuchthattheyarewedgedwithinthepipeflangestoprevent leakage's.

3.9 <u>AIRRELEASEVALVE</u>

EachpumpshallbeprovidedwithapressureReliefValve.TheValveshallbeconstructedof bronze and provided with an open discharge orifice for releasing the water.

3.10 NONRETURNVALVE

- **a** Non-returnvalves shall becast iron spring action swing check type. Anarrowmark inthe direction of flow shall be marked on the body of the valve. The valve shall bear IS:531 certification.
- **b** The Valve shall be cast iron body and cover. The internal flap in the direction of water shall be of cost iron and hinged by a hinge pin of high tensile brass or stainless steel. Cast iron parts shall be conform to IS:210 /70, grade 200 / 260 type.
- c The gasket shall be of high quality rubber and flap seat ring of leaded gun metal to BS 1400 LG 2C.At high pressure of water flow the flapper shall seat tightly to the seat.

3.11 GUNMETAL VALVES

- **a** GunmetalValvesshallbeusedforsmallerdiapipes,andforthreadedconnections.TheValves shall bear certification as per IS:778.
- The body and bonnet shall be of gun metal to IS:318, grade LTB 2. The stem, gland and gland nut shallbeofforgedbrasstoIS:319.ThehandwheelshallbeofcastirontoIS:210,gradeFG200 /260.
- **c** TheHandwheelshallbeofhighqualityfinishtoavoidhandabrasions. Movementshallalsobe easy. The spindle shall be non rising type.

4 **<u>FIRE EXTINGUISHERS</u>**

4.1 5kgABCTypeDryPowderFireExtinguisher

9Ltrs Cap.CO2 water type Fire Extinguisher

- 4.2 The Extinguisher shall be filled with ABC Grade 40, Mono Ammonium Phosphate 40 % from any approved manufacturer.
- 4.3 The Capacity of the extinguisher when filled with Dry Chemical Powder (First filling) as per IS 43088, part II, shall be 5 kg +/-2 % or 10 +/-3 %.
- 4.4 It shall be operated upright, with a squeeze grip valve to control discharge. The plunger neck shall have a safety city, fitted with a pin, to prevent accidental discharge. It shall be pressurized withDry Nitrogen, as expelling. The Nitrogen to be charged at a pressure of 15 kg / cm2.
- 4.5 Body shall be of mild steel conforming to relevant IS Standards. The neck ring shall be also mild steel and welded to the body. The discharge valve body, shall be forged brass or leaded bronze, while the spindle, spring and siphon tube shall be of brass. The nozzle shall be of brass, while the hose shall be of braided nylon. The body shall be cylindrical in shape, with the dish and dome welded to it. OS ufficient space for Nitrogen gas shall be provided inside the body, above the powder filling.

4.6 TheNeckringshallbeexternallythreadedthethreadingportionbeing1.6cm.Thefilleropeningin the neck ring shall not lessthen 50 mm. Discharge nozzle shall be screwed to thehose. The design ofthenozzleshallmeetthe performancerequirement, soastodischargeatleast 85% ofcontents upto a throw of 4 mtrs, continuously, at least for 15 seconds. The hose, forming part of discharge nozzle, shall be 500 mm long, with 10 mm dia internally for 5 kg capacity and 12 mm for 10 kg capacity. It shall have a pressure gauge fitted to the valve assembly or the cylinder to indicate pressureavailableinside.The extinguisher shallbetreatedwith anti corrosivepaint, and it shallbe labeled with words ABC 2.5 cm long, within a triangle of 5 cm on each face. The extinguisher body and valve assembly shall withstand internal pressure of 30 kg / cm2 for a minimum period of 2 minutes. The pressure Gauge shall be imported and suited for the purpose.

5. ELECTRICALINSTALLATION

5.1 **Cables:**

PVC insulated fire retardant copper cables shall be used for connecting motors. The size of cables to be used for different capacity motors shall be as follows :

<u>MotorCapacity</u>	Size&Numberof Cables.
Upto5HP	1X3X2.5 Sq.mm

Cables shall be laid as per standard practice conforming to relevant Indian Standards by providing proper cable supports and clamps as required. Cables and wires in conduits shall be laid on the metalic trays made out of slotted angles (40mm X40mm X2mm) and perforated M.S. sheets (2mm thick) duly painted. Cable trays exposed to atmosphere shall be not dip galvanized.

5.2 EARTHING

Main power upto the Electrical panels in Fire pump room alongwith earthing shall be provided by other agency. Each panel shall be earthed to building main earthing. All the motor etc. shall be double earthed to the panel. The earthing shall be done with wires as under:-

Where the current of Motor / equipment is more than 150 Amps 25 mm X3 mm copper strips shall be used.

Allthreephasemotors/equipmentshallbeearthedwithtwoindependentearth conductors as per the requirement of Indian Electricity Rules and Regulation - 1956.

5.3 TESTING

Before commissioning of the equipment the entire Electrical Installation shall be tested in accordance with code of practice IS : 732 - 1963 (Revised) and test report furnished by a qualified andauthorized person. The entire electrical installations hall be got approved by Electrical

Inspector & certificate from Electrical Inspector shall be submitted. All tests shall be carried out in presence of the Management committee.

5.4 PAINTING

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating and then sprayed with a high corrosion resistant primer. It shall then be baked in an oven. The finishing treatment shall be by application of synthetic enamel paint of approved shade.

6 TESTINGANDCOMMISSIONINGOFSYSTEM

- 6.1 The Contractor shall cause interim/stage inspection during execution of the works as and when so called for and shall carry out any rectification/modification as may be suggested by the Management committee
- 6.2 Soon after the work is completed, the Contractor shall get the complete system including all subsystems and instrumentation, control panels etc. thoroughly inspected and tested for satisfactory performance. After satisfactory completion of tests, Contractor shall be required to carry out all start-up trials of the system provided by him.
- 6.3 AnydefectsnoticedduringthesetestsshallbepromptlyrectifiedbytheContractor.
- 6.4 After completion of the start-up trials & testing, all the equipment/items in the system shall be operated to establish proper sequencing/ synchronization and coordinated working of the equipment/items. Any defect noticed during this period shall be speedily rectified and reinstated in order by the Contractor meeting the approval of the Management committee.

7 Samples

The Contractor shall be required to have samples of the following kept at site after approval by the Management committee. The Contractor shall use only those items for which samples have been approved.

- 7.1 Conduit
- 7.2 Cable
- 7.3 Pumppanelparts.
- 7.4 Pipesandfittings
- 7.5 HoseReel
- 7.6 GunMetalGate Valve
- 7.7 Pipesupportsandclamps
- 7.8 FireExtinguishers.
- 7.9 Allothermaterialsasaskedforduringexecution.

FIREALARAMSYSTEMS

1.1. DESCRIPTION:

- A. This section of the specification includes the providing, installation, connection and testing of the microprocessorcontrolled, intelligent reporting fireal arm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, Ethernet and/or digital alarm communications to central stations and wiring as shown on the drawings provided by contractor and approved by Management committee and specified herein.
- B. The fire alarm system shallcomply with requirements of NFPA Standard No. 72 for LocalProtected Premises Signalling Systems except as modified and supplemented by this specification. Thesystem field wiring shall be supervised either electrically or by software-directed polling of field devices.
- 1. The SecondaryPower Sourceof thefire alarm controlpanel will becapableof providing atleast24 hours of backup power with the ability to sustain 5 minutes in alarm at the end of the backup period.
- C. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).
- D. UnderwritersLaboratoriesInc.(UL)-USA:

No.38ManuallyActuatedSignallingBoxes No. 50 Cabinets and Boxes No. 864 Control Units for Fire Protective Signalling SystemsNo.268SmokeDetectorsforFireProtectiveSignallingSyst ems No. 268A Smoke Detectors for Duct Applications No.346WaterflowIndicatorsforFireProtectiveSignallingSystems No. 464 Audible Signalling Appliances No.521HeatDetectorsforFireProtective SignallingSystems No. 1971 Visual Notification Appliances

- E. TheFACPshallmeetrequirementsofULANSI864Ninth Edition
- 1.2. SCOPE:
- A. An intelligent, microprocessor-controlled, fire alarm detection system shall be installed in accordance to the project specifications and drawings provided by contractor and approved by Management committee.
- B. Basic Performance:
- 1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 6 (Class A) Signalling Line Circuits (SLC).

- 2. InitiationDeviceCircuits(IDC)shallbewiredClassB(NFPAStyleB)aspartofanaddressabledevice connected by the SLC Circuit.
- 3. Notification ApplianceCircuits (NAC)shall bewiredClass B(NFPA StyleY)aspartofanaddressable device connected by the SLC Circuit.
- 4. Allcircuitsshallbepower-limited,perUL864requirements.
- 5. Asinglegroundfaultor opencircuiton thesystemSignallingLineCircuitshallnotcausesystem malfunction, loss of operating power or the ability to report an alarm.
- 6. AlarmsignalsarrivingatthemainFACPshallnotbelostfollowingaprimarypowerfailureor outage of any kind until the alarm signal is processed and recorded.
- C. BASICSYSTEMFUNCTIONALOPERATION

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

- 1. ThesystemalarmLEDontheFACPshall flash.
- 2. Alocalsounderwiththecontrolpanelshallsound.
- 3. A backlit 80-character LCD display on the FACP shall indicate all information associated with thefire alarm condition, including the type of alarm point and its location within the protected premises.
- 4. In response to a fire alarm condition, the system will process all control programming and activate all system outputs (alarm notification appliances and/or relays) associated with the point(s) in alarm.Additionally, the system shall send events to a central alarm supervising station via either dialup over PSTN or Internet or Intranet via PSDN or virtual private network.

1.3. SUBMITTALS

A. General:

- 1. TwocopiesofallsubmittalsshallbesubmittedtotheManagement committeeforreview.
- 2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible ULlisted equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
- 3. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B. ShopDrawings:

- 1. Sufficientinformation, clearly presented, shall be included to determine compliance withdrawings and specifications provided by contractor and approved by Management committee.
- 2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
- 3. Showannunciatorlayout, configurations, and terminations.
C. Manuals:

- 1. Submitsimultaneously with the shopdrawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
- 2. Wiring diagrams shall indicate internal wiring for each device and the interconnections betweenthe items of equipment.
- 3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

D. SoftwareModifications

- 1. Provide these rvices of a qualified techniciant operformally stems of tware modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
- 2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zonesand changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

1.4. GUARANTY:

All work performed and all material and equipment furnished under this contract shall be freefrom defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.5. MAINTENANCE:

- A. Maintenance and testing shall be on a semi-annual schedule or as required by the local AHJ. A preventive maintenance schedule shall be provided by the contractor describing the protocol for preventive maintenance. The schedule shall include:
- 1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, water flow switches and all accessories of the fire alarm system.
- 2. Eachcircuitinthefirealarm systemshallbetestedsemi-annually.
- 3. EachsmokedetectorshallbetestedinaccordancewiththerequirementsofNFPA72Chapter 10.
- B. As part of the bid/proposal, include a quote for a maintenance contract to provide allmaintenance, tests, and repairs described below. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

1.6. POSTCONTRACTEXPANSIONS:

- A. The contractor shall have the ability to provide parts and labour to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.
- B. As part of the submittal, include a quotation for all parts and material, and all installation and test labor as needed to increase the number intelligentor addressable devices byten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable beam detectors, addressable monitor modules and addressable control modules equal in number to one tenth of the number required to meet this specification.
- C. The quotation shall include installation, test labour, and labour to reprogram the system for this 10% expansion. If additional FACP hardware is required, include the material and labour necessary to install this hardware.
- D. Do not include cost of conduit or wire or the cost to install conduit or wire except for labour to make final connections at the FACP and at each intelligent addressable device. Do not include the cost of conventional peripherals or the cost of initiating devices or notification appliances connected to the addressable monitor/control modules.
- E. Submittalsthatdonotincludethisestimateofpostcontractexpansioncostwillnotbeaccepted.

1.7. APPLICABLESTANDARDSANDSPECIFICATIONS:

Thespecificationsandstandardslistedbelowformapartofthisspecification. Thesystemshall fully comply with the latest issue of these standards, if applicable.

- A. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriateULtestingstandardaslistedhereinforfirealarmapplicationsandtheinstallationshall be in compliance with the UL listing.
- B. LocalandStateBuildingCodes.
- C. AllrequirementsoftheAuthorityHavingJurisdiction(AHJ).

1.8. APPROVALS:

- A. The system shall have proper listing and/or approval from the following nationally recognized agencies:
 - UL UnderwritersLaboratoriesInc
 - FM Factory Mutual

PART2.0 PRODUCTS

2.1. EQUIPMENTANDMATERIAL, GENERAL:

A. All equipment and components shall be new, and the manufacturer's current model. Thematerials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a fire protective signalling system, meeting the National Fire Alarm Code.

- B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
- C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.
- D All equipment must be available "over the counter" through the Security Equipment Distributor (SED) market and can be installed by dealerships independent of the manufacturer.

2.2. CONDUITANDWIRE:

A. Conduit:

- 1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
- Whererequired, all wirings hall be installed inconduitor raceway. Conduit fills hall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
- Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placedinanyconduit, junction boxorraceway containing theseconductors, per NEC Article 760-29.
- 4. Wiring for 24-volt DC control, alarm notification, emergency communication and similarpowerlimited auxiliary functions may be run in the same conduit as initiating and signalling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
- 5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the FACP manufacturer.
- 6. Conduitshallbe3/4-inch(19.1mm)minimum.

B. Wire:

- 1. Allfirealarmsystemwiringshallbenew.
- Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signalling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
- 3. All wireandcableshallbelisted and/orapproved by arecognizedtesting agencyfor usewitha protective signaling system.
- 4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NEC 760 (e.g., FPLR).
- 5. Wiring used for the multiplex communication circuit (SLC) shall be twisted and support a minimum wiring distance of 10,000 feet when sized at 12 AWG. The design of the system shall

permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit. Shielded wire shall not be required.

- 6. All field wiring (with exception of external communications Ethernet) shall be electrically supervised for open circuit and ground fault.
- 7. The fire alarm control panel shall be capable of T-tapping NFPA Style 4 (Class B) Signalling Line Circuits (SLCs). Systems which do not allow or have restrictions in, for example, the amount of T-taps, length of T-taps etc., is not acceptable.
- C. TerminalBoxes,JunctionBoxesandCabinets:

AllboxesandcabinetsshallbeULlistedfortheiruseand purpose.

D. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labelled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod. The control panel enclosure shall feature a quick removal chassis to facilitate rapid replacement of the FACP electronics.

2.3. MAINFIREALARMCONTROL PANEL:

A. The FACP shall contain a microprocessor-based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, enunciators, Digital Dialler and Ethernet Communicators and other system controlled devices. Ethernet communications if required shall be via IPDACT.Central station supervisory equipment shall be a Teldat Corporation Visoralarm-Plus 2U listed to UL-864 standards.

B. **OperatorControl**

- 1. AcknowledgeSwitch:
 - a. Activation of the control panel Acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the 80-character LCD displayto the next alarm or trouble condition.
 - b. Depression of the Acknowledge switch shall also silence all remote enunciators piezo sounders.
- 2. AlarmSilence Switch:

Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silence able by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

3. AlarmActivate(Drill)Switch:

The Alarm Activates witch shall activate all notification appliance circuits. The drill function

shalllatchuntilthepanelissilencedor reset.

4. SystemResetSwitch:

Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.

5. LampTest:

The Lamp Test switch shall activate all system LEDs and light each segment of the liquid crystal display.

C. SystemCapacityandGeneralOperation

- 1. The control panel shall provide, or be capable of, expansion to 636 intelligent/addressable devices.
- 2. The control panel shall include Form-C Alarm, Trouble and Supervisory relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include programmable Notification Appliance Circuits (NACs) capable of being wired as NFPA Style Y (Class B) or NFPA Style Z (Class A).
- 3. The fire alarm control panel shall include an operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color-coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
- 4. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel. The system shall be fully programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICsto facilitate programming changes. The control unit will support the ability to upgrade its operating program using FLASH memory technology. The unit shall provide the user with the ability to program from either the included keypad, a standard PS2-style PC keyboard or from a computer running upload/download software.
- 5. The system shall allow the programming of any input to activate any output or group of outputs. Systems which have limited programming (such as general alarm), havecomplicated programming (such as a diode matrix), are not considered suitable substitutes.

6. TheFACPshallprovidethefollowingfeatures:

- a. Driftcompensationtoextenddetectoraccuracyoverlife.Driftcompensationshallalso include a smoothing feature, allowing transient noise signals to be filtered out.
- b. Detector sensitivity test, meeting requirements of NFPA 72, Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
- c. Theabilitytodisplayorprintsystemreports.
- d. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification an excessive number of times.
- e. PositiveAlarmSequence(PASpresignal),meetingNFPA72requirements.

- f. Rapidmanualstationreporting.
- g. Non-alarmpointsforgeneral(non-fire)control.
- h. Periodicdetectortest,conductedautomaticallybythesoftware.
- i. Walktest, with a check for two detectors set to same address.
- 7. The FACP shall be capable of coding Notification Appliance Circuits in March Time Code (120 PPM), Temporal (NFPA 72), and California Code. Main panel notification circuits shall also automatically synchronize any of the following manufacturer's notification appliances connected to them: System Sensor, Wheelock, or Gentex with no need for additional synchronization modules.

D. CentralMicroprocessor

- 1. The microprocessor shall be a state-of-the-art and it shall communicate with, monitor and control all external interfaces. A "watch dog" timer circuit to detect and report microprocessor failure.
- 2. The microprocessor shall containand execute all specific actions to be taken in the condition of an alarm. Control programming shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
- 3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file.
- 4. Aspecialprogramcheckfunctionshallbeprovidedtodetectcommonoperatorerrors.
- 5. An auto-programming capability (self-learn) shall be provided to quickly identify devices connected on the SLC and make the system operational.
- 6. For flexibility and to ensure program validity, an optional Windows(TM) based programutility shall be available. This program shall be used to off-line program the system withbatch upload/download. This program shall also have a verification utility which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in incompliance with the NFPA 72 requirements for testing after system modification.

E. LocalKeyboardInterface

1. In addition to an integral keypad, the fire alarm control panel will accept a standard PS2- style keyboard for programming, testing, and control of the system. The keyboard will be able to execute the system functions ACKNOWLEDGE, SIGNALS SILENCED, DRILL and RESET.

F. Display

- 1. The display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
- 2. The display shall include status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
- 3. The displays hall contain an alphanumeric, text-type display and dedicated LEDs for the annunciation of ACPOWER, FIREALARM, SUPERVISORY, TROUBLE, MAINTENANCE, ALARM

SILENCED, DISABLED, BATTERY, and GROUND conditions.

- 4. The display keypad shall be part of the standard system and have the capability to commandall system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
- 5. The display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, DRILL (alarm activate), and SYSTEM RESET.

G. SignallingLineCircuits(SLC)

- The SLCinterfaceshall provide power to and communicate with up to159 intelligent detectors (ionization, photoelectric or thermal) addressable Beam Detectors, and 159 addressable pull stations, intelligent modules (monitor or control) for a system capacity of 636 devices (2 SLC). Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
- 2. The CPU shall receive information from all intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically compensate for the accumulation of dust in each detector up to allowable limits. The information shall also be used for automatic detector testing and for the determination of detector maintenance conditions.
- 3. The detector software shall meet NFPA 72, Chapter 10 requirements and be certified by UL asa calibrated sensitivity test instrument.

H. SerialInterfaces

1. The systemshall provide ameansofinterfacing to ULListedElectronicDataProcessing(EDP) peripherals using the EIA-232 communications standard.

I. Enclosures:

- 1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected and painted red using powder coat techniques in the manufacturer's standard finish.
- 2. The back box and door shall be constructed of steel with provisions for electrical conduit connections into the sides and top.
- 3. Thedoorshallprovideakeylockandshallprovidefortheviewingofall indicators.
- 4. The cabinet shall accept a chassis containing the PCB and to assist in quick replacement of all the electronics including power supply shall require no more than two bolts to secure thepanel to the enclosure back box.

J. PowerSupply:

- 1. Themainpowersupplyforthefirealarmcontrolpanelshallprovide7.0ampsofavailable power for the control panel and peripheral devices.
- 2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
- 3. Positive-Temperature-Coefficient(PTC)thermistors,circuitbreakers,orotherover-current protection shall be provided on all power outputs. The power supply shall provide an integral

batterychargerormaybeusedwithanexternalbatteryandchargersystems.Batteryarrangement may be configured in the field.

- $\label{eq:2.1} 4. \ \ The main power supply shall continuously monitor all field wires for earth ground conditions.$
- 5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.

K. ProgrammableElectronicSounders:

- 1. Electronicsoundersshalloperateon24VDC nominal.
- 2. Electronic sounders shall be field programmable without the use of special tools, to provide slow whoop, continuous, or interrupted tones with an output sound level of at least 90 dBA measured at 10 feet from the device.
- 3. Shallbeflushorsurfacemountedasshowon plans.

L. StrobelightsshallmeettherequirementsoftheADA,ULStandard1971andshallmeetthe following criteria:

- 1. Themaximumpulsedurationshallbe2/10ofonesecond.
- 2. StrobeintensityshallmeettherequirementsofUL1971.
- 3. TheflashrateshallmeettherequirementsofUL 1971.

M. Audible/VisualCombinationDevices:

- 1. ShallmeettheapplicablerequirementsofSectionAlistedaboveforaudibility.
- 2. ShallmeettherequirementsofSectionBlistedaboveforvisibility.

N. SpecificSystemOperations

- 1. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently for verification of alarm signals. The alarm verification time period shall not exceed 2 minutes.
- 2. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
- 3. Point Read: The system shall be able to display or print the following point status diagnostic functions:
 - a. Devicestatus
 - b. Devicetype
 - c. Customdevicelabel
 - d. Devicezoneassignements
- 4. System Status Reports: Upon command from an peratorof the system, a status report will be generated and printed, listing all system status.
- 5. System History Recording and Reporting: The fire alarm control panel shall contain a history bufferthatwillbecapableofstoringupto1000events.Eachoftheseactivationswillbestored

and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systemsthat use volatilememory for history storage are not acceptable substitutes.

- 6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be enunciated on the system display. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
- 7. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication at the panel. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
- 8. The fire alarm control panel shall include Silent and Audible Walk Test functions Silent and Audible. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. The operation shall be as follows:
 - a. TheSilentWalkTestwillnotsoundNACsbutwillstorethewalktestinformationin History for later viewing.
 - b. Alarminganinitiatingdeviceshallactivateprogrammedoutputs,whichareselectedto participate in Walk Test.
 - c. Introducingatroubleintotheinitiatingdeviceshallactivatetheprogrammedoutputs.
 - d. Walk test shall be selectable on a per device/circuit basis. All devices and circuitswhich are not selected for walk test shall continue to provide fire protection and if an alarm is detected, will exit walk test and activate all programmed alarm functions.
 - e. Alldevicestestedinwalktestshallberecordedinthehistory buffer.
 - f. Alldevicesnottestedinwalktestshallberecordedinthehistorybuffer.
- 9. WaterflowOperation

An alarm from a water flow detection device shall activate the appropriate alarm message on the 80-character display; turn on all programmed Notification Appliance Circuits and shall not be affected by the Signal Silence switch.

10. SupervisoryOperation

An alarm from a supervisory device shall cause the appropriate indication on the 80-character display, light a common supervisory LED, but will not cause the system to enter the trouble mode.

11. SignalSilence Operation

The FACP shall have the ability to program each output circuit (notification circuit or relay) to deactivate upon depression of the Signal Silence switch.

12. Non-AlarmInputOperation

Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.

2.4. SYSTEMCOMPONENTS:

A. <u>ConventionalManualCallPoint</u>

 $The manual call point should be compatible with {\sf Add} ressable {\sf Firecontrol panels through {\sf Module}}$

Theyaresuitableforimmediatemanualactivationofthealarmofextinguishingsysteminthe event of fire by breaking the front glass. The call point is reset by replacing the front glass.

MCP's can be surface mounted or flush mounted and are for indoor use generally rated for IP24D and listed with LPCB to BS5839: pt2.

B. CONVENTIONALPhotoelectric/OpticalTypeSmokeDetector

Optical smoke detector with the new and advanced chamber design makes it a universal smoke detector giving a flat response for majority of fires.

The detector while sensitive to all type of smokes will be insensitive to ambient lights, air drafts, and changes within the operating temperature and voltage ranges..

The detector can be connected to either class A or Class B wiring types using two wire connections through the detector plug in base or alternatively through the 4 wire relay bases giving potential free outputs at the time of operation.

The detector shouldhave bi-colour LED. Innormal conditions should blink green and in case of fire it should blink Red.

The Detector shall meet the requirements of either EN 54/ FM/ UL or LPC and shall be specifically approved by FM/ UL/ LPCB. It shall be possible to test the detector's working both from the Panel as well as locally be means as designed be the Bidder.

D. <u>ProjectedAddressableBeamDetector</u>

- 1. Theprojectedbeamtypeshallbea4-wire24VDCintelligent,addressableprojectedbeam smoke detector device.
- 2. ThedetectorshallbelistedtoUL268andshallconsistofasingletransmitter\receiverand corresponding non powered reflector.
- 3. The detector shall operate in either a short range (16'- 230') or long range (16'- 328') whenused with an extender module.
- 4. Thetemperaturerangeofthedeviceshallbe -22degreesFto131degreesF.
- 5. The detector shall feature an optical sight and 2-digit signal strength meter to ensure properalignment of unit without need of special tools.

- 6. Theunitshallbebothceilingandwallmountable.
- 7. The detector shall have theability to be tested using calibrated test filters ormagnet-activated remote test station.

8The detector shall have four standard sensitivity selections along with two automatic self- adjusting settings. When either of the two automatic settings is selected the detector will automatically adjust its sensitivity using advanced software algorithms to select the optimum sensitivity for the specific environment.

E. <u>CONVENTIONALRateofRiseTypeHeatDetector</u>

Itisacombinationofrateofriseandfixedtemperatureprincipleusingthermistorandwith automatic compensation for changes of ambient conditions.

The detector should have bi-colour LED. In normal conditions should blink green and in caseof fire it should blink Red.

The thermal detectors are tested and approved to EN54 part 5 (2000) Class A1R by LPCB.

F. <u>CONVENTIONALHooter/strobe/hootercumstrobe</u>

Horn/Strobeshallbelistedto UL1971andUL464andshallbeapprovedforfireprotectiveservice. Horn/strobe shall be wired as a primary signalling notification appliance with flashing at 1Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector.

The horn shall have two tone options, two audibility options (at 24 volts) and the option to switch between a temporal 3 pattern and a non-temporal continuous pattern. Strobes shall be powered independently of the sounder with the removal of factory installed jumper wires. The horn on horn/strobe models shall operate on a coded or non-coded power supply (the strobe must be powered continuously

G. <u>AddressableMonitorModuleforDryContactDevices</u>

- 1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any normally open dry contact device) to one of the fire alarm control panel SLCs.
- 2. The monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box.
- 3. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
- 4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

H. <u>Two-WireDetectorMonitoring/ZoneMonitorModule</u>

1. MeansshallbeprovidedforthemonitoringofconventionalInitiatingDeviceCircuits populatedwith2-wiresmokedetectorsaswellasnormallyopencontactalarminitiating

devices(pullstations,heatdetectors,etc).

- 2. Each IDC of conventional devices will be monitored as a distinct address on the polling circuit by an addressable module. The module will supervise the IDC for alarms and circuit integrity (opens).
- 3. The monitoring module will be compatible, and listed as such, with all devices on the supervised circuit.
- 4. The IDC zone may be wired for Style D or Style B (Class A or B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
- 5. The monitoring module shall be capable of mounting in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box or in a surface mount back box.

I. <u>AddressableControlRelayModule</u>

- 1. Addressable control relay modules shall be provided to control the operation of fan shutdown and other auxiliary control functions.
- 2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted back box.
- 3. The control relay module will provide a dry contact, Form-C relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relays may be energized at the same time on the same pair of wires.
- 4. The control relay module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

J. <u>SixOutputAddressableControlRelayModule</u>

- 1. Up to 6 Addressable intelligent control relay modules combined on one circuit board shall be provided to control the operation of fan shutdown and other auxiliary control functions.
- 2. Using rotary address switches, the first module shall be addressed from 01 to 154 while the remaining modules shall be automatically assigned to the next five higher addresses.Note: binary dipswitches for setting address are not acceptable.
- 3. Provisionshallbeincludedfordisablingamaximumofthreeunused modules.
- 4. A single isolated set of dry relay form C contacts shall be provided for each of the 6 module addresses, whichshall be capable of being wired for either a normally openor normally closed operation.
- 5. The modules hall allow an address able control panel to switch these contacts on command.
- The module shall contain removable plug in terminal blocks capable of supporting 12 AWG to 18 AWG wire.
- 7. The control relays mounted on the module shall be suitable for pilot duty applications and rated for a maximum of 3.0 amps at 30 VDC, resistive, non-coded and 2.0 amps at 30 VDC maximum, resistive, coded.

K. <u>MultipleTwo-WireDetectorMonitoring</u>

 $1. \ \ As ingle multiinput module shall be provided for the monitoring of up to 10 conventional$

Initiating Device Circuits populated with 2-wire smoke detectors as well as normally-open contact alarm initiating devices (pull stations, heat detectors, etc).

- 2. Each IDC of conventional devices will be monitored as a distinct address on the polling circuit by an addressable point. The module will supervise the IDC for alarms and circuit integrity (opens).
- 3. The first address on the 10 input boards shall be set from01 to 150 and the remaining module addresses shall be automatically assigned to the next nine higher addresses.
- 4. Provisionshallbeincludedfordisablingamaximumoftwounused addresses.
- 5. The supervisedstate(normal, open,orshort)ofthemonitored device shallbesent backtothe panel.A common SLC input shall be used for all modules, and the initiating device loops shall share a common supervisory supply and ground.
- 6. The IDC zonemay be wired for StyleD or Style B (Class A or B)operation. A green LED for each circuit shall be provided that shall flash under normal conditions, indicating that the monitor moduleisoperational and regular communication with the control panel. LEDs shall latchon when a circuit is in alarm.

L. IsolatorModule

- 1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on anSLC Style 6 (Class A) or Style 4 (Class B branch). The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
- 2. If a wire-to-wire short occurs, the isolatormodule shall automatically open-circuit(disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
- 3. The isolator module shall not require any address setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
- 4. The isolator module shall mount in a standard 4-inch (101.6 mm) deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

M. <u>AlphanumericLCDTypeAnnunciator(Ann-BusMode)</u>:

- 1. Thealphanumericdisplayenunciatorshallbeasupervised, remotely located back-liteighty (80) characters LCD display for a larman nunciation inclear Englishtext.
- 2. TheLCDenunciatorsshalldisplayallalarmandtroubleconditionsinthesystem.
- 3. Anaudibleindicationofalarmshallbeintegraltothealphanumericdisplay.
- 4. Itshallbepossibleto connectup to8 LCDdisplaysand becapableofwiring distancesup to 6,000 feet from the control panel.
- 5. Upto8totaldevicesofanykind,LCD,printergateway,LED,Relayorl/Omodulemaybe installed on the ANN-BUS.

2.5. SYSTEMCOMPONENTS-ADDRESSABLE/CONVENTIONALDEVICES

- A. Devices- General
 - 1. Addressable devices shall employ the simple-to-set decade addressing scheme. Addressable devices which use a binary-coded address setting method, such as a DIP switch, are not an allowable substitute.
 - 2. Detectors shall be addressable and intelligent, and shall connect with two wires to the fire alarm control panel signalling line circuits.
 - 3. Addressable smoke and thermal (heat) detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flashunder normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed intosteady illumination the control panel, indicating that analarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED.
 - Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 10.
 - Detectors shall be ceiling-mount and shall include a separate twist-lock base with tamperproof feature. Base options shall include a base with a built-in (local) sounder rated for a minimum of 85 DBA, a relay base and an isolator base designed for Style 7 applications.
 - 6. Detectors shall provide a test means whereby they will simulate analarm condition and report that condition to the control panel.
 - 7. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
 - 8. Detectorsshallprovideaddress-settingmeansusingdecimalswitches.

2.6. BATTERIES:

A. Upon loss of Primary (AC) power to the control panel, the batteries shall have sufficientcapacity to power the fire alarm system for required standby time (24 or

60hours)followedby5minutesofalarm.

- **B.** The batteriesareto be completely maintenance free. No liquids are required. Fluid levelchecks for refilling, spills, and leakage shall not be required.
- C. If necessary to meet stand by requirements, external battery/charger systems may be used.

PART3.0-EXECUTION

3.1. INSTALLATION:

- **A.** Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- **B.** All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and maybeexposedinunfinishedareas.Smokedetectorsshallnotbeinstalledpriortothesystem

programming and test period. If construction is ongoing during this period, measures shall betaken to protect smoke detectors from contamination and physical damage.

- **C.** All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- **D.** Manual pull stations shall be suitable for surface mounting or semi flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2. TEST:

The service of a competent, NICET level II technician shall be provided to technically supervise and participate during allof theadjustments and tests for the system. All testing shall be inaccordance with NFPA 72, Chapter 10.

- A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- B. Closeeachsprinklersystemflowvalveandverifyproper supervisoryalarmattheFACP.
- C. Verifyactivationofallwaterflowswitches.
- D. Openinitiatingdevicecircuitsandverifythatthetroublesignalactuates.
- E. Openandshortsignallinglinecircuitsandverifythatthetroublesignalactuates.
- F. Openandshortnotificationappliancecircuitsandverifythattroublesignalactuates.
- G. Groundallcircuitsandverifyresponseoftroublesignals.
- H. Checkpresenceandaudibilityoftoneatallalarmnotificationdevices.
- I. Checkinstallation, supervision, and operation of all intelligents moked etectors using the walk test.
- J. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
- K. When the system is equipped with optional features, the manufacturer's manual shall beconsulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3. FINALINSPECTION:

A. At the final inspection, a minimum NICET Level II technician shall demonstrate that the system functions properly in every respect.

3.4. INSTRUCTION:

- A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. The contractor or installing dealers hall provide a user manual indicating "Sequence of Operation."

SPECIFICATIONFORDIESELGENERATINGSETS

1.00 GENERAL

This specification is intended to cover supply, installation, testing and commissioning of **D.G. Sets for Peak Load,** silent type, air-cooled (radiator type), Turbo Charge after cool Diesel Engine Alternator Sets in outdoor type acoustic enclosure.

2.00 SCOPEOFWORK

The scope of work shall include under this specification design, manufacture, supply, loading, unloading, storage, installation, testing and commissioning of the Diesel engine alternator sets including labour, tools, tackles and plants, hardwares and consumables, steel fabrication etc.

- 2.1 Silent type Diesel engine alternator set complete with base frame & accessories and with outdoor type acoustic enclosure.
- 2.2 Fuel oil system including day service oil tank, piping, valves, filters etc. from engine to service dayoil tank.Return fuel line with fuel cooler and piping with accessories upto day service tank etc.
- 2.3 Lubeoilsystemwithpipingetc.
- 2.4 TodesignthemechanicalventilationsystemforD.G.enclosurewithfansandductetc.asper system requirements.
- 2.5 Suitable rating of 4 pole MCCB with sheet-steel enclosure shall be mounted on D.G. set suitable for cable connection from top/bottom.
- 2.6 ExhaustemissionshallmeetCPCB&SPCBnormsandresidentialsilencer,exhaustpipingwith mineral wool insulation and aluminium cladding as called for.
- 2.7 Steelfabricatedstructure/support/hangerincludingfixing,groutingandboltingetc.
- 2.8 Paintingofsteel work.
- 2.9 Auxiliarycontrolpanelifrequired.
- 2.10 All equipment shall be of the class most suitable for working under the conditions specified and shall withstand the atmospheric conditions without deterioration.
- 2.11 Minor civil work is included in the contractor's scope of work. However, the responsibility of coordination with the civil and other contracting agencies ensuring completion of turnkey contract rests with the contractor.
- 2.12 Contractor shall co-ordinate with all other agencies working at site for interconnection and safety aspects.
- 2.13 Also theD.G.supplierwill furnishback up combined guarantee for2years from the date of supply from Engine and alternator supplier for smooth running. In case there is any defect the free replacement of any part or in whole will be made immediately at not loss to Society.

3.00 FEES&PERMITS

The contractor shall obtain all sanctions and permits required for the running of DG sets from all the relevant authorities. All actual fee payable in this regard will paid by the contractor. On completion of the work, the supplier shall obtain N.O.C from concerned authorities including Chief Electrical Inspectorate, of State, and shall be delivered in original to the Society.

4.00 CODES&STANDARDS

The design, construction, manufacture, inspection, testing and performance shall comply with all the currently applicable statutes, safety codes, relevant Bureau of Indian Standards (BIS), British Standards (BS), International Electro Technical Commission (IEC) publication, NEMA & VDE Standards amended upto date.

Someoftheapplicablestandardsarelistedbelow:

IS-1601	:	Performanceandtesting of IC engines for general purpose.	
BS649	:	PerformanceandtestingoflCenginesforgeneralpurpose.	
BS-4613	:	Electricalperformanceofrotatingelectricalmachine.	
BS-4999/5000	:	ApplicablepartsofBS4999/5000.	
IEC-34-1/ IS	:	Specificationforrotatingelectricalmachines.	
- 4722/			
VDE-0530			
IS-4889	:	Method of determination of efficiency of rotating electrical machinery.	
IS-6491	:	Degreesofprotectionprovided by enclosures for rotating Electricity machinery	
IS-4729	:	${\sf Measurement} and evaluation of vibration of rotating {\sf Electrical} machines.$	
AIEE-606	:	Recommendedspecificationforspeedgoverning(1959)ofinternal combustion engine generator units.	
IS-2705	:	Currenttransformers.	
IS-1248	:	Electricalindicatinginstruments.	
BS – 5514 /	:	Reciprocating internal combustion (I.C) engined riven A.C. Generators.	
IS-03046or			
IS-08528Part2			
IEEE-115	:	Testprocedureforsynchronousmachine.	
 IndianElectrici IndianElectrici FactoryAct. 	ty A tyRı	ct. ules.	
IS-7098Partl&II	:	${\tt XLPE} insulated {\tt PVC} sheathed for working voltage {\tt 1.1} to {\tt 11} {\tt KV}.$	
IS-3975	:	Mildsteelwire, strips&tapes for armouring cable.	
IS-3961	:	Currentratingofcables.	
IS-694	:	PVC/HRPVCinsulated(heavyduty)electriccablesforworking.voltage upto and including 1100 volts.	
IS-424-1475	:	Powercableflexibilitytest.	
(F-3)			
IS-1554(Part-I)	:	PVC/.HRPVCinsulatedcablesupto1100volts.	
IS-5083	:	Extrudedinner/outerseath.	

IS-6121	:	Cableglands.
IS-10418	:	Cabledrums.
IS-13947/ IEC 947	:	Aircircuitbreaker/mouldedcasecircuitbreaker.
IS-8623	:	Specificationsforfactorybuiltassembliesofswitchgearandcontrol gear for voltage upto and including 1000vac/1200vdc.
IS1018	:	Switchgearandcontrolgearselection/installationandmaintenance.
IS-13779	:	Digitalmeasuringinstrumentsandtestingaccessories.
IS-2705	:	Currenttransformerformeteringandprotectionwithclassificationburden and insulation.
IS-2147(Partl,II&III)	:	Degree of protection provided by enclosuresfor low voltage. Switchgear& control gears.
IS-3427	:	Metalenclosedswitchgearandcontrolgear.
BS-162	:	Safetyclearance.
IS-3202	:	Codeofpracticeforclimateproofingofelectricalequipment.
IS-375	:	Marking and arrangement for switchgear, busbars, main connections and auxiliary wiring.
IS-722	:	Acelectric meters.
IEC-255	:	Electrolyticcopper/aluminiumbusbars.
IS-5082	:	Electrolyticcopper&aluminium
IS-4201	:	ApplicationguideforCurrentTransformer.
IS-4146	:	ApplicationguideforVoltageTransformer.
IS-3034	:	Code of practice for firesafety ofindustrial building-electrical generating and distribution station.
IP-30	:	Nationalelectricalcode(NEC)BISpublication.
IS-2959	:	Contactors.
IS-1030-1982	:	Specification for carbon steel castings for general engineering purpose.

5.00 DESIGN

The design and workmanship shall be in accordance with the best engineering practices, to ensure satisfactory performance and service life. The equipments offered by the contractor shall be complete in all respects. Any materials or accessories, which may not have been specifically mentioned, but which are usual and necessary for the satisfactory and trouble free operation and maintenance of the equipment shall be provided without any extra cost to the purchaser. This shall also include & panes for commissioning of equipments.

All work to be performed and supplied shall be as a part of contract require specific approval/review of Management committee. Major activities requiring approval/review shall include but not to be limited to the following:

Biddershallberesponsiblefor:

- Detailed co-ordination with other services, shop drawings for various electrical layoutssuch as equipmentlayout, cabling layouts, earthing layouts, including equipment installation and cable termination details etc. prior to start of work.
- Preparationofbillofmaterialsforcabling,earthingandmiscellaneousitemsetc.
- Cableschedule(aspersiterequirement).
- Interconnectiondrawing.
- Protectionco-ordinationdrawings.
- Shopinspectionandtestingprocedures.
- Fieldtestingandcommissioningprocedures.
- Preparationofasbuiltdrawings.

6.00 SITECONDITIONS

i)Design ambient	50Deg.C.maximumforengineand40degC foralternator
ii)Altitude	300Mabovesealevel
iii)Relative Humidity	98%maximum
iv)Siteenvironment	Normal

7.00 DESIGNCRITERIA

7.02

7.01 ELECTRICALDETAILSOFINCOMINGSUPPLY

a)	SupplyVoltage	11KVasperSEBapproved.
b)	Faultlevel(sym.)atsupplyof point (designed)	350MVA(tobeconfirmedfromState Electricity Board by Tenderer).
c)	Neutral	Aspersupplycompany
d)	Voltage Variation	<u>+</u> 5%
e)	FrequencyVariation	<u>+</u> 3%
L.T.POV	VERDISTRIBUTIONSYSTEM	
a)	Voltage	415V

b) Frequency 50 Hz

	c)	Neutra	al			Solio	dlyGrounded
	d)	Short Capaci	Circuit ty	Fault	withstand	10-	-50KA(1Sec.)
7.03	CONT	ROLSUPF	PLYFOREL	ECTRIC	ALSYSTEM		
	Th	evarious	ssupplyvo	ltageto	beusedinthe	contro	olpanelsformainequipmentsare:
	a)	Spring	ChargeM	otor		230\	/oltAC
	b)	Closing	g/TripCoil			24 V	DC
	c)	Alarm	/Indicatio	n/Relay		24 V	DC
	d)	Heater	rs			230\	/AC
7.04	PA	AINTING	OFPANEL				Powdercoatingofapprovedshadeas per Specification Clause of painting.
7.05	P/ ST	AINTING EEL	OF CABL	E TRAY A	AND STRUCT	URE	Powdercoatedofapprovedshadeasper Specification Clause of painting.
8.00	C	ABLEDET	TAILS				
8.01	L. ⁻	T.CONTR	ROLCABLE	S			CopperconductorFRLS/PVCinsulated 1.1KV grade.
8.02	PC	OWERCA	BLES(L.T.)			Aluminium/copperconductor FRLS/PVC /XLPEarmoured.
8.03	GI	ROUNDII	NGCONDI	UCTOR			Copper/G.I.asperBOQ.
9.00	ACC	URACYO	CLASSOF	METERS	5		
	Re	evenueN	letres				Class 0.5 or a sper SEB approved.

1.00 DRAWINGS

i) The drawings along with this specification is provided by contractor and approved by Management committee. These drawings are meant to give general idea regarding the nature of work covered by these specifications.

Digital Type.

Am-meterVoltmeterandOtherInstrument

- Any information/data shown/not shown in these drawings shall <u>not relieve the contractor of</u> <u>hisresponsibility</u> to carry out the work as per the specifications. Additional information required by the bidder for successfully completing the work shall be obtained by him.
- iii) ShopDrawings

The contractors hall prepare detailed coordinate delectrical shopdrawing. Cable Schedule with other relevants ervices and submitto the Management committee for approval or before

commencing the work. The shop drawings shall indicate all setting out details and physical dimensions of all components with wiring and cabledetails including system operating write up in the system i.e. Control and Relay Panel D.G.'s, cable schedule and routes, manhole trap and fixing details for the above mentioned work. All work shall be carried out on the approval of these drawings. However, approval of these drawings do not relieve the contractor of his responsibility for providing maintenance free and fool proof system including any missing component/accessories to meet with the intent of the specifications. Contractor willsubmit 2 prints for preliminary approval and finally six prints for distribution.

iv) CompletionDrawings/AsBuiltDrawings

On completion of the work and before issue of certificate of virtual completion, the contractor shall submittothe Society 6setsalongwithsoftcopyof 'AsBuilt'drawingsofthework alongwithoriginals including write up (trouble shooting, installation, operation and maintenance manual with instructions) incorporating all such changes and modifications during engineering and execution.

Thesedrawingsmustprovide:

- Locationofallearthingstations,routeandsizeofallearthingconductors.
- Layoutandparticularsofall cables.
- LocationanddetailsofD.G.controlpanel/aux.panel,andrelaypanelswithdescriptiondetailed control wiring diagram.
- Layoutofcabletrayswithsupportandtheirfixingdetails.

11.00 MANUFACTURER'SINSTRUCTIONS

Where manufacturers have furnished specific instructions, relating to the material/equipments to be used on this job, covering points not specifically mentioned in this documents, manufacturers instructions shall be followed.

12.00 MATERIALSANDEQUIPMENTS

All the materials and equipments shall be of the approved make and design. Unless otherwisecalled for any approval by Management committee, only the best quality materials and equipment shall be used.

A. VENTILATIONOPENING

Inordertoensure adequateventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust.Outdoor compartment openings shall be provided with shutter type blinds.

B. DEGREEOFPROTECTION

The enclosures of the Control Cabinets, Junction Boxes and Marshalling Boxes, Panels etc. to be installed shall provide degree of protection as detailed here under.

- Installedoutdoor:IP-55.
- Installedindoorinairconditionedarea:IP-31.
- Installedincoveredarea:IP-42.
- Installedindoorinnonairconditionedareawherepossibilityofentryofwaterislimited:IP-41.
- ForL.T.switchgear(ACandDCdistributionboards):IP-42.

The degree of protection shall be in accordance with IS:13947 (Part-I)/IEC-947 (Part-I).Type test report for degree of protection test, on each type of the box shall be submitted for approval.

C. RATINGPLATES, NAMEPLATESANDLABELS

D.G. Sets, D.G. control panel and auxiliaries items installed in the building is to permanently attached to it in a conspicuous position. A rating plate of non-corrosive material with engraved manufacturer'sname, yearofmanufacture, equipment name, typeorserial numbertoge therwith

details of the loading conditions of equipment in question has been designed to operate and such diagram plates as may be required by the purchaser. The rating plate of each equipment shall be according to IEC requirement.

All such nameplates, instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternatively two separate plates one with Hindi and the other with English inscriptions may be provided.

D. FIRSTFILLOFCONSUMABLES,OILANDLUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, welding/soldering/brazing materialfor allcopper/G.I. earthingandessentialchemicals etc,(however diesel shall be provided by Society). which will be required to put the equipment/scheme covered underthescope of thespecifications, into successful operation, shall be furnished by the Contractor unless specifically excluded under the exclusions in these specifications and documents.

E. DESIGNIMPROVEMENTS

Thebiddershallnotethattheequipmentofferedbyhiminthebidonlyshallbeacceptedforsupply.

If for any reason, Contractor wishes to deviate from specification, prior permission fromManagement committee shall be sought.

If any such change is agreed upon and that if affects the price and schedule of completion, the parties shall agree in writing as to the extent of any change in the price and/or schedule of completion before the Contractor proceeds with the change.Following such agreement, the provision thereof, shall be deemed to have been amended accordingly in the specification.

F. QUALITYASSURANCEPROGRAMME

To ensure that the equipment and services under the scope of this Contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Purchaser's site or at any other place of work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points necessary. Such programme shall be outlined by the Contractor and shall be finally accepted by the Purchaser after discussions before the award of Contract. A quality assurance programme of the contractor shall generally cover the following:

- Hisorganizationstructureforthemanagementandimplementationoftheproposed quality assurance programme.
- Documentationcontrolsystem.
- Qualificationdataforbidder'skeypersonnel.
- The procedure for purchases of materials, parts components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
- System for shop manufacturing and site erection controls including process controls and fabrication and assembly control.
- Controlofnon-conformingitemsandsystemforcorrectiveactions.
- Inspectionandtestprocedurebothformanufactureandfieldactivities.
- Controlofcalibrationandtestingofmeasuringinstrumentsandfieldactivities.
- Systemforindicationandappraisalofinspectionstatus.
- Systemforqualityaudits.
- SystemforauthorizingreleaseofmanufacturedproducttothePurchaser.
- Systemformaintenanceofrecords.
- Systemforhandlingstorageanddeliveryand
- A quality plan detailing out the specific quality control measures and procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services rendered.

The Society or its duly authorized representative reserves the right to carry out quality audit and qualitysurveillanceofthesystemandprocedureoftheContractor/hisVendor'squalitymanagement and control activities.

G. QUALITYASSURANCEDOCUMENTS

The Contractor shall be required to submit the following Quality Assurance Documents within three weeks after dispatch of the equipment.

- AllNon-DestructiveExaminationprocedures,stressreliefandweldrepairprocedureactually used during fabrication and reports including radiography interpretation reports.
- Welderandweldingoperatorqualificationcertificates.
- Welder'sidentification list, listing welder'sandwelding operator'squalification procedureand welding identification symbols.
- Raw material test reports on components as specified by the specification and/or agreed to in the quality plan.
- Stressrelieftimetemperaturecharts/oilimpregnationtimetemperaturecharts.
- Factory test results for testing required as per applicable codes/mutually agreed quality plan/standards referred in the technical specification.
- The quality plan with verification of various customer inspection points (CIP) as mutually and methods used to verify the inspection and testing points in the quality plan were performed satisfactorily.

13.00 PACKAGING

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of availability of Railway wagon/truck/trailer sizes in India should be taken account of the Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. Society takes no responsibility of the availability of any special packaging/transporting arrangement.

14.00 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discolouration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.

15.00 HANDLING, STORINGANDINSTALLATION

- In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Construction, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented.
- Contractor shall follow the unloading and transporting procedure at site, as well as storing, testing and commissioning of the various equipment being procured by him separately. Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's Engineer(s) and shall extend full co-operation to them.
- In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained form the Management committee.Contractor shall be held responsible for any damage to the equipment consequent for not following manufacturer's drawings/instructions correctly.
- Where assemblies are supplied in more than the one section, Contractor shallmake all necessary connections between sections.All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning.Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Contractor at his own expense.

- TheContractorshallsubmit to the Management committee every week, areportdetailing all the receipts during the weeks. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.
- The Contractor shall be fully responsible for the equipment/material until the same is handed over to the Society in an operating condition after commissioning.Contractor shall be responsible for the maintenance of the equipment/material while in storage as well as after erection until taken over by Owner, as well as protection of the same against theft, element of nature, corrosion, damages etc.
- The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipment which require indoor storage.
- Thewords'erection'and'installation'usedinthespecificationaresynonymous.
- Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.
- The minimum phase to earth, phase to phase and section clearance alongwith other technical parameters for the various voltage levels shall be maintained as per relevant IS.

16.00 PROTECTIVEGUARDS

Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards with necessary spares and accessories shall be designed for easy installation and removal for maintenance purpose.

17.00 DESIGNCO-ORDINATION

The Contractor shall be responsible for the selection and design of appropriate equipments to provide thebestco-ordinatedperformance of the entiresystem. The basic design requirements are detailed out in this Specification. The design of various components, sub-assemblies and assemblies shall be so done that it facilitate easy field assembly and maintenance.

18.00 DESIGNCO-ORDINATIONMEETING

The Contractor will be called upon to attend design co-ordination meetings with the Management committee during the period of Contract. The Contractor shall attend such meetings at his owncost at Chandigarh or at mutually agreed venue as and when required and fully co-operate withsuch persons and agencies involved during those discussions.

19.00 DIESELENGINE

- 19.01 AircooleddieselengineelectricstartinghighspeeddieselenginewithintegratedDGSetController conforming to BS:649/1958 with 10% over loading for one hour in any 12 hours duration. The engine will befitted with the followingstandardaccessories. The supplier can quote for equivalent engine and shall furnish complete details of the same along with tender quotation.
 - a) Flywheeltosuiteflexible coupling.
 - b) Flexiblecoupling.
 - c) Exhaustfanturbochargerwithaftercooler.
 - d) Coolingwatercentrifugalpump.
 - e) Radiator(enginemounted).
 - f) Corrosionresistor.
 - g) Automaticoverspeedtripprotection.
 - h) Lub.oilpump.
 - i) Lub.oilprimingpump(ifRequired).
 - j) Lub.oilfilter.
 - k) Bypassfilter.
 - l) Fuelpump.

- m) Fuelfilter.
- n) Airintake manifold.
- o) PCC3.3/EPC/woodward/Powercom(havingSEMscontrolsystem).
- p) Selfstarter24voltsDCincludingbatteryandbattery charger.
- q) Residentialsilencer.
- r) Flexiblepipeforsilencers.

20.00 GOVERNINGSYSTEM

20.01 TheGovernorshallbeelectronicfuelcontroltypeforcoupledGenset.

21.00 EXHAUSTSYSTEM

Engine emission exhaust system shall be meet the CPCB/SPCB norms of exhaustemissions forD.G. Sets residential type silencer ducting, bends, hood/canopy, thermally insulated aluminium clad exhaustpiping etc.shall beprovided alongwithstructural supportwith staysforeachengine.Heat resistant paint shall be provided on exhaust pipe for the portion which is of outside the building including canopy.Exhaust system pollution level shall be indicated and shall be got approved by authorities. (Exhaust smoke quality & quantity should be within the norms of central & state pollution control board).

21.01 ExhaustPipeInsulation

Exhaust pipe insulation shall be carried out with mineral wool (rigid pipe sections) of 150Kgs./Cu.m for temperature above 250 deg.C.The material for pipe insulation shall be factoryfaced with aluminium foil reinforced with kraft paper.The aluminium foil of 24 SWG shall extend by minimum 50mm on one side of pipe side along the length to seal all longitudinal joints etc.

22.01 ENGINEINDICATORS

- a. Digitaltachometerwithrunninghourmeter
- b. Startingattemptcounter
- c. Lubricatingoilpressure low
- d. Watertemp.high/low.
- e. Waterpressure low/high.
- f. Overspeed
- g. Enginefailtostart
- h. KVA
- i. VoltsR-Y-B/RY-YB-BR.
- j. AmpsR-Y-B.
- k. Faultconditionwithresetforengine.

23.00 ALTERNATOR(415V–3Phase,4WireSystem)

23.01 The Alternator shall be industrial type screen protected drip proof. IP-23. Class – Hinsulation with temperatureriselimitedto Class-'H',selfventilated, aircooled,rotatingfield,salientpole, brushless, machine with self excited, self regulated exciter and shall be rated for continuous duty.

- 23.02 The Alternator shall have a continuous rating of not less than the value specified under specific requirement shall be at 0.8
- 23.03 The Alternator shall withstand without mechanical damage, an over load of 50% for a period of 30 sec. The generator/alternator shall with stand over load of 10% for 1 hour every 12 hourly. The terminal voltage shall be adjustable and the range of adjustment shall be \pm 5% of nominal voltage.
- 23.04 The Alternator shall be capable of withstanding without damage/injury for 3 secs., 3 phase short circuit at its terminals, when operated at rated KVA and power factor at 5% over voltage with fixed excitation (3 times the line current for 10 Sec.).
- 23.05 The Alternator shall be capable of withstanding for thirty (30) secs. a current of fifty (50) percent in excess of its rated current, the voltage being maintained, as near the rated value as possible, consistent with max. capacity of the prime mover.
- 23.06 Allexternalnutsandboltsshallbeofhightensilesteelonly.
- 23.07 The alternator shall be capable to sustain the unbalanced current between the phases minimum 25% of rated currentprovide that the KVA rating and maximum current does not exceed frated current in any phase as per BS-4999 Part-101.
- 23.08 Thealternatorshallbedynamicallybalancedcompletewithrotorandshaft.
- 23.09 Damper winding shall be provided in the pole to damp the oscillations and ensure satisfactory performance during parallel operation.

24.00 OUTDOORTYPEACOUSTICENCLOSUREFORD.G.SET

- a) SilentDGsetcontainerisofmodularconstructionwiththeprovisiontoassembleand dismantle easily as per the site condition.
- b) Therearenoprotrudingparts.
- c) The container is fabricated out of CRCA sheet of 16SWG.
- d) Thesheetmetalcomponentsarehotdipninetankpre-treated.
- e) Tohavelongliftofcontaineritispurepolyesterbasedpowdercoated(insideaswell outside).All nut and bolts/hardware are zinc coated.
- f) FueltankatthebaseofsilentDGsetishavingrequiredcapacity.Itisprovidedwith breather, drain plug.
- g) Thefuellevelcanbeindicatedwiththehelpoffuelgauge meter.
- h) Thereisprovisionforfillingthefuelfromoutsideasinthecaseofautomobileswith locking arrangement.
- i) Batteryisaccommodatedinaseparatetrayinthe container.
- j) Thereisaprovisionfordrainplugsfordrainingmobileoil/diesel.
- k) ThedoorsaregasketedwithhighqualityEPDNgasketstoavoidleakageofsound.
- I) Thedoorhandlesarelockabletype.
- m) Sound proofing of enclosure is done with high quality rock wool/mineral wool confirming to IS:8183 of 50mm thickness and density at 96 Kgs/Cu.m.
- n) Therockwoolisfurthercoveredwithfibreglassclothandperforatedpowdercoatssheet.
- o) AspecialresidentialsilencerisprovidedwithintheDGtocontrolexhaustnoise.
- p) Specially designed attenuators are provided to control sound at air entry to the container and exist from the container.
- q) To make the system vibration free, engine and alternator (single bearing) is mounted onanti-vibration pads.
- r) Noiselevelis75dB(A)at1meterdistance.

25.00 TESTS

25.01 The Diesel Generator sets shall be tested as per the relevant IEC Standards.All the tests on individual and combined sets will be witnessed by theManagement committeewith no extra claimto Society.The supplier shall submit test reports complete descriptions/testing procedure units accepted and value obtain from as per the following but not limited to:

A. AcceptanceTestsonD.G.Set.

One(1)houratvariableloadincluding10% overload at manufacturer works.

Beforeeachtest, the engineshall be brought to aste adystate under the conditions of the test.

B. NOTICEPERIOD

Atleast 1 week notice time shall be maintained before the tests mentioned above bymanufacturer.

25.02 TestCertificate

- a. TestCertificateshallbesubmittedintwo(2) copies.
- b. The test certificates shall be furnished to the purchaser for prior approval before despatch of any equipment from works and the approval in writing from purchaser shall be essential to effect despatch of the equipment.
- c. The test reports shall furnish complete identification of the data including serial number of each equipment.

26.00DEVIATION

Should the contractor desire to deviate from this specification in any way, he shall draw specific attention to such deviation giving complete reasoning/comparison with other products.

Unless such deviations are recorded in the separately attached Deviation Sheets, as submitted with offer, it will be taken for granted that the offer is made in conformity with this specification.

27.00 QUALITYASSURANCEPROGRAMME

Quality Assurance shall follow the requirements of Management committee as applicable.Quality Assurance involvement will commence at enquiry and follow through to completion and acceptance thus ensuring total conformity to Society's requirements.

Technicalliterature, testing procedure with acceptable values hall be submitted along with the bid. Any

deviation shall be explained with supporting documents shall also be submitted.

28.SPECIFICATIONFORDGAUTOMATION SYSTEM

ControllerBasedDGSYNCHRONIZATIONSYSTEM

1. CONTROLPHILOSOPHY

AutomaticStart&StopofEngine:

Controller Logic for Auto Synchronizing ,Auto sharing& Auto Load Management including auto start / auto stop of DG Set

The system should come in operation after sensing of grid failure initiation of DG operation fromMan machine interface to automatically control the start and stop of the engine, depending on the predefinedloadsettinginthecontroller.Incaseenginedoesnotstart inthefirstcranking,twomore auto commands should be given with proper interval.Even then if engine fails to starts indication must appear on MMI (main machine interface).In the event, the engines are under loaded load sensed is capable of being catered by less then running engines, command must be given toengine running for shortest duration at the moment.Provision to select number of DG sets to be started at no load to cope up with sudden load without tripping ready the DG's.

2. DGSynchronizationController

The entire operation of the captive power generation system will becontrolled automatically through a controller. These controllers will be state of art equipments using latest technology and of most rugged and reliable design. Since they shall be operating in the harsh & unfriendly environment of DG room, they will be suitable to operate trouble free in those conditions. The chosen equipment should be able to withstand high temperature, humidity and voltage fluctuations, thus making it suitable for the operating conditions described above and should perform the following functions

- Trippingoflesspriorityloadsintheplantincaseofunderfrequencyofbusbothinisolationas well as synchronized mode.
- Control of all the auxiliary drive of DG set should Auto Synchronizing ,start / stop automatically with proper interlock.
- Controller system shall have provision to test the DG in auto mode without closing the braker to do the routine electrical / mechanical testing of set without interruption to power generation.
- TheSystemsupplierwillsupplybuiltdrawing. Alongwithtroubleshootingandoperationand maintenance guidelines.

Protection	ASNICode	Protection	ASNICode
Under/OverVoltage	27P/59P	ReversePower	32R
Under/OverFrequency	81U/810	VoltagedependentOverCurrent	51V
Short Circuit	50P/N	UnbalanceVoltage	47
OverCurrent	51	UnbalanceCurrent	46
df/dt	81R(ROCOF)	UnderExcitation	32RV
VectorSurge	78	OverExcitation	32FV
OverLoad	32	OverSpeed	12

ControllermusthavetheseprotectionsforGenerator.

LowBatteryVoltage	27DC	HighBatteryVoltage	59DC
PhaseSequenceError	47	Hz/VFailure	53
EarthFault	51N		

3 CommunicationforSCADA&BMSconnectivity

1 CANCommunicationJ1939

4

- 2 Modbus(RS-485)
- 3 EthernetCommunication

ControllerMustbe3PhaseSynchronization 3 Phase Generator Voltage 3 PhaseBusVoltage

- 3.1 AutoMode
- a) SystemOperation
- Whilethenormalmainssupplyishealthy,theDGsetshallbeatrestandtheloadshallbe supplied bymains.During this period all the bus couplers shall be in OPEN position.
- The controller system shall monitor supply voltage on each phase.When the mains supply fails completely or falls below set value (variable between 80% to 95% of the nominal value)on any phase, the monitor module shall initiate start upof diesel engine.To avoid initiation due to momentary dips or system disturbance, a time delay adjustable between 0.5 to 5 seconds (adjustable) shall be incorporated in the start up initiation.
- Athreeattemptstartingfacilityshallbeprovidedwiththesequence6secondsON 5secondsOFF 6 seconds ON 5 seconds OFF and 6 seconds ON.At the end of the third attempt if the engine has not been already started and built up voltage, engine shall be locked outfor start. A master timer shall be provided for the function.An audio visualalarm shall be given.
- Suitable adjustable timers shall be incorporated whichshall make it feasible to vary independently ON-OFF setting periods from 1-10 seconds. If the alternator does not build up voltage after the first or any start, as may, further starting attempt shall not be made and the starting facility shall bereset.
- Onceenginehas built upvoltage,signals shall be provided tooperatethealternator, mains and bus coupler circuit breakers as per logic sequence required. The Mains supply circuit breaker shallopen before the alternator circuit breaker closes. Before giving close command to alternator breaker, all the bus couplersshall be given close command. At this point of time all the load shall be on one DG. System provided in the DG Synchronization control Panel shall check and ensure thatalltheengineauxiliarieslikecuboilpump, CTfan, coolingwaterpumparerunning andhealthy. In case of any fault in engine auxiliaries, the system shall automatically stop the DG set and an audio visual alarm shall be given. Suitable inputs for overload and single phase preventer for alternator and for each of the engine auxiliaries shall also be considered as inputs for this function.
- DG Synchronization control system shall continuously monitor total load on the DG set. In case the load on any of the DG sets is less than 60 % of the rated value, the controller shall assess the load onthe adjacent DG set. In case the summation of the loads is within 90% of the rating of one of the DG sets, one DG set shall shut down and load shall be transferred to the second DG set. In case the total load on the system is not more than 90% of the full load rating of a single DG set, the controller shall shut down due to non availability of adequate load and should the load increase, the controller shall automatically start the DG set and shall isolate the buses/loadson the MainLTpanel bus.
- The Automatic Load Management system shall be designed to provide optimum utilization of theDG sets so that operation of the DG sets is need based with higher load factor on each set. The systemwouldthereforetransferloadsfromonebustotheotherontheMainLTpanelwithMain

L.T. panel as per logic sequence required. The controller shall ensure that that the ACB's on the closed and opened and DG sets are started and stopped according to the predetermined logic and interlocking scheme to provide a fail safe system.

- When the voltage in the mains get restored, its quality shall be monitored for about one minute and if proven satisfactory, the main supply breaker shall close automatically for retransfer of the load from Diesel engine to the main supply at LT panel. However prior to this operation DG and bus coupler breakers shall open to ensure that all the bus couplers all the bus couplers are in open position before the mains breaker closed.
- The Automatic Logic Management systemshallalso consider that in the eventuality of failure of any component of the controller, adequate safeguards shall be provided in that the system shall revert to the manual mode with visual and audible alarms. These safeguards and the system shall be detailed in the offer.
- The Logic Panel shall automatically arrange for sequential starting of DG sets to be based on numberofoperatinghoursofeachDGsetsothattoensurethatallDGsetsareoperatedasequally as possible.
- In case of over load on the DG system, the logic panel shall give audio visual alarm to enable the operators to switch off loads as required and if this is not taken care of in predetermined time, the Logic Panel shall put the DG in shut down mode with alarm.
- TheDGsetshallstopafteridlerunningofoneminuteafterrestorationofmainsupply.
- TheDGsetrevertstostandbyconditionsandisreadytostartshouldthemainssupplyfailagain.
- b) SequenceofoperationforAutostart,Autoloadmanagement&AutoSynchronizing
- Onefailure of grid supply, DG-1shallstartautomatically and close its breaker shallstart feeding the load.
- OnDG-1attainingitsfullratedcapacity,DG-2shallstartautomatically.
- Voltage and frequency of DG-2 shall be monitored and necessary commands shall adjust the parameters of DG-2 with bus.
- Systemshallalsomonitortheslipfrequencyandthebeatvoltageofthemachineorsystem.
- TheabovesequenceshallbefollowedforsubsequentDG's.
- It shall be possible to alter sequence of DG set starting through manual selectors or through Man Machine Interface.
- Active Power shall be made equal on both the machines automatically with the help of active load balancing system through governor control.
- Reactive power shall be balanced automatically with the help of quardature droop kit fitted on the machine.However, if quadrature droop system is not functioning accurately, reactive load balancing system shall control AVR to achieve KVAR regulation within present band with direct analog(+/-3,0-5,+/- 5, etc. volt) control.
- Load management system shall have 6 output contacts for tripping various loads by field wiring and also trip the breaker of different DG set and give alarm for shutting off DG in accordance with predefined parameters to avoid under loading / over loading / cascading effect of tripping and unnecessary fuel wastage.
- On restoration of grid supply, DG breakers and Bus coupler breakers shall be switched off in sequence with time delays to cover dips and grids supply breakers shall be switched On. Dg sets shall continue to run for one minutes after DG breaker has been switched OFF.
- Itshallbepossibletoaltercrucialsettings/timedelaysthru.ManMachineInterface.

- Controller, annunciation system, protection system and metering system shall have compatibility for future interface with PC for graphics displays / report generation.
- Systemshallhavetotalmanualoverride.

Tenderers may note that the controller controls and sequence of operation are indicative of requirements and the controllers hall not with standing the above, be complete inall respects to achieve the control, monitoring and operation of DG sets indicated above.

3.1.2 ManualMode

- Undermanualmodeitshallbepossiblefortheoperatortostartupthegeneratorsetbypressingthe (START) push button.
- Threeattemptstartingfacilityshallalsobeoperativeforthestartupfunction.
- Alternator, mains and bus coupler circuit breakers 'CLOSE' and 'TRIP' operations as per logic sequence required shall be manual by pressing the appropriate push button on the panel. Closure shall be feasible only after alternator has built up full voltage. If the load is already on 'MAINS' pressure on 'CLOSE' button shall be ineffective.
- When running under manual mode, if the mains supply has failed, the load shall automatically get transferred to the alternator immediately overriding the stipulation of pressure on 'CLOSE' button.
- Engineshutdown,otherthanduetofaultsshallbemanualbypressinga'STOP'button.

3.1.3 TestMode

- When under 'TEST' mode pressure of 'TEST' button shall complete the start up sequence simulation and start the engine. The simulation will be that of mains failure.
- Engineshall build up voltagebut the set shall not close alternator circuit breaker when the load is on the mains. Monitoring performance for voltage/frequency etc. should be feasible without supply to load.
- If during TESTrun the power supply has failed, the load shall automatically get transferred to alternator.
- Bringingthemodeselectortoautopositionshallshutdownthesets.

TECHNICALSPECIFICATIONSFOREXTERNALELECTRICALWORKS

STANDARDS

All equipment, material and components shall comply with the requirements of the latest editions ofIndian Standards with updated amendments. Standards and Regulations applicable in the area where equipment is to be installed shall also be followed.

The equipment offered complying with other standards, these standards shall be equal to or superior to those specified and full details of the differences shall be furnished along with the tender.

SomeoftherelevantIndianandBritishStandardsarelistedbelow:

IS 13947	:	A.C.CircuitBreakers(RelevantParts/SCC).
IS3427	:	MetalenclosedSwitchgear&ControlGear.
BS162	:	SafetyClearances.
IS2705	:	CurrentTransformers(Parts1to 4).
IS3156	:	VoltageTransformers(Parts1to 4).
IS3202	:	CodeofPracticeforclimateproofingofelectricalequipment.
IS375	:	Marking & Arrangement for Switchgear Bus Bars, main connections and auxiliary wiring.
IS722	:	A.C.ElectricMeters.
IS1248	:	DirectactingElectricalIndicatingInstruments.
IS3231	:	ElectricalRelaysforPowerSystem Protection.
IS2544	:	EpoxyCastResinInsulators.
IS5082	:	ElectrolyticCopperandAluminium.
IS5792	:	HighVoltageHRC fuses.

11KVANDMEDIUMVOLTAGECABLES

1. GENERAL

Technicalspecificationsinthissectioncoverssupplyingandlayingof:

- 11kV cables
- Mediumvoltagecables.

2. STANDARDSANDCODES

All equipments, components, materials and entire work shall be carried out in conformity with applicable and relevant Bureau of Indian Standards and Codes of Practice, as amended upto date and as below. In addition, relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and /or IEC Standards shall be applicable.

Equipments certified by Bureau of Indian Standards shall be used in this contract in line with government regulations. Test certificates in support of this certification shall be submitted, as required.

It is to be noted that updated and current standards shall be applicable irrespective of dates mentioned along with ISS's in the tender documents.

PVC insulated heavy duty cables	IS1554-1988
Cross link polyethylene insulated PVC (sheathed XLPE cables)	IS7098-1985
Code of practice for installation and maintenance of power cables	IS1255-1983
Conductorsforinsulated electrical cables	IS8130-1984
Drumsforelectricalcable	IS10418- 1982
Methodsoftestforcables	IS10810- 1988
Recommended current rating	IS3961-1987
RecommendedshortcircuitratingofhighvoltagePVCcables	IS5891-1970

3. CABLES

3.1 11KVCables

11 KV cable shall be aluminium conductor with cross linked polyethylene (XLPE) insulation, galvanized steel armouring and PVC sheathing conforming to IS 7098. Conductors shall be sector shaped, made from electrical purely aluminium of 3 x 4 H or H temper conforming to IS 8130 XLPE insulation of high purity shall be extruded on the conductors with screen a layer of semi- conducting material shall be applied over the XLPE insulation to prevent partial discharge at insulation surface. This shall be followed up by metallic aluminium tape screen the cores shall be discharged tested. Built up cores shall then be laid up and filler codes added. Combined core shall beprovidedwithextrudedPVCsheathing.Galvanizedsteelwireofstriparmouringshallthenbe

provided protected by an overall extruded black PVC sheet. The outer sheath shall bear the manufacturer's name and trade mark at every meter length.

3.2. MediumVoltageCables

Medium voltage cables shall be aluminium conductor XLPE insulated, PVC sheathed armoured conforming to IS 7098. Cables shall be rated for a 1100 Volts. The conductor of cables from 16 Sq. mm. to 50 Sq. mm. shall be stranded. Sector shaped stranded conductors shall be used for cables of 50 sq. mm and above. Conductors shall be made of electrical purity aluminium 3/4 H or H temper. Conductors shall be insulated with high quality XLPE base compound. A common covering (bedding) shall be applied over the laid up cores by extruded sheath of unvulcanised compound. Armouring shall be applied over outer sheath of PVC sheathing. The outer sheath shall bear the manufacturer'snameandtrademarkateverymeterlength.Coresshallbeprovidedwithfollowing colour scheme of XLPE insulation.

1 Core	:	Red/Black/Yellow/Blue
2 Core	:	RedandBlack
3 Core	:	Red, Yellowand Blue
3 1/2 /4 Core	:	Red, Yellow, Blueand Black

Current ratings shall be based on the following conditions.

a)	Maximumconductortemperature	90ºC
b)	Ambientairtemperature	45°C
c)	Groundtemperature	30 ⁰ C
d)	Depthoflaying	1000mm

ShortcircuitratingofcablesshallbeasspecifiedinIS7098Part-I.

Cables have been selected considering conditions of maximum connected loads, ambient temperature, grouping of cables and allowable voltage drop. However, the contractor shallrecheck the sizes before cables are fixed and connected to service.

4. DELIVERY, STORAGEANDHANDLING

Cable drum shall be stored on a well drained, hard surface, preferably of concrete, so that the drums do not sink in ground causing rot and damage to the cable drum. The cable drum shall conform to IS 10418. During storage, periodical rolling of drums, in the direction of arrow marked on the drum, shall be done once in 3 month through 90°C Both ends of cables shall be properly sealed to prevent moisture ingress Drums shall be stored in well ventilated area protected from sun and rain. Drums shall always be rested on the flanges and not on flat sides. Damaged battens of drums etc. shall be replaced. Movement of drums shall always be in direction of the arrow marked on the drum. For transportation over long distance, the drums shall either be mounted on drum wheelsandpulledbyropesortheyshallbemountedontrailersetc.drumsshallbeunloaded preferably by crane otherwise they shall be rolled down carefully on suitable ramps. While transferringcableform1drumtoanother, thebarrelofthenewdrumshallhavediameternotless

than the original drum. Cables with kinks or similar visible defects like defective armouring etcshall be rejected. Cables shall be supplied at site in cut pieces as per actual requirements.

5. LAYINGOFCABLES

Cables shall be so laid that the maximum bending radius is 12 times the overall diameter of the cable for medium voltage cables and 20 times the overall diameter for 11 kV cables. Cables shallbe laid in masonry trenches, directly on walls/cable trays, directly buried in ground or in pipes/ducts as elaborated below. Cables of different voltages and also power and control cables shall be laid in different trenches with adequate separation. Wherever available space is restricted such that this requirement cannot be met, medium voltage cables shall be laid above HT cables.

5.1 InMasonryTrenches

Wherever so specified, cables shall be laid in indoor/outdoor masonry/RCC trenches provided by Contractor. Cables shall be laid on MS supports fabricated from minimum 38mm x 38mm x 6mm painted/galvanizedangleironsupportsgroutedintrenchwallsatintervalsnotexceeding600 mm. If required, cables shall be arranged in tier formation inside the trench. Suitable clamps,hooks and saddles shall be used for securing the cables in position and dressing properly so that the clear spacing between the cables shall not be less than the diameter of the cable. Trenches shall be provided with chequered plate/RCC covers. Wherever so specified, trenches shall be filled with fine sand.

5.2 On Trays/Walls

Wherever so specified, cables shall be laid along walls/ceiling or on cable trays. Cable shall be secured in position and dressed properly by means of suitable clamps, hooks, saddles etc. such that the minimum clear spacing between cables is diameter of the cable. Clamping of cables shall be at minimum intervals as below.

Typeof cables	Size	Clampingby	Fixing intervals
MV	Uptoandincluding25sqmm	Saddles1mm thick	45cm
MV&HV	35sqmm to120sqmm	Clamps3mmthick25mmwide	60cm
MV&HV	150sqmm andabove	Clamps3mmthick40mm wide	60cm

Note:Thefixingintervalsspecifiedapplytostraightruns.Inthecaseofbends,additionalclamping shall be provided at 30 cm from the center of the bend on both sides.

Cable trays, of sizes as required and drawings shall be of perforated doubled bend channel/ladder design unless otherwise stated. Cable trays shall be fabricated from minimum 2 mm thick sheet steel and shall be complete with tees, elbows, risers, and all necessary hardware. Cable trays shall comply with the following:

Trays shall have suitable strength and rigidity to provide proper support for all contained cables. Trays shall include fittings for changes in direction and elevation. Cable trays and accessories shall be painted with one shop coated of red oxide zinc chromate primer and two side coats of aluminium alkyd paint or approved equivalent. Cable trays shall not have sharp edges, burrs or projection that may damage the insulation jackets of the wiring. Cable trays shall have side rails or equivalent structural members. Unlessotherwisespecificallynotedontherelevantlayoutdrawing,allcabletraymountingworks to be carried out ensuring the following:

Cable tray mounting arrangement type to be as marked on layout drawing. Assembly of tray mounting structure shall be supplied fabricated, erected & painted by the contractor. Tray mounting structures shall be welded to plate inserts or to structural beams as approved by the Management committee. Wherever embedded plates & structural beams are not available for welding the tray mounting structure contractor to supply the MS plates & fix them to floor slab by four anchor fasteners of minimum 16 mm dia having minimum holding power of 5000 Kg at no extra cost. Maximum loading on a horizontal support arm to be 120 Kg. metre of cable run. Width of the horizontal arms of the tray supporting structures to be same as the tray widths specified in tray layout drawings, plus length required, for welding to the vertical supports. The length of vertical supporting members for horizontal tray runs shall be to suit the number of tray tiersshown in tray layout drawings. Spacing between horizontal supports arms of vertical tray runs tobe 300 mm. Cable trays will be welded to their mounting supports. Minimum clearance between the top most tray tier and structural member to be 300 mm. Cables in vertical race ways to be clamped by saddle type clamps to the horizontal slotted angels. Clamps to be fabricated from 3 mm thick aluminium strip at site by the contractor to suit cable groups. The structural steel (standard quality) shall be according to latest revision of IS : 226 & 808. Welding shall be as per latest revisions of IS : 816.All structural steel to be painted with one shop coatof red oxide and oil primer followed by a finishing coat of aluminium alkyd paint where any cuts or holes are made on finished steel work these shall be sealed against oxidation by red oxide followed by the same finishing paint. Steel sheet covers wherever indicated to be similarly painted. Trays shall beerected properly to present a neat and clean appearance. Trays shall be installed as a complete system. Trays shall be supported adequately by means of painted MS structural members secured to the structure by dash fasteners or by grouting. The cable entire tray system shall be rigid. Each runofcabletrayshallbecompletedbeforelayingofcables.Cabletraysshallbeerectedso asto be exposed and accessible.

5.3 BuriedDirectlyInGround

5.3.1 General

Cables shall be so laid that they will not interfere with underground structures. All water pipes, sewage lines orotherstructures whichbecomeexposed by excavation shall be properlysupported and protected from injury until the filling has been rammed solidly in places under and around them. Any telephone or other cables coming in the way are to be properly shielded as directed by the Management committee. Surface of the ground shall be made good so as to conform in all respects to the surrounding ground to the satisfaction of the Management committee.

5.3.2 Routingofcables

Before cable laying work is undertaken, the route of the cables shall be decided with the Management committee. While shortest practicable route shall be preferred, cable runs shall follow fixed development such as roads, footpaths etc with proper off-sets so that future maintenance and identification are rendered easy. Whenever cables are laid along well demarcated or established roads, the LV/MV cables shall be laid further from the kerb line thanHV cables. Cablesof different voltages and also power and control cables shall be kept indifferent trencheswith adequate separation. Where availablespace is restricted,LV/MV cables shall be laid
above HV cables. Where cables cross one another, the cables of higher voltage shall be laid at a lower level than the cables of lower voltage. Power and communication cables shall as far as possible cross at right angles. Where power cables are laid in proximity to communications cables the horizontal and vertical clearances shall not normally be less than 60 cm.

5.3.3 WidthOfTrench

The width of trench shall be determined on the following basis. The minimum width of trench for laying single cables shall be 350 mm. Where more than one cable is to be laid in the same trenchin horizontal formation, the width of trench shall be increased such that the inter-axial spacing between the cables except where otherwise specified shall be at least 200 mm. There shall be a clearance of at least 150 mm between axis of the end cables and the sides of the trench.

5.3.4 DepthOfTrench

The depth of trench shall be determined on the following basis:

- Wherecablesarelaidinsingletierformation, the total depth of the trench shall not be less than 750 mm for cables up to 1.1 kV and 1250 mm for cables above 1.1 kV.
- Whenmorethanonetierofcables isunavoidableandverticalformationoflayingisadopted, the depth of trench shall be increased by 300 mm for each additional tier to be formed.

5.3.5 ExcavationOfTrenches

The trenches shall be excavated in reasonably straight lines. Wherever there is a change in direction, suitable curvature of 12 times the overall diameter of the largest cable shall be provided. Where gradients and changes in depths are unavoidable these shall be gradual. Excavation should be done by any suitable manual or mechanical means. Excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench. Adequate precautions shall be taken not to damage any existing cables, pipes or other such installations during excavation. Wherever bricks, tiles or protected covers or bare cables are encountered, further excavation shall not be carried out without the approval of the Management committee. Existing property exposed during trenching shall be temporarily supported or propped adequately as directed by the Management committee. The trenching in such cases shall be done in short lengths, necessary pipes laid for passing cables therein and the trench refilled as required. If there is any danger of a trench collapsing or endangering adjacent structures the sides shall be well shored up with timbering and/or sheathing as the excavation proceeds. Where necessary these may even be left in place when back filling the trench. Excavation through lawns shall be done in consultation with the Management committee. Bottom of the trench shall be level and free from stone, brick, etc. The trench shall then be provided with a layer of clean dry sand cushion of not less thanm in depth.

5.3.6 LayingOfCableInTrench

The cable drum shall be properly mounted on jacks or on a cable wheel at a suitable location. It should be ensured that the spindle, jack etc are strong enough to carry the weight of the drum without failure and that the spindle is horizontal in the bearings so as to prevent the drum creepingtoonesidewhilerotating. The cableshall be pulled overrollers in the trench steadily and uniformly without jerks or strains. The entire cable length shall, as far as possible, be laid in one stretch. Howeverwhenthis is not possible theremainder of the cableshall be proved by flaking

i.e. making one long loop in the reverse direction. After the cable is uncoiled and laid over the rollers, the cable shall be lifted slightly over the rollers beginning from one end by helpersstanding about 10 metres apart and drawn straight. The cable should then be taken off the rollers by additional helpers lifting the cables and then laid in the trench in a reasonably straight line. For short runs and cable sizes upto 50 sq mm 1.1 kV grade the alternative method of direct handling can be adopted with the prior approval of the Management committee. If two or more cables are laid in the same trench care should be taken to preserve relative position. All the cables following the same routes shall be laid in the same trench. Cables shall not cross each other as far as possible. When the cable has been properly straightened the cores shall be tested for continuity and insulation resistance. The cable shall be measured thereafter. Suitable moisture sealing compound/tape shall be used for sealing of the ends. Cable laid in trenches in a single tier formation shall have a covering of clean dry sand of less than 170 mm above not the base cushion ofsandbeforetheprotectivecoverislaid.Inthecaseofverticalmulti-tierformationafterthefirst cable has been laid a sand cushion of 300 mm shall be provided over the initial bed before the secondtierislaid. Ifadditional tiersareformedeachofthesubsequenttiers also shallhavea sand cushion of 300 mm. The top most cable shall have a final sand covering not less than 170 mm before the protective cover is laid. A final protection to cables shall be laid to provide warning to future excavators of the presence of the cable and also to protect the cables against accidental mechanical damage. Such protection shall be with second class bricks of not less than 200 mm x 100 mm x 100 mm (normal size) laid breadth wise for the full length of the cable to thesatisfaction of the Management committee. Where more than one cable is to be laid in the same trench this protective covering shall cover all the cables and project at least 50 mm over the sides of the end cables. In addition bricks on edge shall be placed along the entire run on either side of the cable run. The trenches shall then be back filled with excavated earth free from stones orother sharp edged debris and shall be rammed and watered in successive layers not exceeding300 mm. Unless otherwise specified a crown of earth not less than 50 mm in the centre and tapering towards the side of the trench shall be left to allow for subsidence. The crown of earth should however not exceed 100 mm so as not to be a hazard to vehicular traffic. Where road bermsor lawns have beencut or kerb stones displaced the same shall be repaired and made good to the satisfaction of the Management committee and all surplus earth and rocks removed to places as specified.

5.3.7 LayingInPipes/ClosedDucts

In locations suchas road crossings, entry to buildings/poles in pavedareasetc., cables shall belaid in pipes or closed ducts. Spun reinforced concrete pipes shall be used for such purposes and the pipe shall not be less than 100 mm in diameter for a single cable and not less than 150 mm for more than one cable. These pipes shall be laid directly in ground without any special bed. Sand cushioning and/or brick tiles need not be used insuchinstallations. Unless otherwise specified the top surface of pipes shall be at a minimum depth of 1000 mm from the ground level when laid under roads, pavements etc. The pipes for road crossings shall preferably be on the skew toreduce the angle of bend as the cable enters and leaves the crossing. Pipes shall be continuousand clear of debrisor concrete beforecable is drawn.Sharp edges at ends shall be smoothened to prevent injury to cable insulation or sheathing. No deduction shall be made for sand and bricksnot used for cables passing through RCC Hume pipes or for parts of vertical cables at the lighting poles. Wherever so required, cables shall be laid at the bed of the lake through existing PVC pipeas itemized in bill of quantities.

5.3.8 LayingOfCablesInFloors

Laying of cables directly in floors shall be avoided and GI pipes of adequate size shall be used wherever necessary. However if the cables have to be laid direct in the floor specific written approval of the Management committee shall be obtained and the Contractor shall cut chases, lay the cables and make good the chases to original finish.

5.3.9 CableEntryintoBuildings

Cable entry into buildings shall be made through RCC pipes recessed in the floor. RCC Hume pipes shall be provided well in advance for service cable entries. The pipe shall be filled with sand and sealed at both ends with bitumen mastic to avoid entry of water. Suitable size manholes shall be provided wherever required to facilitate drawing of cables as per requirements.

6. TERMINATION/JOINTINGOFCABLES

Soldered jointing/termination shall be totally avoided. Solderless terminations by using Dowel crimping tools and suitable legs shall be adopted for all cable terminations. Any terminations may without use of proper crimping tool is/ shall be liable to be rejected. In the case of aluminium conductors, it is to be ensured that the conductor oxidation is cleaned by means of emery paper and then a thin coat of tin is applied before pinching into any equipment. Heat shrinkableRaychem type or approved equivalent terminations shall be provided for High Voltage cables and Siemens make or approved equivalent make brass double compression glands shall be providedfor Medium Voltage cable terminations. Straight through jointing of Medium Voltage or High Voltage cable shall normally be totally avoided. If absolutely unavoidable, such jointing shall be carried out as per procedure to be got specifically approved from the Management committee.

7. MEASUREMENTOFCABLERUNS

Thecablerunsshallbemeasureduptotheouterendoftheboxeswithoutanyallowancesforover lapinjoints.Theactualrunofthecables shallbemeasuredandtherateshallincludealltheabove mentioned material, labour etc for laying as required.

8. CABLELOOPS

 $\label{eq:linear} At the time of the installation approximately 3 meters of surplus cables hall be left$

- ateachendofthe cable.
- oneachsideofundergroundstraightthrough/tee/terminationjoints.
- atentriestobuildings.
- and such other places as may be decided by the Management committee.

Thiscableshallbeleftintheformofa loop.

Whereverlongrunsofcablelengthareinstalledcableloopsshallbeleftatsuitableintervalsas specified by the Management committee.

9. BONDINGOFCABLES.

Where a cable enters any piece of apparatus it shall be connected to the casting by means of an approved type of armoured clamp or gland. The clamps must grip the armouring firmly to thegland or casting, so that in the event of ground movement no undue stress is placed on to thecable conductors.

10. TESTING

10.1 TestsatManufacturer'sWork

The cabless hall be subjected to shop test in accordance with relevant standards to prove the design and general qualities to the cables as below (as per IS 10810) :

- Routinetestoneachdrumof cables.
- Acceptancetestsondrumschosenatrandomforacceptanceofthe lot.
- Type test on each type of cables, inclusive of measurement of armour DC resistance of power cables.

10.2 SiteTesting

- All cables before laying shall be tested with a 500 V megger for 1.1 kV grade or with a 2,500/5,000 V megger for cables of higher voltages. The cables cores shall be tested for continuity, absence of cross phasing, insulation resistance to earth/sheath/armour and insulation resistance between conductors.
- All cables shallbe subject o abovementioned test during laying, before covering the cables by protective covers and back filling and also before the jointing operations.
- Afterlayingandjointing, the cables hall be subjected to a 1.5 minutes AC/DC pressure test.
- In the absence of facilities for pressure testing in accordance with clause above it is sufficient to test for one minute with 1000 V megger for cables of 1.1 kV grade and with 2,500/5,00 V megger for cables of higher voltages.

10.3 TestWitness

Tests shall be performed in presence of representative of the Management committee. The Contractorshallgiveatleastfifteen(15)daysadvancenoticeofthedatewhenthetestsaretobe carried out.

MEDIUMVOLTAGESWITCHGEAR

1. GENERAL

This section covers specification of Medium Voltage Switchboards incorporating items of switchgear like Circuit Breakers, SFUs, metering and protection

2 STANDARDSANDCODES

The followingIndianStandardSpecificationsand CodesofPracticewillapplytothe equipmentand the work covered by the scope of this contract. In addition, the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

BIS certified equipment shall be used as a part of the Contract in line with Governmentregulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.

 $\label{eq:listobenoted} It is to be noted that updated and current Standards shall be applicable irrespective of those listed below.$

LowVoltageswitchgear&controlgearIS13947:1993 Part I

:General rules

PartII:Circuit Breakers

PartIII:Switches, dis-connectors, switch dis-connectors and fuse combination units PartIV:Contactors and Motorstarters

PartV:Controlcircuitdevicesandswitchingelements Marking

of Switchgear busbarsIS 11353 : 1985

Degree of Protection of Enclosures for low voltages witch gear. IS 2147: 1962

Electrical relays for power system protection IS 3231 : 1986

CodeofPracticeforselection, installation and Maintenanceofswitchgear&control gearIS10118 :1982

Low voltages witch gear & control gear assemblies IS8623: 1993

3. SWITCHGEAR

4.

3.1 MediumVoltageAirCircuitBreakers

3.1.1 TechnicalParameters

• The circuit breaker shall be of the air break type, robust and compact design suitable for indoor mounting and shall comply with the requirement of IS: 13947 : 1993. Rupturing capacity shall be MVA at 415 Volts or as per schedule of quantities.

3.1.2 ConstructionalFeatures

- The Circuit Breaker shall be flush front, metal clad, horizontal draw-out pattern, three/four pole as required and fully interlocked. Each Circuit Breaker shall be housed in a separate compartment enclosed on all sides.
- The Circuit Breaker cradle shall be designed and constructed to permit smooth withdrawal and insertion. The movement shall be free of jerks, easy to operate and positive.
- All current carrying parts in the breaker shall be silver plated and suitable arcing contacts shall be provided to protect the main contacts which shall be separate from the main contacts and easily replaceable. In addition, Arc chutes shall be provided for each pole, and these shall be suitable for being lifted out for the inspection of the main and the arcing contacts.
- Self aligning cluster type isolating contacts shall be provided for the Circuit Breaker, with automatically operated shutters to screen live cluster contacts when the Breaker is withdrawn from the cubicle. Sliding connections including those for the auxiliary contacts and control wiring shall also be of the self aligning type. The fixed portion of the sliding connections shall have easy access for maintenance purposes.
- The cubicle for housing the Breaker shall be free standing dead front pattern, fabricated from the best quality sheet steel.

3.1.3 OperatingMechanism

- The Circuit Breaker shall be trip free with independent manual spring operated or motor wound spring operated mechanism as specified and with mechanical ON/OFF indication. The operating mechanism shall be such that the circuit breaker is at all times free to open immediately the trip coil is energised.
- Theoperatinghandle and mechanical trippush button shall beat the front of and integral with the Circuit Breaker.
- The Circuit Breaker shall have the following four distinct and separate positions which shall be indicated on the face of the panel.

"Service"--Bothmainandsecondaryisolatingcontactsclosed

"Test"--Mainisolatingcontactsopenandsecondaryisolatingcontactsclosed

"Isolated" -- Both main and secondary isolating contacts open

"Maintenance"--CircuitBreakerfullyoutsidethepanelreadyformaintenance

3.1.4 CircuitBreakerInterlocking

- Sequencetypestrainfreeinterlocksshallbeprovidedtoensurethefollowing:
- It shall not be possible for the Breaker to be withdrawn from the cubicle when in the "ON"position. To achieve this, suitable mechanism shall be provided to lock the Breaker in the tripped position before the Breaker is isolated.
- It shall not be possible for the Breaker to be switched "ON" until it is either in the fully inserted position or, for testing purposes, it is in the fully isolated position.
- ItshallnotbepossiblefortheCircuitBreakertobepluggedinunlessitisintheOFFposition.
- A safety catch shall be provided to ensure that the movement of the Breaker, as it is withdrawn, is checkedbefore it completelyoutof the cubicle, thus preventing its accidental fall due its weight.
- Mechanicalandelectricalanti-pumpingdevicesshallbeincorporatedintheACB'sasrequired.

3.1.5 CircuitBreakerAuxiliaryContacts

The CircuitBreaker shall haveminimum 6 N.O. and6N.C. auxiliary contacts rated at 16 amps415 volts50Hz.Thesecontactsshallbeapproachablefromthefront.Theyshallclosebeforethemain contacts when the Circuit Breaker is plugged in and vice versa when the Circuit Breaker is Drawn Out of the cubicle.

3. 1.6 ProtectiveDevices

- The Circuit Breaker shall have protective devices as required and approved by the Management committee. These will in general be:
- C.T. operated thermal overload releases with magnetic instantaneous short circuit release. The overload releases shall be such that each phase can be individually set depending on the phase unbalanced currents. The releases shallhave inverse time current characteristicsand themagnetic release shall be time delayed with a minimum setting of 25 ms varying upto 300 ms for discrimination without affecting the breaking current capacity of the ACB.
- Overvoltage relay.
- Under/novoltagetripcoilorRelayasrequired.
- OvercurrentandearthfaultIDMTrelayswithshunt/seriestripcoiloperationasspecified.
- The Circuit Breakers shall be suitable to accommodate one or more types of protection asspecified.

3.1.7 InstrumentTransformers

The Circuit Breaker shall have the required Current Transformers as specified for metering and protectionmountedoutside the Circuit Breaker compartment but within the free standing cubicle. The transformers shall comply to the relevant Indian Standards and the Class of Accuracy required for metering and protection. Separate sets of Current transformers shall be provided.

3.1.8Metering

The metering required to be provided for each Circuit Breaker shall be as approved by Management committee. Such metering shall not be provided on the front panel of the Circuit Breaker compartment. A separate compartment shall be provided for the metering and Protective relays as required.

SquarepatternflushmountingmeterscomplyingwiththerequirementsoftherelevantIndian Standards shall only be used.

SelectorswitchesofthethreewayandOFFpatterncomplyingtotherelevantIndianStandards shall be used.

3.1.9 IndicatingLamps

LED type indicating lamps shall be provided for indication of phases and Breaker position as required.

3.1.10ControlWiring

All wiring for relays and meters shall be of copper conductor PVC insulated and shall be colour codedandlabelledwithappropriate plastic ferrules foridentification. The minimum size of control wires to be used shall be 1.5 sq mm.

All control circuits shall be provided with protective H.R.C. fuses. Instrument testing plugs shall be provided for testing the meters.

3.1.11Earthing

The frame of the Circuit Breaker shall be positively earthed when the Circuit Breaker is racked into the cubicle.

3. 1.12TypeTest Certificates

TheContractorshallsubmittypetestcertificatesfromarecognisedtesthousefortheCircuit Breakers offered.

3.2. SwitchFuseUnits

Switch fuse units, incorporated in switchboards wherever required shall conform in all respects to IS 13947: 1993. Switch fuse units shall be suitable for 415 Volts 3 Phase 40 HZ AC supply.

Unit housingshall be ofrobust construction designed to withstand arduous conditions. Sheet steel used shall be given rigorous rust proofing treatment before fabrication and painting .Units shall have double break per phase in order to isolate fuse links when the switch is in OFF position.

Operating mechanism of units shall be crisp and positive in action with quick- make and quick- break silver plated contacts. Operating handle shall be suitable for rotary operation unless otherwise specified. Position of handle such as ON and OFF shall be clearly indicated.

Alllivepartsinsidetheswitchfuseunitsshallbeshroudedtopreventanyaccidental contact.

All the terminals shall be liberally designed. All units above 100 A shall be provided with integral cable sockets.

All switch units shall be provided with suitable interlocks such that the door of the switchboard panel shall notopen unless witch in OFF position. Provision for padlocking the switch in OFF position shall also be provided.

Routine and type tests as per IS 13947: 1993 shall be conducted at works and test certificates furnished.

3.3. MouldedCaseCircuitBreakers

Moulded case circuit breakers (MCCB) or fuse free breakers, incorporated in switchboards wherever required, shall conform to IS 13947: 1993 in all respects. MCCBs shall be suitable either for single phase 240 Volts or 3 Phase 415 Volts AC 50 HZ supply.

MCCB cover and case shall be made of high strength heat resisting and flame retardant thermosetting insulating material. Operating handle shall be quick make/break, trip - free type. Operating handle shall have suitable ON, OFF and TRIPPED indicators. Three phase MCCBs shall have a common handle for simultaneous operation and tripping of all the three phases. Suitable arc extinguishing device shall be provided for each contact. Tripping unit shall be of thermal/magnetic type provided on each pole and connected by a common trip bar such that tripping of any one pole causes three poles to open simultaneously. Thermal/magnetic tripping device shall have IDMT characteristics for sustained over loads and short circuits.MCCB shall be line load reversible type.MCCB shall be provided with rotary handle.

Contacttripsshallbemadeofsuitablearcresistantsinteredalloy.Terminalsshallbeofliberal design with adequate clearances.

MCCBsshallbeprovidedwithfollowingaccessories, if specified indrawings/schedule of quantities:

- Undervoltage trip
- Shunttrip
- Alarmswitch
- Auxiliaryswitch

MCCBsshallbeprovided with following interlocking devices for interlocking the door as witch board.

- Handleinterlocktopreventunnecessarymanipulationsofthebreaker.
- DoorinterlocktopreventdoorbeingopenedwhenthebreakerisinONposition
- De-interlockingdevicetoopenthedoorevenifthebreakerisinONposition.

 $\label{eq:MCCBsshallhaverupturing capacity as specified indrawings and approved by Management committee.$

3.4. Metering, InstrumentationAndProtection.

Ratings, type and quantity of meters, instruments and protective devices shall be as per drawings and schedule of quantities.

CurrentTransformers

C/Ts shall confirm to IS 2705 (part -I, II and III) in all respects. All C/Ts used for medium voltage application shall be rated for 1 kV. C/Ts shall have rated primarycurrent, rated burden and class of accuracy as specified in drawings. Rated secondary current shall be 5A unless otherwise stated. Minimumacceptableclassformeasurementshallbeclass0.5to1andforprotectionclass10. C/Ts shall be capable of withstanding magnetic and thermal stresses due to short circuit faults of 31 MVA on medium voltage. Terminals of C/Ts shall be paired permanently for easy identification of poles. C/Ts shall be provided with earthing terminals for earthing chassis, frame work and fixed part of metal casing (if any). Each C/T shall be provided with rating plate indicating:

- Nameand make
- Serialnumber
- Transformationratio
- Ratedburden
- Ratedvoltage
- Accuracyclass

CTs shall be mounded such that they are easily accessible for inspection, maintenance and replacement. Wiring for CT shall be with copper conductor PVC insulated wires with proper termination works and wiring shall be bunched with cable straps and fixed to the panel structure a neat manner.

PotentialTransformer

PTsshallconfirmtoIS3156(Part-I,IIandIII)inallrespects.

MeasuringInstruments

Direct reading electrical instruments shall conform to IS 1248 or in all respects. Accuracy of direct readingshallbe1.0ofvoltmeterand1.5forammeters.Otherinstrumentsshallhaveaccuracyof 1.5.Meters shall be suitable for continuous operation between -10°C and + 50°C. Meters shall be flush mounting and shall be enclosed in dust tight housing. The housing shall be of steel orphenolic mould. Design and manufacture of meters shall ensure prevention of fogging of instrument glass. Pointer shall be black in colour and shall have Zero position adjustment device operable from outside. Direction of deflection shall be from left to right. Selector switches shall be provided for ammeters and volt meters used in three phase system.

Ammeters

Ammeters shall be of digital type. Ammeters shall normally be suitable for 5 A secondary of current transformers.

 $\label{eq:label} Ammeters shall be capable of carrying substantial overloads during fault conditions.$

Voltmeters

Voltmeters shall be digital type range of 3 phase 415 volt voltmeters shall be 0-500. Volt meters shall be provided with protection fuse.

Wattmeter

Wattmeter shall be of 3 phase digital type and shall be provided with a maximum demandindicator if required.

Powerfactormeters

3 phase power factor meters shall be of digital type with current and potential coils suitable for operation with current and potential transformers provided in the panel. Scale shall be calibrated for 50% lag - 100% - 50% readings. Phase angle accuracy shall be +40.

Energyandreactivepowermeters

Trivector meters shall be two element, integrating type, KWH, KVA, KVA hour reactive meters. Meters shall confirm to IEC 170 in all respects. Energy meters, KVA, and KVARH meters shall be provided with integrating registers. The registers shall be able to record energy conception of 500 hours corresponding to maximum current at rated voltage and unity power factor. Meters shall be suitable for operation with current and potential transformers available in the panel.

Relays

Protection relays shall be provided with flag type indicators to indicate cause of tripping. Flag indicators shall remain in position till they are reset by hand reset. Relays shall be designed tomake or break the normalcircuit currentwithwhich they areassociated. Relay contacts shall be of silver or platinum alloy and shall be designed to withstand repeated operation without damage. Relays shall be of draw out type to facilitate testing and maintenance. Draw out case shall be dust tight. Relays shall be capable of disconnecting faulty section of network without causing interruption to remaining sections. Analysis of setting shall be made considering relay errors, pickup and overshoot errors and shall be submitted to the Management committee for approval.

Overcurrentrelays

Over current relays shall be induction type with inverse definite minimum time lag characteristics. Relays shall be provided with adjustable current and time settings. Setting for current shall be 50to 200 % insteps of 25%. The IDMT relay shall have time lag (delay) of 0 to 3 seconds. The time setting multiplier shall be adjustable from 0.1 to unity. Over current relays shall be fitted with suitable tripping device with trip coil being suitable for operation on 5 Amps.

Earthfaultrelay

Same as over current relay excepting the current setting shall be 10% to 40% in steps of 10%.

Undervoltagerelay

Under voltage relays shall be of induction type and shall have inverse limit operationcharacteristics with pickup voltage range of 50 to 90% of the rated voltage.

3.5. PowerFactorCorrectionCapacitors

Power factor correction capacitors shall conform to IS 2834 in all respects. Approval of insurance association of India shall be obtained, if called for. Capacitors shall be suitable for 3 phase 415volts 50 HZ supply and shall be available in single and three phase units of 5, 10, 15, 20, 25kVAR sizes. Capacitor shall be usable for indoor use, permissible overloads being as below.

- Voltage overloads shall be 10% for continuous operation and 15% for six hours in a 24 hourscycle.
- Current overloads shall be 15 % for continuous operations and 50% for six hours in a 24 hours cycle.
- Overloadof30% continuously and 45% for six hours in a 24 hours cycle.

Capacitors shall be hermetically sealed in sturdy corrosion proof sheet steel containers and impregnated with non inflammable synthetic liquid. Every element of each capacitor unit shall be provided with its own built in silvered fuse. Capacitors shall have suitable discharge device to reduce the residual voltage from crest value of the rated voltage to 50 volts or less within one minute after capacitor is disconnected from the source of supply. The loss factor of capacitor shall not exceed 0.005 for capacitors with synthetic impregnates. The capacitors shall withstand power frequency test voltage of 2500 volts AC for one minute. Insulation resistance between capacitors terminals and containers when a test voltage of 500 volts DC is applied shall not be less than 50 mega ohms.

4. MEDIUMVOLTAGESWITCHBOARDS

4.1 General

MainLTPanel shallbesupplied asperBOQ, specifications & drawings (SLD). Main LTPanel shallbe indoor type, metal clad, floor mounted, free standing, totally enclosed, extensible type, air insulated, cubicle type for use on 415 Volts, 3 phase, 50 cycles system with a fault level withstand of 50 KA RMS symmetrical. Main LT Panel shall be provided with AMF circuit for DG incomer breaker, micro PLC for autoload management/auto load sharing as required Hardware & Software (asperthe BOQ) to achieve the autostart/stop of DGS ets, autochange over, buscoupler switching & interlocking of incomer & bus coupler breakers of Main LT Panel.

- Allmediumvoltageswitchboardsshallbesuitableforoperationatthree phase/threephase4wire, 415 volt, 50 Hz, neutral grounded at transformer system with a short circuit level withstand of 31 MVA at 415 volts or as per schedule of quantities.
- The Switch Boards shall comply with the latest edition with upto date amendments of relevant Indian Standards and Indian Electricity Rules and Regulations.

4.2 SwitchBoardConfiguration

- The Switch Board shall be configured with Air Circuit Breakers, MCCB's, and other equipment asrequired and approved by Management committee.
- TheMCCB'sshallbearrangedinmulti-tierformationwhereastheAirCircuitBreakersshallbe arranged in Single or Double tier formation only to facilitate operation and maintenance.
- The Switch Boards shall be of adequate size with a provision of 25% spare space to accommodate possible future additional switch gear.

4.3 EquipmentSpecifications

All equipment used to configure the Switch Board shall comply to the relevant Standards and Codes of the Bureau of Indian Standards and to the detailed technical Specifications as included in this tender document.

4.4 ConstructionalFeatures

- The Switch Boards shall be metal enclosed, sheet steel cubicle pattern, extensible, dead front, floor mounting type and suitable for indoor mounting.
- The Switch Boards shall be totally enclosed, completely dust and vermin proof. Synthetic rubber gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust and vermin proofto provide a degree of protection of IP 54. All doors and covers shall also be fully gasketed with synthetic rubber and shall be lockable.
- The Switch Board shall be fabricated with CRCA Sheet Steel of thickness not less than 2.0 mm and shall be folded and braced as necessary to provide a rigid support for all components. The doors and covers shall be constructed from CRCA sheet steel of thickness not less than 1.6 mm. Joints of any kind in sheet metal shall be seam welded and all welding slag ground off and welding pits wiped smooth with plumber metal.
- All panels and covers shall be properly fitted and square with the frame. The holes in the panel shall be correctly positioned.
- Fixing screws shall enter holes tapped into an adequate thickness of metal or provided with hank nuts. Self threading screws shall not be used in the construction of the Switch Boards.

4.5 SwitchboardDimensionalLimitations

- Abasechannel75mmx5mm thickshallbeprovidedatthebottom.
- A minimum of 200 mm blank space between the floor of switch board and bottom most unit shall be provided.
- The overall height of the Switch Board shall be limited to 2400 mm
- Theheightoftheoperatinghandle,pushbuttonsetcshallberestrictedbetween300mmand 1800 mm from finished floor level.

4.6 SwitchBoardCompartmentalization

 $\label{eq:constraint} The Switch Board shall be divided into distinct separate compartments comprising$

- A completely enclosed ventilated dust and vermin proof bus bar compartment for the horizontal and vertical busbars.
- EachcircuitbreakerandMCCBshallbehousedinseparatecompartmentsenclosedonallsides.
- Sheet steel hinged lockable doors for each separate compartment shall be provided and duly interlocked with the breaker/switch fuse unit in "on" and "off" position.
- For all Circuit Breakers separate and adequate compartments shall be provided foraccommodating instruments, indicating lamps, control contactors and control fuses etc. Theseshall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker, busbars and connections.
- A horizontal wire way with screwed cover shall be provided at the top to take interconnecting control wiring between vertical sections.
- Separate cable compartments running the height of the Switch Board in the case of front access Boards shall be provided for incoming and outgoing cables.
- Cable compartments shall be of adequate size for easy termination of all incoming and outgoing cables entering from bottom or top.
- Adequateandpropersupportshallbeprovidedincablecompartmentstosupportcables.

4.7 SwitchBoardBus Bars

- The Bus Bar and interconnections shall be of electrolytic Copper/Aluminium and of rectangular cross sections suitable for full load current for phase bus bars. The maximum current density for coppershallbe1.25ampspersq.mm.andforAluminium shallbe.8ampperSq.mm.andsuitable to withstand the stresses of a 31 MVA fault level or at 415 volts for 1 second or as per schedule of quantities.
- The busbars and interconnections shall be insulated within sulation tape / fiberglass.
- ThebusbarsshallbeextensibleoneithersideoftheSwitch Board.
- The bus bars shall be supported on non-breakable, non-hygroscopic insulated supports at regular intervals, to withstand the forces arising from a fault level of 31 MVA at 415 volts for 1 second.
- Allbusbarsshallbecolourcoded.
- All bus bar connections inSwitch Boards shall be bolted with brass bolts and nuts. Additional cross section of bus bars shall be provided wherever holes are drilled in the bus bars.

4.8 SwitchBoardInterconnections

- All connections between the bus bars/Breakers/cable terminations shall be through solid copper strips of adequate size to carry full rated current and PVC/fibre glass insulated.
- For unit ratings upto 100 amps PVC insulated copperconductor wires of adequate size to carry full load current shall be used. The terminations of all such interconnections shall be crimped.

4.9 DrawoutFeatures

Air Circuit Breakers shall be provided in fully drawout cubicles. These cubicles shall be such that drawout is possible without disconnection of the wires and cables. The power and control circuits shall have self aligning and self isolating contacts. The fixed and moving contacts shall be easily accessible foroperation and maintenance. Mechanical interlocks shall be provided on the drawout cubicles to ensure safety and compliance to relevant Standards. The MCCB's shall be provided in fixed type cubicles.

4.10 InstrumentAccommodation

- Instruments and indicating lamps shall not be mounted on the Circuit Breaker Compartment door for which a separate and adequate compartment shall be provided and the instrumentation shall be accessible for testing and maintenance without danger of accidental contact with live parts of the Switch Board.
- ForMCCB'sinstrumentsandindicatinglampscanbeprovidedonthecompartmentdoors.
- The current transformers for metering and for protection shall be mounted on the solid copper/aluminium busbars with proper supports.

4.11 Wiring

All wiring for relays and meters shall be with PVC insulated copper conductor wires. The wiring shall be coded and labelled with approved ferrules for identification. The minimum size of copper conductor control wires shall be 1.5 sq. mm.

4.12 CableTerminations

- Knockout holes of appropriate size and number shall be provided in the Switch Board inconformity with the location of incoming and outgoing conduits/cables.
- The cable terminations of the Circuit Breakers shall be brought out to terminal cable sockets suitably located at the rear of the panel.

- The cable terminations for the MCCB's shall be brought out to the rear in the case of rear access switchboards or in the cable compartment in the case of front access Switch Boards.
- The Switch Boards shall be complete with tinned brass cable sockets, tinned brass compression glands, gland plates, supporting clamps and brackets etc for termination of 1100 volt grade aluminium conductor PVC/PVCA cables.

4.13 SpaceHeaters

TheSwitchBoardshallhaveineachpanelthermostaticallycontrolledspaceheaterswitha controlling 15 amp 230 volt switch socket outlet to eliminate condensation.

4.14 Earthing

AmainearthbarofG.I./copperasrequiredshallbeprovidedthroughoutthefullengthofthe Switch Board with a provision to make connections to the sub-station earths on both sides.

4.15 SheetSteelTreatmentAndPainting

- Sheet Steel materials used in the construction of these units should have undergone a rigorousrust proofing process comprising of alkaline degreasing, descaling in dilute sulphuric acid and a recognised phosphating process. The steel work shall then receive two costs of oxide filler primer before final painting. Castings shall be scrupulously cleaned and fettled before receiving a similar oxide primer coat.
- All sheet steelshall aftermetal treatment be sprayorpowder painted with two coatsof shade692 to IS 5 on the outside and white on the inside. Each coat of paint shall be properly stoved and the paint thickness shall not be less than 50 microns.

4.16 NamePlatesAndLabels

Suitable engraved white on black name plates and identification labels of metal for all Switch Boards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

4.17 Installation

The foundations prepared as per the manufacturers drawings shall be levelled, checked for accuracy and the Switch Board installed. All bus bar connections shall be checked with a feeler gauge after installation. The able end boxes shall be sealed to prevent entryof moisture. The main earth bar shall be connected to the sub-station earths.

A 15 mm thick rubber matting of approved make on a 100 mm high timber platform shall be provided infront of and along the full length of the Switch Board. The width of the matting shall be 1000 mm. The rubber mat shall with stand 15 KV for 1 minute and leakage current shall not exceed 160 mA/sq. metre.

 $\label{eq:approx} After installation the Switch Board shall be tested as required prior to commissioning.$

4.18 <u>Testing&Commissioningatsitebythirdparty</u>

- a) Alignmentofpanel, interconnection of Busbars and tightness of bolts and connection.
- b) Interpanelwiring
- c) Freemovementof ACB/MCCB/SFU

- d) Operationofbreakers
- e) InsulationTests
- f) Primary&secondaryinjectiontestsofrelays.
- g) Interlockingfunction.

BUSDUCT

1 INTRODUCTION

Bus ducts shall be provided to connect transformer MV side/DG sets to Main LT Panels/Main Emergency Panel. Bus ducts shall be supplied in convenient lengths and shall be capable of easy assembly at site. Bus ducts shall incorporate flexible bellows, bends, risers, jumpers and connections etc. as required.

2 STANDARDS

Bus ducts shall conform to IS 8623 Part 2 - 1993. Rating of bus ducts shall be as specified in drawings and and approved by Management committee. Design data in support of temperature rise being within permissible limits and adequacy of supports to withstand mechanical stresses, during normal and short circuit conditions, shall be furnished along with the tender.

3 SYSTEMPARAMETERS

Busductsshallbesuitableforfollowingsystem parameters:

Busbars	:	0.8/1A
Nominal voltage	:	415 Volts
Number of conductors	:	3Phase4wire
Maximum system voltage	:	500 Volts
Power frequency withstand	:	2500 Volts
Temperature rise	:	35°Cabove45°Cambient(bustemperature80°C)
Short circuit strength	:	As per IS 8623 Part I and II

4 CONSTRUCTION

Bus ducts shall be enclosed type with bus bars being sleeved with PVC sleeve. Bus ducts and enclosure testing shall withstand thermal and mechanical stresses due to system short circuit withoutdeformation.Busbars shall beof electricalwrought aluminium of crosssection calculated to allow temperature rise as specified above taking all de-rating factors into consideration. Maximum bus bar temperature shall not exceed 120°C during system short circuits for more than3 seconds and less than 5 seconds.Bus bars shall be held as close as possible to minimize reactance.Insulationshallbecapableforwithstanding130°Cwithoutdeterioration.Designshall

allow for expansion of adjacent bus bars and enclosure. Design shall permit a misalignment of 12 mmat transformer end..

5 ENCLOSURE

Bus ducts enclosure shall be of totally enclosed dust and vermin proof construction and shall be fabricated from 2 mm thick CRCA sheets suitablyrust proofed with alkaline degreasing, descaling and phosphating. The covers thickness shall not be less than 1.6 mm. Enclosure shall be given two coats of primer and then stove enamelled with finishing coats of enamel paint to give a paint film of minimum 50 Microns/galvanized. Enclosure shall have facility for suspension at regularintervals.Electrical bonding between adjacent sections of enclosure shall be ensured with proper external or internal connections. Double run of earth bus of specified size shall be provided throughout the run of bus ducts and connected to the system earth grid. Enclosure shall be provided with removable cover plates at top and bottom.

6 ACCESSORIES

Bus ducts shall be provided with right angle bends as required. Construction of bends shall be similar to straight length. Joints between bends and straight pieces shall be spliced and properly bolted, a slicing chamber being provided for the purposes. Adapter boxes shall be provided at end connections to transformers, panels etc. Flexible connections with copper flexible tapes of required size and number shall be provided at transformer & DG end.

11 KVSWITCHBOARDS

1. GENERAL

The technical specifications cover the equipment to be supplied for a 11 kV Switchboards suitable for 11 kV 3 phase earthed system. 50 HZ AC supply with a fault level of 350 MVA at 11kV. The equipment shall be suitable for continuous operation at the stipulated ambient conditions.

2. STANDARDSANDCODES

The following Indian Standards Specifications and Codes of Practice shall apply to the equipment covered by this Contract. In addition, the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

BIS certified equipment shall be used as a part of the Contract in line with Government Regulations. Necessary Test Certificates in support of the certification shall be submitted prior to supply of the equipment.

It is to be noted that updated and current Standards shall be applicable irrespective of those listed below.

11000voltCircuitBreaker IS13118;1991

 $Metal {\tt Enclosed Switchgear and Control gear for voltages above 1000 volts {\tt IS3427:} 1969$

Electrical Relays for Power System Protection IS 3231 : 1986

VoltageTransformers IS3156:1978

CurrentTransformers IS2705:1981

RubberMatsforElectricalWorksIS5424:1983

Danger Notice Plate IS 2551 : 1982

3. 11000VOLTCIRCUITBREAKERS

3.1 TechnicalParameters

The 11000 volt circuit breakers shall be triple pole Vacuum type suitable for indoor mounting and shall comply with the requirements of the relevant Indian Standards. The Circuit Breakers shall be suitable for operation at 11000 volts 3 phase 50 Hz supply system and shall have a certified symmetricalbreakingcapacityof350MVAat11000voltsorasstipulatedinscheduleofquantities.

3.2 TechnicalSpecifications

The Circuit Breakers shall be Vacuum type and shall consist of three identical single pole vacuum interrupter units which shall comprise of a pair of butt contacts enclosed within a sealed ceramic body with SS end plates. The moving contacts shall be sealed into the enclosure via a SS steel bellow which shall permit axial movement of the contact. The contact arrangement shall be surrounded by SS sputter shield to prevent condensation of metal on the inside of the insulating envelop and also to provide good voltage grading across the gap and the outer envelope. The contact material and the contact geometry shall be suitable for the purpose so as to attain current chopping at minimum current to prevent build-up of unduly high over voltages and to prevent the arc to cause localised high spots on the contact.

TheCircuitsBreakershallbesuitableforswitchingdutyofTransformers

4. CIRCUITBREAKERCONSTRUCTIONALFEATURES

The 33000 volt circuit breaker shall be flush front, metal clad, truck mounted , drawout type and fully interlocked. The truck that carries the Circuit Breaker shall be of rigid fabricated construction. Each Circuit Breaker shall be housed in a separate compartment enclosed on all sides.

EachwithdrawabletruckshallhaveitsownCircuitBreaker.

All electrical connections on the truck shall be brought to secondary plugs which engage similar sockets in the housing.

The Circuit Breakers shall be of the double break type. Interphase barriers and tank lining of insulating material shall be provided.

The drawout mechanism shall be so designed and constructed as to permit smooth withdrawaland insertion. The movement shall be free of jerks, easy to operate and positive.

All current carrying parts in the Circuit Breaker shall be silver plated and suitable arcing contacts shall be provided to protect the main contacts.

Isolating contacts of the spring loaded self aligning pattern shall be provided for the Circuit Breaker. Suitable arc control devices shall be mounted around the fixed contacts. Terminal insulators of synthetic resin bonded paper shall be provided suitable for the specified short circuit level

Sheetsteelbarriersshallbeprovidedbetween

- InstrumentPanelandPotentialTransformer
- InstrumentPanelandCurrentTransformers
- BusbarchamberandCircuitBreakercompartments

5. CIRCUITBREAKEROPERATINGMECHANISM

The Circuit Breaker shall be trip free and equipped with a motor power operated closing mechanism. The operating mechanism shall be such that the Circuit Breaker is at all times free to open immediately the trip coil is energised.

MechanicalON/OFFpositionindicationshallbeprovidedonthefrontofthecircuitbreaker. The

operating mechanism shall be mounted on the front panel of the truck.

Theoperatinghandle and the mechanical trip pushbut tonshall be at the front of and integral with the Circuit Breaker.

The operating mechanism shall provide four distinct and separate positions of the Circuit Breaker on the cradle

- Service
- Test
- Isolated
- Maintenance

6. CIRCUITBREAKERINTERLOCKING

Each Circuit Breaker shall be provided with the following mechanical safety interlocks to ensureprotection to the equipment and the operator.

The Circuit Breaker cannot be closed unless it is in the `PLUGGEDIN' position.

TheCircuitBreakercannotbewithdrawnfromorpushedintothehousingunlessthemain contacts are open.

The CircuitBreakercannotbe put into servicewithoutmaking thesecondaryconnectionsbetween the truck and housing.

The cover of the drawout voltage transformer cannot be open edunless the transformer is isolated.

7. CIRCUITBREAKERAUXILIARYCONTACTS

The Circuit Breaker shall have a minimum of 6 N.O. and 6 N.C. auxiliary contacts rated at 5 amps. Thesecontacts shallclose beforethemain contacts when theCircuit Breaker isplugged in and vice versa when the Circuit Breaker is lowered.

8. **PROTECTIVERELAYS**

The Circuit Breaker shall have over current, earth fault protection and auxiliary relay devices as required and approved by Management committee. These relays shall be mounted flush on a separate compartment with access from the rear for wiring and maintenance.

9. POTENTIALANDINSTRUMENTTRANSFORMERS

A drawout type cast resinvoltage transformer shall be mounted in the panel and connected to the line. The tank shall be arranged for horizontal isolation.

The Circuit Breaker shall have the required current transformers as required and approved by Management committee for metering and protection mounted outside the Circuit Breaker compartment but within the free standing cubicle. The transformers shall comply to the relevant Indian Standards. All current transformers for metering shall be Accuracy Class I and of capacity and ratio as required. Separate sets of current transformers shall be provided for metering and protection.

10. INSTRUMENTATION

Instruments and indicating lamps as required and approved by Management committee shall not be mountedontheCircuitBreakercompartmentdoor. A separateadequatecompartment shallbe provided. The instruments and relays shall be accessible for testing and maintenance without danger of accidental contact with live parts in the Switchgear Panel.

Square pattern flush mounting meters and selector switches of the three way and OFF pattern complying with the requirements of the relevant Indian Standards shall be used.

The current transformers for metering and protection shall be mounted on the solid copper busbars with proper supports.

 ${\tt LEDtypeindicating} lamps shall be provided for phase and other operational indications.$

11. TYPETEST CERTIFICATES

The Contractor shall submit type test certificates of the Circuit Breakers complying to the relevant Indian Standards from a recognised Test House.

12. 11KVSWITCHGEAR PANEL

12.1 General

The switchgear panels shall be suitable for operation at 11000 volt 3 phase 50 Hz supply system with ashortcircuitwithstand of 350 MVA at 11,000 volts and a corresponding short time rating for 1 second.

The Switchgear panels shall comply with the requirements of the latest edition with upto date amendments of the relevant Indian Standards Specifications, Indian Electricity Rules and Regulations.

12.2 SwitchgearConfiguration

Thepanelshallbeconfigured with 11,000 volt Circuit Breakers, associated metering and protective devices and other equipment and approved by Management committee.

Each11,000voltCircuitBreakershallbehousedinanindividualpanelinsingletierformation.

12.3 EquipmentSpecifications

All equipment used to configure the Switchgear Panel shall comply to the relevant Standards and Codes of the Bureau of Indian Standards and the detailed technical specifications as included in this tender document.

12.4 ConstructionalFeatures

The 11000 volts Switchgear Panel shall be totally enclosed, dead front, metal clad, cubicle pattern, floor mounting, extensible on both sides and suitable for indoor use.

The Switchgear Panels shall be totally enclosed and completely dust and vermin proof. Synthetic rubber gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust andverminproof.Alldoorsandcoversshallalso befullygasketedwithsyntheticrubber and shall be lockable.

The Switchgear Panels shall be fabricated with CRCA Sheet Steel of thickness not less than 2.0 mm and shall be folded and braced as necessary to provide a rigid support for all components. The doors and covers shall be constructed from CRCA Sheet Steel of thickness not less than 1.6 mm. Joints of any kind in sheet steel shall be seam welded and all welding slag ground off and welding pits wiped smooth with plumber metal.

All panels and covers shall be properly fitted and square with the frame. The holes in the panel shall be correctly positioned.

Fixing screws shall enter holes tapped into an adequate thickness of metal or provided with hank nuts. Self threading screws shall not be used in the construction of the Switchgear Panels.

12.5 SwitchgearPanelLimitations

 $\label{eq:label} A base channel of 75 mmx5 mmthick shall be provided at the bottom.$

TheSwitchgearPanelheightshallnormallyberestrictedtoamaximumof2300mm.

12.6 SwitchgearPanelCompartmentalisation

 $\label{eq:compartments} The Switchge ar Panels shall be divided into distinct separate compartments comprising$

A completely enclosed ventilated dust and vermin proof bus bar compartment for the vertical and horizontal busbars.

 ${\it Each Circuit Breakers hall behoused in a separate compartment enclosed on all sides.}$

Separate and adequate compartments shall be provided for accommodating instruments, indicating lamps, protective relays, control fuses etc as required. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts.

A horizontal wire way with screwed covers shall be provided at the top to take interconnecting control wiring between vertical sections.

Cable compartment shall be of adequate size for easy termination of all incoming and outgoing cables. Adequate and proper supports shall be provided in the compartment for supporting the cables.

12.7 SwitchgearPanelBusbars

The main horizontal and vertical interconnection busbars shall be of hard drawn high conductivity electrolytic copper and of rectangular cross sections suitable for full rated current. The current density for copper shall be 1.25 amps per sq. mm. and suitable to withstand the electromagnetic and thermal stresses of a 350 MVA fault level at 11,000 volts for 3 second.

 $The busbars and interconnections shall be insulated with fibre glass sleeves. \ The$

busbars shall be extensible on either side of the Panels.

The busbars shall be supported on non-breakable, non-hygroscopic insulated supports at regular intervals to withstand the stresses of a 350 MVA fault level.

Allbusbarsandinterconnectionsshallbecolourcoded.

The main horizontal busbars shall run through the entire length of the Switch gear Panels.

12.8 SwitchgearPanelInterconnections

All interconnections shall be with solid electrolytic copper of adequate size to carry the full rated current and fibre glass insulated.

12.9 DrawoutFeatures

All Circuit Breakers shall be provided in fully drawout cubicles. These cubicles shall be such that drawout is possible without disconnection of the wires and the cables. The power and control circuits shall have self aligning and self isolating contacts which shall be easily accessible for maintenance. Mechanical interlocks shall be provided on the drawout cubicles to ensure safetyand compliance to the relevant Standards.

12.10 SwitchgearPanelInterlocks

Each group of busbars and feeder connections shall be fitted with automatically operated safetyshutters with positive opening and closing when the Circuit Breaker is raised or lowered.

Facility shall be provided for hand operation of the shutters and latching in either open or closed position.

Padlockingprovision of the shutter in the closed positions hall be included formain tenance purposes.

12.11 InstrumentsAndProtectionRelays

Instruments, indicating lamps and all protection and control relays shall not be mounted on the Circuit Breaker compartment door. A separate adequate compartment shall be provided. The instruments and relays shall be accessible for testing and maintenance without danger of accidental contact with live parts in the Switchgear Panel.

LEDtypeindicatinglampsshallbeprovidedforphaseandotheroperational indications.

The current transformers for metering and protection shall be mounted on the solid copper busbars with proper supports.

12.12 SwitchgearPanelInternalWiring

All wiring for relays and metering shall be with PVC insulated copper conductor wires. The wiring shall be coded and labelled with approved ferrules for identification. The minimum size of copper conductor control wires shall be 2.5 sq.mm.

All control circuits shall be provided with 10 kA MCB's Instrument testing plugs shall be provided for testing the meters.

12.13 CableTerminations

Knock out holes of appropriate size and number shall be provided in the Panels in conformity with the location of the incoming and outgoing cables.

The cable terminations of the Circuit Breakers shall be brought out to terminal cable sockets suitably located in the cable chamber at the rear of the panels.

12.14 SpaceHeaters

The Switchgear Panel shall have in each panel thermostatically controlled space heaters with a controlling 16 amp 230 volt socket outlet with MCB to eliminate condensation.

12.15 Earthing

Two main earth bars of copper as required shall be provided throughout the length of the Switchgear Panels with a provision to make connections on both sides to the sub-station earths.

12.16 DesignationLabels

Suitably engraved white on black name plates and identification labels of metal for all Panels and circuits shall be provided. These shall indicate the feeder number and the designation

12.17 SheetSteelTreatmentAndPainting

Sheet steel materials used in the construction of the Switchgear Panels should have undergone a rigorous rust proofing process comprising of alkaline degreasing, descaling in dilute sulphuric acid and a recognised phosphating process. The sheet steel work shall then receive two coats of oxide filler primer before final painting. Castings shall be scrupulously cleaned and fettled before receiving a similar oxide primer coat.

All sheet steel work shall after metal treatment be spray or powder painted with two coats of shade 692 to IS 5 on the outside and white on the inside. Each coat of paint shall be properly stoved and the paint thickness shall be not less than 50 microns.

- **12.18** The circuit breakers shall be provided with following accessories.
- i) Auxiliaryswitchwith5NO+5NC contacts.
- ii) Mechanicaloperationcounter
- iii) Springcharginghandle
- iv) Rechargingin/outhandle
- v) Foundationbolts
- vi) Maintenancemanual
- vii) Instructionmanual

12.19 Auxiliarysupply

- a) Thetippingshallbeat24VDCthroughabatterybankunit
- b) Spaceheater, Indication and other auxiliary supply shall be through to 230V AC

12.20 SiteTestbythirdparty

- a) Alignmentpanel, interconnection of busbarand tightness of bolts and connection
- b) Interpanelwiring
- c) Freemovementofcircuitbreakertrolley
- d) Manual/electricaloperationofthebreaker
- e) Meggertest
- f) CT/PTratio/Polarityprimaryinjectiontest.
- g) Secondaryinjectiontestonrelays

UNITIZEDCOMPACTSUB-STATION

PART 1- GENERAL

1.01 WORK DESCRIPTION

- A. This specification covers design, engineering, manufacture, assembly, Testing, Inspection, Packing, Transportation and supply and on site sample commissioning of 11/0.415 kV Packaged Substation with all safety accessories, tools and tackles. The substation shall be designed, manufactured and tested as per IEC 62271-202. The substation shall be tested for internal arc test.
- B. Test methods of Pre-fabricated sub-station which are cable connected to be operated from inside or outside for alternating current of primary rated voltage 11KV and for a suitable capacity transformer for service frequencies. The Pre-Fabricated sub-station is to be installed at ground level.
- C. All factory built assemblies subject to rain or wet conditions or located outside electrical switch room shall be weatherproof constructed to IP 65, able to withstand high impact strength of 60 KN/m2 (min.), temperature resistant, flame retardant and corrosion resistant.
- D. Specificrequirementsshallbeinaccordancewithsinglelinediagram/specification&BOQ.

E. The technical parameters of equipments i.e. HT & LT switchgear Capacitor Bank, Contactors & transformers etc. shall be referred.

1.02 STANDARDS

- A. All equipment, material and components shall comply with the requirements of the latest editions of Indian Standards with updated amendments. Standards and Regulations applicable in the area where equipment is to be installed shall also be followed.
- B. The equipment offered complying with other standards, these standards shall be equal to or superior to those specified and full details of the differences shall be furnished along with the tender.
- C. The Compact sub-station shall be engineered and constructed in accordance with the latestrevision of the following Indian and British standards:

IEC60694:	eq:commonclauseforHighVoltageswitchgearandlowvoltageswitchgear.
IS13118/IEC62271-100	HighVoltagealternatingcurrentcircuitbreakers.
IS12729/IEC62271-200	ACmetalenclosedswitchgearandcontrolgearforratedvoltagesabove1kV and upto and including 52kV.
IEC62271-202	High-Voltage/Low-Voltageprefabricatedsubstation.
IS9921/IEC60129	ACswitchesandearthingswitches.
IS9920/IEC60265	Switchesanddisconnectors.
IEC60420	Combinedswitch/disconnectors.
IEC60420	Highvoltagefuses.
IS2705/IEC60185	CurrentTransformers.
IEC60060	Highvoltagetestprocedures.
IEC60529	Classification of degrees of protection for enclosures.

- D. Incase of imported equipments tandards of the country of origins hall be applicable if these standards are equivalent or stringent than the applicable Indian standards.
- E. The equipment shall also conform to the provisions of Indian electricity rules and other statutoryregulations currently in force in the country.
- F. BS/IECorISnotmentionedabovebutareapplicabletothisinstallationshallalsoapply.

1.03 SUBMISSION

- A. Detailed shop drawings for complete equipment, including equipment installation and cable termination details etc. prior to start of work.
- B. Such drawings shall show the proposed method of construction of the cubicles, method of supporting equipment and Busbar, full details of Busbar layout, method of support, electrical control wiring diagrams, equipment weight, colours, and surface treatment.
- C. The drawings shall also incorporate a full list of proposed materials. The construction shall not commence until the drawings are approved for construction.
- D. Factoryandsitetestingproceduresandreportformatsshallalsobeincluded.
- E. PreparationofbillofmaterialsforDifferent Items.
- F. Interconnectiondrawing.
- G. Protectionco-ordinationdrawings/tablesforcompletepowersystem.

- H. Shopinspectionandtestingprocedures.
- I. Field-testingandcommissioningprocedures.
- J. Preparationofasbuiltdrawingsfortheservicesthecontractoris rendering. Anyotherwork/activity,whichisnotlistedabove;howeverisnecessaryforcompletenessof electrical system.

PART 2- PRODUCTS

2.1.0 COMPACT VCB

2.1.01 DESIGNCRITERIA

- A. The 11KV Non-Extensible, Non-metering Switchgear shall be installed at Outdoor substation location along the ring main 11KV feeder system. 11KV wing isolator Controls incoming/Outgoing feeder cables of the 11KVdistribution system. Tee-off SF6/Vacuum Circuit Breaker shall be used to Control and isolate the 11KV/415V distribution transformer/HT Consumers connected through 11KV grade underground cable at distribution centre.
- B. The Switchgear and component thereof shall be capable of withstanding the mechanical and thermal stresses of short circuit listed in ratings and requirements clause without any damage or deterioration of the materials.
- C. For continuous operation at specified ratings temperature rise of the various Switchgear components shall be limited to permissible values stipulated in the relevant standard and / or this specification.
- D. The equipment offered shall be suitable for continuous satisfactory operation as per site condition specified elsewhere.

2.1.02 SPECIFICREQUIREMENT

TheNon-ExtensibleringmainunitsuitableforIndoor/Outdoorinstallationrequirementof11KV, 21KA SF6/VCB insulated Non-Ext. Non-Metering SF6 insulated Ring Main Unit shall be as under.

- a) Two numbers of 11KV,630 Amps, continuously rated fault making, load breaking Switches. These units shall be triple pole, SF6 Insulated, quick break type with spring assisted/ spring charge storedenergymechanism foroperation. Itshall havearrangementforterminating up to 300 mm² PILC/XLPE incoming and outgoing feeder cables.
- b) One Tee-Off unit with 11kV, 250 Amps SF6/Vacuum Circuit Breaker (for Controlling transformer), load breaking and fault breaking type fitted with three 250 Amps continuously rated SF6 insulated busbar along with CT with combination for protection of transformer. It shall have arrangement for terminating up to 300 mm² 11KV, 3C PILC/XLPE cables.
- c) Providingrightangledreusablebootforterminations(3x3nos.)

2.1.03 SYSTEM

The system network is 11000 Volts, 3 phase 3 wires 50 cycles with neutral solidly grounded. The voltage and frequency are subject to variation as perstatutory limits governedby IndianElectricity Rules 1956 with latest amendments in force.

2.1.04 GENERALFINISH

The equipment should be totally enclosed, metal clad, vermin and dust proof suitable for tropical climateuseasdetailedabove. The body of the RMUU nitshould be of metal is edcastres intank / stainless steel and should be rust free.

2.1.05 PAINTING

The surfaceofallmetallicparts shallbethoroughlycleaned, scrappedand degreased preferablyby shot blasting or any other treatment. The exterior surface shall be given two coats of rust resisting red oxide primer conforming to IS 2074:1992 and final two coats of weather resisting battleship greyenamelpaintorRAL9002. The paints hall with stand the operating conditions described above and equipment shall not show any sign of the rust formation.

2.1.06 RATING

The busbar shall have continuous rating of 630 Amps. The isolator should have continuous ratingof 630 Amps and SF6/Vacuum circuit breaker shall have a continuous rating of 250 Amps.

All connection including band joints for busbars etc shall be of ample cross section to cater the rated load current continuously and shall be suitable for short time rating of 21KA for 3 seconds.

2.1.07 BREAKINGANDMAKINGCAPACITY

The SF6/Vacuum circuit breaker shall be capable of having rupturing capacity of 350 MVA symmetrical at 11000 Volts three phase. Symmetrical breaking capacity shall be 21 KA and the making capacity of 52.5 KA at 11000 Volts. The isolators shall be capable for breaking rated fullloadcurrentandshallhavefaultmakingcapacityof52.5KApeak. Incaseofasymmetricalbreaking capacity, DC component shall be indicated by bidder in the offer.

2.1.08 TYPEOFEQUIPMENT

- A. The equipment shall be compact, totally enclosed in as self-contained self supporting, gas tight compartment, mounted on base frame or channels. The assembly shall be equipped with common power busbars, load break Switches and SF6/vacuum circuit breaker as specified in specific requirement as above. Allmedium voltage parts busbars be totally enclosed in an SF6 environment.
- B. The freestanding metal housing shall be designed to withstand internal pressure and external mechanical loads without distortion. Where required the SF6 gas insulated Switchgear housing shall have an over pressure relief device vented to the rear side of the equipment. An operating mimic diagram shall be provided on the front side of RMU. Each unit shall be provided with lifting facility of proven design for easy handling.
- C. Isolator/BreakerON-OFF,Earth,&'SF6gaspressurelow'indicationetc.shallbeprovided.
- D. Handleoperated'springassisted'or'springcharged'mechanicaloperationshallbeprovided.
- E. SF6Insulation:Switchgearhousingshallbecompletelygastight.
- F. A manometer should be provided to indicate the healthy state of SF6 gas pressure inside the tank. SF6 gas pressure inside the tank shall not be more than 1 bar (g) at 20 Deg Centigrade.
- G. TheRMUUnitshouldbeSCADAcompatibleforourfutureuse.

2.1.09 BUSBARS

ThebusbarshallbeSF6insulatedtype.Thecrosssectionalareaofthecopperbusbarandjointing accessories shall be stated in the tender.

2.1.10 ISOLATOR

- A. Each load break switch shall be of SF6 gas insulated type with gas as insulating medium and interrupting medium.
- B. Eachloadbreakswitchshallbeofthetriplepole, simultaneouslyoperated, non-automatic typewith quick break contacts and with integral earthing arrangement.
- C. The mechanism of the switch shall be quick-break and quick make type, the speed of operation being independent of operation force with mechanically operated indicator.

- D. Each load break switch shall be fitted with a direct manually operated spring assisted/charged mechanism having three positions, "ON", "OFF" and "EARTH" provided with padlocking facility. All operating handles shall be located on the front panel of the ring main unit.
- E. Voltage Indication: There should be arrangement to check whether the cable connecting to the isolator is live or not.
- F. The operating mechanism shall be maintenance free without the need for any lubrication duringits lifetime.
- G. The switches should be designed such that they can be operated remotely if required by providing motor drives in future.
- H. Thetechnicalparticularsofswitchare:

Ι.

a)	Constructionperphase	SF6-SingleBreak
b)	CurrentCapacity	630A
c)	MakingCapacity	52.5 KA(peak)
d)	Breakingcapacitynormalloadcurrent	630A(0.7pf)
e)	Shorttimerating	21KA for3 second
f)	Shortcircuitcurrentmakingcapacity(KAP)	52.5KA
g)	Impulsewithstandvoltagetoearthbetweenpoles.	75kV
h)	Powerfrequencywithstandvoltagetoearthandbetween poles	28kVRMS

2.1.11 SF6/VACUUMCIRCUITBREAKER

- A. The tee-off unit shall consist of 11KV, 250 Amps SF6/VCB (for Controlling transformer), load breaking and fault breaking type fitted with three 200 Amps continuously rated SF6 gas insulated busbars and arrangement for cable to the primary side of the transformer.
- B. The Tee-off circuit breaker shall be suitable for manual closing and opening and also for provision for remote tripping in future.
- C. The operating mechanism shall be direct hand operated trip free with a mechanically operated indicator, positively coupled to the operating mechanism to indicate whether the breaker is in the closed or in the open position.
- D. Each circuit breaker shall be fitted with a direct manually operated spring assisted/charged mechanism having three positions, "ON", "OFF" and "EARTH" provided with padlocking facility. All operating handles shall be located on the front panel of the ring main unit.
- E. VoltageIndication:Thereshouldbearrangementtocheckwhetherthecableconnectingtothe breaker is live or not.
- F. The tee-off unit shall be provided with accessories for tripping such as CT operated series trip coils for over current and earth fault protection.
- G. Breakershallbeprovidedwithashunttripcoilsuitablefor230VACsupply.
- H. Current Transformer: The Ratio of the CTs shall be suitable for Controlling transformer as specified in purchase enquiry. The VA Burden of the CTs shall be sufficient to supply the energy required by the relay for normal operation and tripping of the circuit breaker.
- I. Protection System: The protection system should be provided with self-powered IDMT protection relays, which requires no external power source or batteries for tripping. Relay shall be static type with three over current & single earth fault element. The over current element should follow afuse replica or extremely inverse curve and earth fault element should be definite time type. The protection system should be suitable for protecting transformers of rated power up to 990kVA.

J. ThetechnicalparticularsoftheCircuitBreakershallbeas followed:

a)	Construction	SF6/VacuumSingleBreak
b)	Currentcapacity	630A
c)	Makingcapacity	52.5kA
d)	Shorttimerating	21kAfor3Sec.
e)	Impulseflashoverwithstandvoltage	75kV peak
f)	Powerfrequencywithstandvoltage	28kV(rms)
g)	CurrentTransformer	11kVtapewound
	a)CTratio	250/1A
	b)Overcurrentfactor	Tocorrespondtobreakingcapacity
	c)Classofaccuracy	ClassXsuitableforselfpoweredrelay
	d)Impulseflashoverwithstand voltage	75kV(peak)
	e)Powerfrequencywithstand voltage	28kV(rms)
h)	Protection	Self powered IDMT Protection relays, No external AC/DC aux power required for tripping. Static type, with 3 over current and single earth fault elements. the over current element should follow a fuse replica or extremely inverse curve and earth fault element should be definite time type. The protection system should be suitable for protectingtransformersofratedpowerfrom 160 KVA.
i)	The circuit breakers shall be provided within terlocked earths witch	
j)	ThreeNos.CT.sonthebushingsincaseofcomprovided to the full rated voltage of the	ablemountedringCT'sadequateinsulation shall be e RMU, including impulse withstand voltage.

2.1.12 FAULTPASSAGEINDICATORS(FPI)

There should be one number fault passage indicator for incoming or Outgoing isolator. These shall facilitate quick detection of faulty section of line. The fault indication may be on the basis of monitoring fault current flow through the device. The unit should be self-contained requiring no auxiliary power supply. The FPI shall be integral part of RMU, shall be capable of displaying the fault and phase currents. The FPI shall have LCD display, automatic reset facility& a potential free contact for SCADA.

2.1.13 OPERATIONSANDINTERLOCKING

- A. All operations shall be from front of the equipment via spring-assisted mechanism. The Ring Main Unit and SF6/VCB for Tee-off should be provided with a series trip coil for tripping. It shall be possible to operate the Switches and circuit breaker manually and spring assisted mechanism shall ensure speed of operation of Switches.
- B. OperationhandleshallbeconsideredaspartoftheunitandshouldbeprovidedwitheachRMU.
- C. Load break Switches and earthing Switches shall be fully interlocked to ensure that operation is carried out in correct sequence. Movement of operating handle against interlock shall not by any means originate, store or activate the energy mechanisms. Padlocking facility shall be provided for operation of load Switch and earthing Switch. Safety of operation shall be ensured by interlocks.
- D. Simultaneously closing of the main Switch and earth Switch. This interlock shall be integral part of the operating mechanism.
- E. The SF6 insulated isolators and SF6/VCB breaker operating mechanisms shall be totally enclosed and self-lubricating type. The manually operated handle shall be mounted in front of the isolators and so designed that the operation is complete by one movement without any undue stain on the operator.
- F. Allmechanicalinterlockshallberobustsoasnottogiveanywayduringnormaloperation.
- G. Thetrippingofbreakerunitshouldbeprovidedwithpushbutton.

2.1.14 EARTHINGARRANGEMENT

- A. It shall be easily possible to test cables of Isolators without opening cable compartment covers & without disconnecting cables.
- B. Equipmentearthingofcopperstripsofadequatesizeshallbeprovided.

2.1.15 CABLEBOXES

- A. The isolators and SF6/VCB shall be provided with suitable cable boxes for connection 3 core, 11KV XLPE cables of size up to 300 mm² approaching vertical from below. The cable boxes shall be so located at convenient height to facilitate easy cable jointing work.
- B. The design of the cable box shall be such that any type of jointing methods such as heat shrinkable/pushon type/colds hrinkable type termination's can be adopted.
- C. Earthing: All ringmain units shall have aspecialearthbar with asectionalareaofnot less than 100 mm² run along the whole of metal enclosed Switch structure, each end being connected to the main earthing system where metal cases are used on instruments these shall be connected to this bar by conductors of not less than 16 mm² section.
- D. Themanufacturershallsupplyallfoundationbolts, nutsandwashersnecessary for installation.
- E. Removable eyebolts shall be provided to facilitate the handling of the RMU/tee-off unit/ SF6 isolators.
- F. Labels: AllRMUsshallbeclearlylabelled as required indicating where necessary their purpose and "ON" and "OFF" lettered on brass, ivory, enamelir on or other suitable materials.

2.1.16 TESTS

Each type of H V Switchgear shall be completely assembled, wired, adjusted and tested at the factory asper the relevant standards and during manufacture and on completion.

<u>RoutineTest</u>

The tests shall be carried out in accordance with IEC 62271-200 include but not necessarily limited to the following:

- i. WithstandvoltageatPowerFrequencyforallcurrentcarryingpartsincludingwiring
- ii. Measurementofresistanceofthemaincircuit
- iii. GasLeakagetest
- iv. Withstandvoltageonauxiliarycircuits
- v. Operationoffunctionallocks, interlocks, signalling devices and auxiliary devices
- vi. Suitabilityandcorrectoperationofprotections,Controlinstrumentsandelectricalconnections of the circuit breaker operating mechanism.
- vii. Verificationofwiring
- viii. Visual Inspection

Routine test shall be carried out on all equipment such as circuit breakers, current transformers, relays, meter etc. as per relevant standards.

<u>TypeTest</u>

The following type test should have been conducted on Ring Main Unit in line with IEC 62271-200.

- i. Shorttimecurrenttestonmaincircuits
- ii. Shorttimecurrenttest onearthingcircuit
- iii. Noloadoperationandmechanicalendurancetest
- iv. Impulsewithstandtest75kVrms(1min.)
- v. Temprisetest

Type test certificate of Ring Main unit, if so desired by the customer, shall be furnished; otherwise the equipment shall have to be type tested, free of charge, to prove the design.

2.2.0 <u>11/0.4150ILTYPEDISTRIBUTIONTRANSFORMER</u>

1

2.2.01 GENERAL

All equipment and material shall be designed manufactured and tested in accordance with the latest applicable Indian Standard, IEC standard and CBIP manuals except where modified and / or supplemented this specification.

The electrical installation shall meet the requirement of Indian Electricity Rules as amended up to date; relevant IS code of practice and Indian electricity act. In addition other rules of regulations applicable to the work shall be followed.

The Transformer offered shall in general comply with the latest issues including amendments of the following Indian standards.

2.2.02 CODEANDSTANDARDS

The transformershall comply with the latest edition of the following and other relevant Indian Standards / Manual:

IS335;	Insulatingoil
IS 1271:	Thermalevaluation and classification of electrical insulation
IS 2026:	PowerTransformers
IS 2099:	Bushingforalternativevoltagesabove1000V
IS 2705:	Currenttransformer
IS 3347:	Dimensionforporcelaintransformerbushings.
IS 3637:	Gasoperatedrelays
IS 3639:	Fittingandaccessoriesforpowertransformers
IS 4201:	Applicationguidefor CTs
IS 6600:	Guideforloadingofoilimmersedtransformer
IS 8478:	ApplicationguideforONloadtapchangers
IS 8468:	Onloadtapchangers
IS 10028:	Codepractice forselection, installation and Maintenance of transformer
IS 13947:	LVSwitchgearandControlgear-Part-IGeneralrulesCBIPManualon transformers
IS 2074:	Readymixedpaint, airdrying redoxide, zincchrome priming
IS5:	Colorofreadymixpaint
IEC76:	Powertransformer
IEC76.2orIEC	Temperaturelimits
IEC-76-1orIEC726or IS: 2026	AllParts
IEC-298,orIEC 466	HighvoltageSwitchgearandControlgear
IEC-947-1,IEC-439-1	LowvoltageSwitchgearandControlgear
IS:1180IS:2026	Fordistributiontransformers
IEC-550(151):1978, IS:1885	SEVChapter151Electromagnitudedevices.
IEC-60-1:1989	HighvoltagetestTechniquePart-I.
IS:2017Partl	Generaldefinitionandtestrequirements.
IEC-68-2-62:1991	Environmentaltesting-part2,testsimpactamendmentI(1993)

IEC-71-2:1976, IS: 3716	Insulationco-ordinationPart2Applicationguide
IEC:76-1:1993,IS:	PowertransformerPartIgeneral
2026(Partl)	
IEC76-2:1993	PowertransformerPart2temperaturerise.
IEC76-5, 1976	PowertransformerPart5abilitytowithstandshortcircuittest
IEC:243-1,1988:	MethodsoftestsforElectricstrengthofsolidinsulating
IS:258-1	MaterialPart-Itestsandpowerfrequencies.
IEC:354:1991:IS: 6600	Loadingguideforoilimmersedpowertransformer.
IEC:551:1987:IS:	Determinationoftransformerandreactorsoundlevel.
13964	
IS:2932:	Enamelsynthetic, exteriora) under coatingb) Finishing
IS:3347:	Dimensionofporcelaintransformerbushingforuseinveryheavilypolluted atmosphere

Transformershallalso conformtotheprovisionsofthelatestrevisionsoftheIndianElectricityrulesand any other statutory

TRANSFORMER

Outdoortransformershallbe step downtransformerfrom11KVto0.415KVthreephase50cycles copper wound.Transformer shall be having high efficiency, low magnetic field and impedanceshall be as per IS &transformer shall conform to IS 1180 of level IIin all respects like insulation levels, temperature rise, impendence voltage and losses.

It shall be double wound core type with ON-AN cooling having delta connection on HT side andstar on secondary side having automatic on load tap changing device high tension side for tapping +5% and -15% at step of 2.5% (Eighttappings, nine positions). The transformer shall be complete with the following accessories.

- a) On load tap changer with remote tap changer control panel to automatic voltage regulatingrelay.
- b) OLTCconservatorwithdrainagevalve, filling hole with cover and silicagel breather and oillevel indicator.
- c) Oilconservatorwithsumpanddrainvalvewithcoverplate.
- d) Dehydratingbreatherwithsilica gelandoil seal.
- e) Oilfillingvalve32mmwithcover plate.
- f) Thermometerpockets.

- g) Diagram, ratingplate, terminal markingplate.
- h) Twoearthingterminals.
- i) Liftinglugsforactivepartonly.
- j) Fourbi-directionalplainrollers.
- k) Firstfillingofoil.
- I) Doublediaphragmexplosionventwithsightglass.
- m) 150mmdialtypewindingtemperatureindicatorwithmaximumreadingpointerandalarmand trip contacts.

Pocketforaboveitem.

- n) Plainoillevelgaugewithminimumlevelmarking.
- o) Airreleaseplugontankcover.
- p) .P.thermojunction box.
- q) Detachableradiatorwithtopandbottomstopvalvesanddrainandairreleaseplugs.
- r) 150mmdiatypeoiltemperatureindicatorwithmaximumreadingpointerandalarmandtrip contact.
- s) 150mmdiamagneticoillevelindicatorwithlowlevelalarmandtripcontactsandminimum filling and maximum level markings.
- t) Jackingpadswithhaulageholes.
- u) Basechannelwithviewingholes.
- v) Draincumbottomfiltervalve32mmwithcover plate.
- w) 11KVcableendboxavailablefor1No.3corex240Sq.mmXLPEcableinH.T.side.
- x) Provisionfor3200Amp10nos3.5x300sqmmXLPE–Alarmouredcable.
- y) 100VA,440/110VTransformerforRTCC.
- z) Extraneutralbushingforsolidearthing.
- aa) NeutralCTinseparateboxwithterminalbroughtinforconnection.

ab)Pressure equaliser pipe.

The transformer berated for a maximum temperature rise of 50 Deg. C for oil and 55 Deg. C for winding over 45 Deg. C ambient temperatures.

The transformershall conform to the IS: 335 and 1180, of 2018

TRANSFORMERLOSSES:

- 12.1 The no load losses in kilowatt at rated voltage and frequency and the load losses in kilowatt atrated full load current and frequency at 75 Deg. C shall be guaranteed to 5.05 kW at 50% Loadand 15 kW at 100% load respectively respectively withtolerance as per IS-1180 of level -II
- 12.2 Incaseduring testing theactuallossesare found withinguaranteed figure the transformers shall be accepted without any advantage to contractor for lower loss.
- 12.3 Whereactuallossesduringtestingarefoundinexcessofmaximumguaranteedfigures, the transformers shall be rejected.

Design calculation of no load and load losses along with complete technical data's and factors assumed will be enclosed along with GTP intender documents.

Measurement of losses shall form part of type test/routine/ acceptance test. The losses of firstand subsequent transformers supplied shall also be guaranteed at the time of pre commissioning test and the losses exceeding guaranteed figures shall stand rejected. The supplier shall replace the transformer without any financial liability to the purchaser.

Thesuppliershallsupplytwocopiesofthetypetest/routinetestcertificatetoeachconsignee with each transformer on receipt of dispatch instructions.

WINDINGS

Windings shall be subjected to shrinking andseasoning process, so that no further shrinkage occurs during service. Adjustable devices shall be provided for taking up possible shrinkage in service.

Coils shall be supported at frequent intervals by means of wedge type insulation spacers permanently secured in place and arranged to ensure proper oil circulation. To ensure permanent tighteners of winding assembly, the insulation spacers shall be dried and compressed at high pressure before use.

All low voltage windings for use in the circular coil concentric winding shall be wound on a preformed insulating cylinder for mechanical protection of the winding in handling and placing around the core.

Windings shall not contain sharp bends which might damage the insulation or produce high dielectric stresses.No strip conductor wound on edge shall have width exceeding six times the thickness.

Materials used in the insulation and assembly of the windings shall be insoluble, non-catalytic and chemically inactive in the hot transformer oil, and shall not soften or be otherwise affected under the operating conditions.

Varnish application on coil windings may be given only for mechanical protection and not for improvement in dielectric properties. In no case varnish or other adhesive be used which will seal the coil and prevent evacuation of air and moisture and impregnation by oil.

All threaded connections shall be locked.Leads from the winding to the terminal board and bushings shall be rigidly supported to prevent injury from vibration.Guide tubes shall be used where practicable.

Windingsandconnectionsshallbebracedtowithstandshocksduringtransportorshortcircuits. Coil

clamping rings shall be of steel or of a suitable insulating material.

Permanent current carrying joints in the windings and leads shall be welded or brazed.Clamping bolts for current carrying parts insideoil shall bemade of oil resistancematerialwhich shall not be affected by acidity in the oil.Steel bolts, if used, shall be suitably treated.

Terminate of all windings, also of stabilising windings, shall be brought out of the tank for external connections.

Windings shall be of copper, the conductors shall be transposed at sufficient intervals in order to minimise eddy currents and equalise the distribution of currents and temperatures along with the windings.

The completed core and coil assembly shall be dried in vacuum at not more than 0.5mm of mercury absolute pressure and shall be immediately impregnated with oil after the drying process to ensure the elimination of air and moisture within the insulation.Vacuum may be applied in either vacuum over tank or in the transformer tank.Vapour phase dryout shall be preferred.

TANK

Tank shall be made from good commercial grade low carbon steel and shall be of welded construction.

Tank shall be designed to permit lifting, by crane or jacks or the complete transformer assembly filled with oil.Suitable lugs and bosses shall be provided for this purpose.

Tank together with radiators, coolers, conservator, bushings, vessel and other fittings shall be designed to withstand without permanent distortion the following conditions:

- a) Fullvacuumof760mmofHg.forfillingwithoilbyvacuum.
- b) Internalgaspressureof0.35Kg/cm2(5lbs/sq.in)withoilatoperatinglevel.

The transformer top shall be provided with a detachable tank cover with a bolted flanged gasket joint.Lifting lugs shall be provided for removing the cover.The surface of the cover shall be suitably slopped so that it does not retain rain water.

Manholes with bolted covers shall be provided in the top or sides of transformer for easy access to the lower ends of bushings, tap changers and to permit replacement auxiliaries without removing tank cover.

 $\label{eq:constraint} A dequate space shall be provided at the bottom of the tank for collection of sediments.$

The transformer base shall be designed to permit skidding of the complete transformer unit in any direction, when using plates or rails. The underbase shall be detachable unless transport facilities permit a fixed base. Pulling eyes shall be provided for moving the transformer in either direction.

The material used for gaskets shall be cork-neoprene or approved equivalent.Gasketted joints for tank and manhole covers, bushings and other bolted attachments shall be so designed that the gasket will not be exposed to the weather.Spare gaskets shall be provided for all openings as shipping gaskets will not be reused.

Tankshallbeprovidedwithvalvesetc.as required.

Tank shall be provided with a pressure release device which shall be operated at a pressure below the test pressure for the tank and radiators. The device shall be rain-proof after blowing and shall be provided with a device visible from ground to indicate operation. An equaliser pipe connecting the pressure relief device to the conservator shall be supplied. <u>Explosion vent shall be equipped with remote monitoring/alarm contracts with oil indicator</u>.

The transformer be rated for a maximum temperature rise of 50 Deg. C by thermometer inoil and 55 Deg. C by resistance at CTR with a daily average ambient temperature of 40 Deg. C and peak ambient temperature of 50 Deg. C.

ONLOADTAPCHANGING(OLTC)

The diverter switch contacts shall be housing separate oil chamber not communicating with oil of the main transformer tank. The contacts shall be accessible for inspection without lowering oil level in the main tank and the contact tips shall be replaceable.

The OLTCoil chambershall haveoil filling and drain plug, reliefvent and level glass. It shall also be fitted with a separate oil surge relay. The outlet of this relay shall be connected to a separate conservator tank or a totally partitioned compartment of the main conservator. A magnetic oil level gauge with separate potential free contacts for alarm and trip shall be provided.

The equipment shall be suitable for local and remote electrical control and local manual control. The features to be provided with these controls are detailed below:

i) <u>ManualControl</u>

The crankingdeviceformanualoperationofOLTC gearshallberemovableandsuitablefor operation by a man standing on ground level. The mechanism shall be complete with the following:

- a) Mechanicaltappositionindicatorwhichshallbeclearlyvisiblefromnearthe transformer.
- b) Mechanicaloperationcounter.
- c) Mechanical stoppers to prevent over cranking of the mechanism beyond the extreme position.
- d) The manual control considered as backup to the motor operated tap control shall be interlocked with the motor to block motor start up during manual operation. The manual operating mechanism shall be labelled to show the direction of operations for raising the secondary voltage and vice-versa.
- ii) <u>ElectricalControl</u>

Theincludesthe following:

a) Electricallocalcontrolfromtransformermarshal box.
- b) Electricalremotecontrolfromremotecontrol(RTCCPanel).
- c) The control scheme shall have the following features:

i) An interlock to cut off electrical control automatically upon recourse being takento manual control.

ii) Selection of point of control local or remote, itshall notbepossible for anytwo electrical controls to be in operation at same time.

- d) Reinforcement of the initiating impulse for a tap change, ensuring a positive completiononce initiated.
- e) Stepbystepoperation, ensuring only on etapchange for each tapchanging command.
- f) Aninterlocktocutofftheelectricalcontrolwhenittendstooperatethegearbeyond either of the extreme tap positions.
- g) An interlock to block a counter command for reverse tap change during a tap change until the mechanism comes to rest and resets the circuits for a fresh operation.

The equipment shall be so arranged so as to ensure that when a tap change has commenced itshall be completed independent of the control relays and switches. If a failure of auxiliary supply during a tap change or any other contingency would result in the movement not being completed adequate means shall be provided to safeguard the transformers and its auxiliary equipment. A supply monitoring relay with alarm contacts shall be provided for the tap changer.

The auxiliary device for electrical controls of the OLTC shall be housed either in the OLTC driving mechanismboxor inTransformersmarshalling box. It shall be provided with a circuit breaker with magnetic and thermal O/L devices for controlling the auxiliary supply of the OLTC motor.

TappositionindicatorshallbesuppliedlooseformountingontheRTCC. On

theRTCC there shall be following components also:

- i) Raise/Lowerswitchformanualoperation.
- ii) LampindicatingONLOADTAPCHANGEin progress.

RTCC panel shall have automatic tap changing feature i.e. whenever voltage fluctuations occur the tap switch shall change automatically to set net output voltage of 0.433 KV.For this purpose, a Auto/ Manual selector switch shall be provided in RTCC.

OLTCshallhaveindividuallyseparatebreather.

The external surface of transformers hall be painted with epoxypaints had eof IS: 631.

The installation, testingand commissioning shallconform to IS CodeofPractice IS: 1886-1967 with latest amendment and regulations of local authorities.

When lifting a transformer care shall be taken to see that lifting chain will not interfere with any part of the transformer.Never fix the sling to any other part of the transformer except the lifting lugs.Lifting lugs, and jacking pads shall be used for lifting of the transformer.While using jacking pads utmost care shall be taken in proper application of jacks.Where transformer is dragged or pulled on sleeper or rollers the traction eyes provided at the bottom frame shall be used with suitable wire ropes and shackles.Tank cover should always be fitted lifting the tank. The transformershallbe lifted bylugsorshacklesorby anyothersuitablemeans(suchas dragging on rollers) and mounted on MS channel embedded in cement concrete.Care shall be taken to see that transformer is not flitted during lifting and erection of transformer.The rollers shall bechoked to prevent movement of the transformer after being positioned on the plinth.Adequate and necessary clearances from wall etc.. shall be provided as required as per IS: 1886 - 1967.

Before energising the transformer the oil must be got tested and approved from any of the Government Test House or from approved appropriate authority. The oil shall be tested in accordance with the requirement of IS - 335/1970. In case the results obtained are substandard the entire quantity of oil be replaced with the approved quality of oil and test taken again. The process shall be repeated till satisfactory results are achieved. In case of presence of foreign matter/moisture etc.. in theoil, the oil may be got filtered through oil filtration plant. The temperature of oil in the spray tank shall not exceed 80 Deg. C. during the purification process. The minimum IR valve by the end of purification process shall be atleast 20 Megohm at an oil temperature of 60 Deg. C. Topping up of oil if required shall be done with tested oil.

The insulation resistance of the winding shall be measured with 2500 V DC meggar and resultsshall correspond to the factory test results. The transformer shall be charged only after the above tests are conducted and approval of local authorities is obtained.

- a) Transformers will be delivered without oil, filled with inert gas and without externally mounted accessories.
- b) The Contractor shall place the transformer on its foundation assemble parts, erect the separate cooler banks where provided, erect the supporting structure for detachable type cable chamber, conduit and wiring connecting and filling of transformer with oil.
- c) The Contractor shall arrange to fill transformer oil and also arrange for oil filtration before filling.H.V. Test/Breakdown strength of transformer oil shall be carried out taking asample from individual transformer and till the result is not found to satisfaction of Engineer, oil conditioning shall have to be carried out.
- d) JackfortheabovetransformersshallhavetobeprovidedbytheContractor.
- e) If vacuum oil filling in transformer is envisaged the Contractor shall arrange the necessary equipment.
- f) AllthecableterminationsandcontrolwiringistobecarriedoutbyContractor.

CONTROL WIRING

The Contractor shall supply and install, test and commission all control/instruments wiring asfound necessary. The job is turnkey and shall remain the responsibility of Contractor to ensure its functioning in useful and defined manner.

 $\label{eq:altheory} All the indoor control wiring shall have copper conductor and {\sf PVC}\ insulated.$

The indoor control wiring shall conform to IS : 694 for voltage grade of 1.1 KV for A.C./230 V for D.C.

The conductor cross sectional are shall not be less than 2.5 Sq.mm.

The indoor wiring shall be in surface conduit neatly placed on wall or ceiling either in horizontal or vertical run.

The control wiring which are to be placed outdoor or which are to run in cable trench shall be of 650/1100 voltage grade and shall conform to IS: 1554.The cable shall have minimum dia of conductor to 2.5 sq.mm.

VECTORGROUP

TransformershallhavevectorgroupofDyn11 TESTS:

Transformers shall be subjected to routine & type tests as specified in IS 1180, IS 11171 iec- 726& given below:

Routinetests:

- a) Turnsratiomeasurementatvarious taps
- b) HVandLVwindingresistance
- c) Checkingofvectorgroup
- d) InsulationResistanceTest
- e) NoLoadLoss&NoLoadcurrentmeasurement.
- f) MeasurementofLoadlossesat25%,50%,75%,100%&110%.
- g) Impedancevoltageandimpedance.
- h) Separatesourcevoltagewithstandtest
- i) Inducedovervoltagewithstandtest.
- j) Partialdischarges25PCupto1.2timesoftheratedvoltage.
- k) HeatRunTest

Type tests:

- a) Impulsevoltagewithstandtest.
- b) Shortcircuittest.
- c) Measurementofacousticnoise level.
- d) LeakageTest(tank).

The power frequency test voltage for the secondary winding shall be 2.5 KV R.M.S.The transformer shall be charged only after the tests areconducted and approval of local authorities is obtained.

Tenderer may submit type test certificates conducted on similar rated transformers for bid validation.

TESTINGANDINSPECTION

a) The Contractor shall draw up and carry out a comprehensive inspection and testing programme during manufacture and commissioning of the transformer. The programme shall be duly approved by the Management committee.

b) Contractor shall ensure that type tested equipment is only offered and routine test shallbe conducted as per relevant standards in presence of the Management committee.

DRAWINGANDINFORMATION

Thevendorshallfurnishfollowingdrawings/documentsinaccordancewithenclosedrequirement.

a) Generalarrangementoftransformer.

- b) GeneralarrangementofHVcableboxwithconnectiondiagram.
- c) GeneralarrangementofLVbus-ductandconnection arrangement.
- d) Generalarrangementofmarshellingboxandwiringdiagram.
- e) Ratinganddiagramplateindicating%impedence etc.
- f) Typetestandguaranteedtechnicalparameters.
- g) Reactance, resistance and capacitance.
- h) Theinitialchargingcurrent(inrushcurrent).
- i) Calculationfortransformersuchascoresizing,fluxdensity,turnratio&sizingof transformer.

QUALITYASSURANCE

Quality Assurance shall follow the requirements of Society as applicable.Quality assurance involvement will commence at enquiry and follow through to completion and acceptance thustotal conformity to Society's requirements.

DEVIATION

Deviation from specifications must be stated in writing at the quotation stage.

In the absence of such a statement, it will be assumed that the requirements of the specifications are met without exception.

2.4.0 ENCLOSUREFORPACKAGESUBSTATION

Thepackagesubstationshallhavethefollowingfeatures.

- A. Enclosureforthepackagesubstationshallbemadeofgalvanizedirontype,2mmthickminimum.
- B. Separatecompartmentfor11kVcompactVCB,DistributionTransformer<Switchgear
- C. DooroftheHTandLTcompartmentshallbedesignedsuchascompletedoorisdividedinto minimum two fold / parts vertically for minimum space requirement while opening.
- D. Metalbaseof4mmhotdipgalvanizedorCRCAsteelshallbeprovided.
- E. Thecolourofenclosureshallbecream(RAL1001).
- F. Structureofthesubstationshallbeabletowithstandthegrossweightofall equipment.
- G. Theroofofthesubstationshallbedesignedtosupportloadsupto250kg/m².
- H. Intermediate ceiling roof shall be provided. Minimum clearance should be left between the top of any component installed in the substation and the roof of the substation.
- I. ProtectiondegreeoftheenclosureforMV&LVcompartmentsshallbe IP54.
- J. ProtectiondegreeoftheenclosureforTransformercompartmentshallbeIP24D.
- K. LouversshallbedesignedfornaturalventilationandthermalClassK10.
- L. MV and LV compartment shall be accessible on the sides of the substation through double doors equipped with key lock and rubber seals. It should be possible to padlock doors.
- M. LVinterconnectionshouldbebymeansofAluminiumbusbars.
- N. InternalearthingcircuitshallbeprovidedbymeansofAl.(50x6mm)busbars.
- O. InternallightingshallbeprovidedforMV&LV compartments.
- P. DesignofTransformerCompartmentshallbesuchtoaccommodateoiltypetransformers.
- Q. Non-metallicbarriershallbeprovidedbetweenMCCB.
- R. Non-metallicphaseseparatorshallbeprovidedbetweenthethreephasesconnectedtoMCCB.
- S. SuitablecutoutshallbeprovidedonLTcompartmentforinstallingmetersetc.
- T. The Packaged Substation should have ample arrangement to meet the requirements of protection of all electrical equipments. The clearances between live parts and minimum clearances to earth have to be maintained to the respective standards. The size of the substation should be compacted meet the traffic and road requirements.
- U ThebidderhastospecifythetotalweightofthePackaged Substation.

2.3.0 RELAYCO-ORDINATION

Bidder shall ensure proper relay co-ordination between 11 KV compact VCB & LT switchgears and shall provide calculation in support of the same.

2.4.0 TESTS

A. RoutineTest

The tests shall be carried out in accordance with IEC 62271-202 include but not necessarily limited to the following:

- i. DielectrictestontheHV interconnection.
- ii. Testonauxiliaryandcontrol circuits.
- iii. Functionaltests.
- iv. Verificationofcorrectwiring.
- v. Testafterassemblyonsite.

B. TypeTest

The tests shall be carried out in accordance with IEC 62271-202 include but not necessarily limited to the following:

- i. Teststoverifytheinsulationleveloftheprefabricatedsubstation.
- ii. Teststoprovethetemperatureriseofthemaincomponentscontainedinaprefabricated substation.
- iii. Teststoprovecapabilityofthemainandearthingcircuitstobesubjectedtotheratedpeakand rated short-time withstand currents.
- iv. Functionalteststoprovesatisfactoryoperationoftheassembly.
- v. Teststoverifythedegreeof protection.
- vi. Test'stoverifythewithstandoftheenclosureoftheprefabricatedsubstationagainst mechanical stress.
- vii. Internalarctest.
- viii. EMCcompatibilitytests.
- IX. TypetestcertificateofPSS,ifsodesiredbythecustomer,shallbefurnished.

C. TestWitness

All tests shall be performed in presence of Management committee, if so desired by the Society. The Contractor shall give at least fifteen (10) days advance notice of the date when tests are to be carried out.

D. <u>TestCertificates</u>

Certifiedreportsofallthetestscarriedoutattheworksshallbefurnishedinthree(3)copiesfor approval of the Management committee.

The equipment shall be dispatched from works only after receipt of Management committee written approval of thetest reports.

2.5.0 TOOLS

A. One complete set of all special or non-standard tools required for installation, operation and maintenance of the switch board shall be provided. The manufacturer shall provide a list of such tools individually priced with his quotation.

2.6.0 SPARES

A. The manufacturer/tendered shall also supply a complete list of commissioning spares and tools. The same shall be included in the bid price. No extra payment shall be made on account of non-availability of spares during commissioning.

2.7.0 REJECTIONOFEQUIPMENT

- A. Deviationfromspecificationmustbestatedinwritingatthequotationstage.
- B. In absence of such statement, it will be assumed that the requirements of the specifications aremet without expectation.
- C. If any of the above tests fail to comply with the requirements of this Specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site, the Management committee may reject the item or defective component thereof, whichever is considerednecessary, and after adjustment or modification as directed by the Management committee, the Contractor shall submit that item for further inspection and/or test. In the event of the defective item being of such nature that the requirements of this Specification cannot be fulfilled by adjustment or modification, such item is to be replaced by the Contractor at his own expense, to the entire satisfaction of the Management committee. Delivery of panel boards on site without significant cable connection (Say 80%) shall not entitle progress payment certified for material delivery on site.

TECHNICALSPECIFICATIONSFORCABLETRAYS

- 1. Cable trays, of sizes as required and drawings shall be of perforated doubled bend channel/ladder design unless otherwise stated. Cable trays shall be fabricated from minimum 2 mm thick sheet steel and shall be complete with tees, elbows, risers, and all necessary hardware. Cable trays shall comply with the following:
- 2. Trays shall have suitable strength and rigidity to provide proper support for all contained cables. Trays shall include fittings for changes in direction and elevation. Cable trays and accessories shall be painted with one shop coated of red oxide zinc chromate primer and two side coats of aluminium alkyd paint or approved equivalent. Cable trays shall not have sharp edges, burrs or projection that may damage the insulation jackets of the wiring. Cable trays shall have side rails or equivalent structural members.
- 3. Unless otherwise specifically noted on the relevant layout drawing, all cable tray mounting works to be carried out ensuring the following :
- 4. Cable tray mounting arrangement type to be as marked on layout drawing. Assembly of tray mounting structure shall be supplied fabricated, erected & painted by the contractor. Tray mounting structures shall be welded to plate inserts or to structural beams as approved by the Management committee. Wherever embedded plates & structural beams are not available for welding the tray mounting structure contractor to supply the MS plates & fix them to floor slab by four anchor fasteners of minimum 16 mm dia having minimum holding power of 5000 Kg at no extra cost. Maximum loading on a horizontal support arm to be 120 Kg. metre of cable run. Width of the horizontal arms of the tray supporting structures to be same as the tray widths specified in tray layout drawings, plus length required, for welding to the vertical supports. The length of vertical supporting members for horizontal tray runs shall be to suit the number of tray tiersshown in tray layout drawings. Spacing between horizontal supports arms of vertical tray runs tobe 300 mm. Cable trays will be welded to their mounting supports. Minimum clearance between the top most tray tier and structural member to be 300 mm. Cables in vertical race ways to be clamped by saddle type clamps to the horizontal slotted angels. Clamps to be fabricated from 3 mm thick aluminium strip at site by the contractor to suit cable groups. The structural steel (standard quality) shall be according to latest revision of IS : 226 & 808. Welding shall be as per latest revisions of IS : 816.All structural steel to be painted with one shop coatof red oxide and oil primer followed by a finishing coat of aluminium alkyd paint where any cuts or holes are made on finished steel work these shall be sealed against oxidation by red oxide followed by the same finishing paint. Steel sheet covers wherever indicated to be similarly painted. Trays shall beerected properly to present a neat and clean appearance. Trays shall be installed as a complete system. Trays shall be supported adequately by means of painted MS structural members secured to the structure by dash fasteners or by grouting. The entire cable tray system shall be rigid. Each

runofcabletrayshallbecompletedbeforelayingofcables.Cabletraysshallbeerectedsoastobe exposed and accessible.

TECHNICALSPECIFICATIONSFOREARTHING

1. GENERAL

All the non-current carrying metal parts of electrical installation shall be earthed properly. Allmetal conduits, trunking, cable sheaths, switchgear, distribution fuse boards, light fittings and all other parts madeofmetalshall be bonded together and connected bymeansofspecified earthing conductors to an efficient earthing system. All earthing shall be in conformity with IndianElectricity Rules.

TheEarthingSystemshallintotallycomprise the following:-

- a) EarthElectrodes
- b) EarthingLeads
- c) EarthConductors

All three phase equipment shall have two separate and distinct body earths and single phase equipment shall have a single body earth.

2. STANDARDS

All equipments, components, materials and entire work shall be carried out in conformity with applicable and relevant Bureau of Indian Standards and Codes of Practice, as amended upto date and as below. In addition, relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and /or IEC Standards shall be applicable.

Equipments certified by Bureau of Indian Standards shall be used in this contract in line with government regulations. Test certificates in support of this certification shall be submitted, as required.

 $\label{eq:listobenoted} It is to be noted that updated and current standards shall be applicable irrespective of dates$

mentioned along with ISS's in the tender documents.

3. EARTHINGMATERIAL

Materials of which the protective system is composed shall be resistant to corrosion or be adequately protected against corrosion. The material shall be as specified in the schedule of quantities and shall comply to the following requirements:

- Copper -When solidorstranded copperwireis used it shallbeofthegradeordinarily required for commercial electrical work generally designated as being of 98% conductivity when annealed, conforming to Indian standard specifications.
- GalvanisedSteel -Galvanised steelused shallbethoroughly protected against corrosion by hot dipped Zinc coating. The material coating shall withstand the test specified in IS 2309:1969.

• Thestripstobeusedshallbeinmaximumlengthsavailableasmanufacturednormallyavoiding unnecessary joints.

4 EARTH ELECTRODES

• PlateEarthElectrode

The plate electrodes shall be of copper/ GI as as per drawing approved by the Management committee. The minimum dimensions of the electrodes shall be 600 mm x 600 mm. Thickness of copper electrodes shall not be less than 3 mm and of GI electrodes not less than 6 mm.

The electrode shall be buried in ground with its face vertical and top not less than 4 meters below ground level.

• EarthElectrode Pit

MethodofInstallingWateringArrangement

In the case of plate earth electrode, a watering pipe of 20 mm dia of medium class G.I. Pipe shallbe provided and attached to the electrode. A funnel with mesh shall be provided at the top of this pipe forwatering the earth. The watering funnel attachment shall be housed inmasonryenclosure of not less than 300 x 300 x 300 mm. A RCC framebase withremovableRCCcover slab M-25- 4nos- 10mm dia-M.S. reinforcementsbarat top & bottomboth wayshall be suitably embedded in the masonry enclosure

LocationofEarthElectrode

The following guidelines shall be followed for locating the earth electrodes

Anearthelectrodeshallnotbesituatedlessthan5metresfromanybuilding.

The excavations for electrode shall not affect the column footings or foundations of the buildings. In such cases electrode may be further away from the building.

Thelocationoftheearthelectrodeshallbesuchwherethesoilhasreasonablechanceofremaining moist, as far as possible.

 $\label{eq:entrances} Entrances, pavements and roadways shall not be used for locating the earth electrode.$

NumberofEarthElectrodes

In all cases the relevant provision of rule 33, 61 & 67 of the Indian Electricity Rules 1956 as amended shall be complied with.

Metallic covers or supports of all medium or H.T. apparatus or conductors shall, in all cases be connected to not less than two separate and distinct earth electrodes.

5. EARTHINGLEADS

The strip earthing leads shall be connected to the Earth Electrode at one end and to the metallic body of the main equipment at the other end. The earthing lead shall connect to the earthing network in the installation.

EarthingLead Sizes

Stripearthingleadsshallbeofcopper/Glandasperspecifications.

EarthingLeadInstallation

The length of buried strip earthing lead shall be not less than 15 metres and shall be buried in trench not less than 0.5 m deep.

If conditions necessitates use of more than one earthing lead they shall be laid as widely distributed as possible preferably in a single straight trench or in a number of trenches radiating from one point.

MethodofConnectingEarthingLeadToEarthElectrode

In the case of plate earthelectrode theearthing leadshall be securely bolted to the platewith two bolts, nuts, check nuts and washers as required by IS 3043 : 1987.

All materials used for connecting the earth lead with electrode shall be GI incase of GI Pipe and GI plate earth electrodes or tinned brass in case of Copper plate electrode.

ProtectionofEarthing Lead

The earthing lead from electrode onwards shall be suitably protected from mechanical injury and corrosion by a 15 mm dia GI pipe in case of wire and 100/40 mm dia medium class GI Pipe

The portion of the G.I. pipe within ground shall be buried at least 30 cm deep (to be increased to60 cm in case of road crossing or pavements). The portion within the building shall be recessed in walls and floors to adequate depth.

6. EARTHINGCONDUCTORS

Earthing conductors shall form the earthing network throughout the installation for earthing of all non- carrying metal parts.

ConnectionofEarthingConductors

- Mainearthing conductors shall be taken from the earth connections at the mainswitch boards to all other switchboards in the network.
- Sub-mains earthing conductors shall run from the main switch board to the sub distribution boards and to the final distribution boards.
- Loop earthing conductors shall run from the distribution boards and shall be connected to any point on the main/sub-main earthing conductor, or its distribution board or to an earthleakage circuit breaker.
- Metal conduits, cable sheathing and armouring shall be earthed at theends adjacent to switch boards at which they originate, or otherwise at the commencement of the run by an earthing conductor in effective electrical contact with cable sheathing, Switches, accessories, lighting fitting etc shall be effectively connected to the Loop Earthing Conductors. These though rigidly secured in effective electrical contact with a run of metallic conduit shall not be considered earthed, even though the run of metallic conduit is earthed.

EarthingConductorInstallation

The earthing conductors inside the building wherever exposed shall be properly protected from mechanical injury by running the same in GI pipe of adequate size.

Jointsshallberivetedandbrazedinapprovedmanner.

Sweated lugs of adequate capacity and size shall be used for termination. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substances and properly tinned.

• SizingofEarthingConductors

Allfixtures, outlet boxes and junction boxes shall be earthed with Barecopper wires as specified.

All 3 phase switches and distribution boards upto 60 amps rating shall be earthed with 2 Nos. distinct and independent 4 mm dia copper/6 mm dia GI wires. All 3 phase switches and distribution boards upto 100 amps rating shall be earthed with 2 Nos. distinct and independent 6 mm dia copper/8 mm dia GI wires. All switches, bus bar, ducts and distribution boards of rating200 amps and above shallbe earthed with a minimum of 2 Nos. separate and independent 25 mm x 3 mm copper/25mm x 6 mm GI tape.

7. **PROHIBITEDCONNECTIONS**

Neutral conductor, sprinkler pipes, or pipes conveying gas, water, or inflammable liquid, structural steel work, metallic enclosures, metallic conduits and lighting protection system conductors shall not be used as a means of earthing an installation or even as a link in an earthing system.

8. **RESISTANCETOEARTH**

Noearthelectrodeshall havea greaterohmic resistancethan1ohms as measured by an approved earth testing apparatus. In rocky soil the resistance may be upto 1 ohms. The electrical resistance measured between earth connection at the main switchboard and any other point on the completed installation shall be low enough to permit the passage of current necessary to operate fuses or circuit breakers, and shall not exceed 1 ohm.

ROUTINEANDCOMPLETIONTESTS

1. INSTALLATIONCOMPLETIONTESTS

Atthecompletionofthework, the entire installation shall be subject to the following tests:

- 1. Wiringcontinuitytest
- 2. Insulationresistancetest
- 3. Earthcontinuitytest
- 4. Earthresistivitytest

Besides theabove, any other testspecified by the localauthority shall alsobecarried out. Alltested and calibrated instruments for testing, labour, materials and incidentals necessary to conduct the above tests shall be provided by the contractor at his own cost.

2. WIRINGCONTINUITYTEST

All wiring systems shall be tested for continuity of circuits, short circuits, and earthing after wiring is completed and before installation is energized.

3. INSULATIONRESISTANCETEST

The insulation resistance shall be measured between earth and the whole system conductors, or any section thereof with all fuses in place and all switches closed and except in concentric wiring all lamps in position of both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it does not exceed 1100 volts for medium voltage circuits. Where the supply is derived from AC three phase system, the neutral pole of which is connected to earth, either director through added resistance, pressure shall be deemed to be that which is maintained between the phase conductor and the neutral. The insulation resistance measured as above shall not be less than 50 megohms divided by the number of points provided on the circuit the whole installation shall not have an insulation resistance lower than one megohm.

The insulation resistance shall also be measured between all conductors connected to one phase conductor of the supply and shall be carried out after removing all metallic connections between he two poles of the installation and in those circumstances the insulation shall not be less than that specified above.

The insulation resistance between the frame work of housing of power appliances and all live parts of each appliance shall not be less than that specified in the relevant Standard specification or where there is no such specification, shall not be less than half a megohm or when PVC insulated cables are used for wiring 11.5 megohms divided by the number of outlets. Where a whole installation is being tested a lower value than that given by the above formula subject to a minimum of 1 Megohms is acceptable.

4. TESTINGOFEARTHCONTINUITYPATH

The earth continuity conductor including metal conduits and metallic envelopes of cable in all cases shall be tested for electric continuity and the electrical resistance of the same alongwith the earthing lead but excluding any added resistance of earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

5. TESTINGOFPOLARITYOFNON-LINKEDSINGLEPOLESWITCHES

In a two wire installation a test shall be made to verify that all non-linked single pole switches have been connected to the same conductor throughout, and such conductor shall be labeled or marked for connection to an outer or phase conductor or to the non-earthed conductor of the supply. In the three of four wire installation, a test shall be made to verify that every non-linked single pole switchis fitted to one of the outer or phase conductor of the supply. The entireelectrical installation shallbe subject to the final acceptance of the Management committee as well as the local authorities.

6. EARTHRESISTIVITYTEST

EarthresistivitytestshallbecarriedoutinaccordancewithISCodeofPracticeforearthingIS3043.

7. PERFORMANCE

Should the above tests not comply with the limits and requirements as above the contractor shall rectify the faults until the required results are obtained. The contractor shall be responsible for providing the necessary instruments and subsidiary earths for carrying out the tests. The abovetests are to be carried out by the contractor without any extra charge.

8. TESTSANDTESTREPORTS

The Contractor shall furnish test reports and preliminary drawings for the equipment to the Management committee for approval before commencing supply of the equipment. The Contractor should intimate with the tender the equipment intended to be supplied with its technical particulars. Any test certificates etc., required by the local Inspectors or any other Authorities would be supplied by the Contractor without any extra charge.

TECHNICALSPECIFICATIONFORLIGHTNINGPROTECTIONWORKS

1. LIGHTENINGPROTECTIONSYSTEMESEIONSTREAMERAdvancedLightingProtectionSystem (Based on French Standards)

1.1 SCOPEOFWORK

The work to be done under this section comprises the supply & installation necessary for the complete installation of the lighting protection systems.

The design of the components shall be traceable to field research, laboratory, fundamental analysis, and statistical levels of the lightning event.

The design of the components shall be traceable to long term practical field studies laboratory testing, fundamental scientific principal and statistical levels of the lightning event as documented in international standard.

The lighting protection systems hould complies in accordance with NFC17-102 standard and shall be installed strictly to the manufacturer's instructions.

The advanced lighting protection systems hall include components as follow:

ESEION Streamer Air terminal

Mechanicalsupports

Down-conductors

PerformancecountingEquipment(Electro-mechanicalcounter) A

low impedance Grounding system .

1.2 STANDARDS

Complete installation shall be engineering and constructed in accordance with the latest revision of the following:

NFC-17-102

IEC 61204

The detail of the lighting protection system shall also confirm to the requirements of all relevant local codes, as applicable, together with the additional requirements referred to in this specification and drawings, whichever is more stringent and acceptable to the engineer.

1.3 IONSTREAMERAIRTEMINAL

Theairterminalshallbeofthetypethatrespondsdynamicallytotheappearanceofalightning down leader by creating free electrons between outer surfaces and an earthed central finial rod.

The ION STREAMER air terminal should work under Early Streamer Emission (ESE) Technology and the attractive radius of the air terminal shall be traceable to known and acceptable lighting research and statistics.

The Lighting conductor should deliver a unique gain time in efficiency, anticipating the natural formation of an upward leader. The Air terminal generates a leader that propagates rapidly to capture the lighting stroke and conducts it towards the ground.

 $\label{eq:action} Arcing is not to be continuous and shallonly occur during the progress of the lighting leader.$

The air terminal shall not cause high frequency radio interference except during the millisecond interval associated with the progress of the lighting and during the main return strike of lighting events in the region.

Thematerialsoftheairterminationshallbenon-corrodinginnormal atmosphere.

The ION STREAMER air termination shall not be dependent upon batteries or external power supplies for anypart of its operation.

The height of the air terminal support mast should be minimum 3 mtr and the height will be increased as per the coverage design.

The support shall be securely installed and guy wires shall be used where necessary to enable the air termination and mast system to withstand maximum locally recorded wind velocities.

1.4 DOWNCONDUCTOR

The downconductorshould beused25x3mmcopper stripormin.50 Sq.mmmulti Strainflexible copper wire. Two down conductors shall be used in case of the structure heightis above 28 mtr and both should be connected with maintenance –free Grounding system.

The main copper conductor shall be connected directly to the Ion Streamer air terminationthrough Insulator.

The down conductor must be kept in constant physical contact with the structure via conductive mounting clamps in case of non insulating conductor.

1.5 LIGTHINGFLASHCOUNTER

Each protection system shall be supplied with Lighting strike counter. The counter shall have a register that activates one count for every discharge where the peak current exceeds 400A at the 8/20us.

The lighting flash counter shall be installed to the manufacturer's instruction inareadily accessible manner (always 2 meter above the Ground) so that reading can be taken at regular intervals. It shall be positioned such that its operating temperature is within the range – 20'C to + 60'C.

1.6 GROUNDINGSYSTEM

The ION STREAMER Lightening arrestor grounding system reading shall not exceed 10 ohms static impedance except with prior approval by the specifying engineer or manufacturer of the lighting protection system.

Grounding will be done bycopper bonded steel core ground rodsofmin. 17mmdia., 3 meter long and especially designed for electrical grounding preferably tripod.

Bonding of the grounding system to metallic parts of the building, the structural reinforcing steelof the building to arriving services is recommended.

Electrically conductive, on soluble JAMFILL Powder should be used to achieve low ground resistance. Provided the materials are mixed and installed strictly in accordance with the manufacturer's instructions.

SURGEPROTECTIONDEVICE

Class B surge arrester (BDL/B/65/) for three phase two wiresystem with discharge impulse current (limp as per IEC61643-1 65KA (for 10/350 μ s) between phase to neutral & 100KA (for 10/350 μ s) between Neutral to earth at main LT panels/main panel of building. Maximum continuous operating voltage should be 320V for Phase to neutral. Response time (ta) should be less than 100ns for phase to neutral & Voltage protection level should be less than 1.3 KV.

EarthEnhancementmaterial

Earth enhancement material is a superior conductive material that improves earthing effectiveness, especially in a reas of poor conductivity (rocky ground, areas of moisture variation, sandy soils etc.). It improves conductivity of the earth electrode and ground contactarea. It shall have following characteristics-

shallmainlyconsistofGraphiteandPortlandcement.Bentonitecontentshallbenegligible.

shallhavehighconductivity, improves earth's absorbing power and humidity retention capability.

shallbenon-corrosiveinnaturehavinglowwatersolubilitybuthighly hygroscopic.

shall have resistivity of less than 0.2 ohms-meter. Resistivity shall be tested by making a 20cm. cube ofthematerialand checking resistance ofthecube attheends. Thesupplier shall arrange for such testing at the time of supply, if sodesired.Necessary certificate fromNational / Internationallabforthe resistivity shall also be submitted.

shallbesuitableforinstallationindryformorinaslurry form.

shall not depend on the continuous presence of water to maintain its conductivity.

shallbepermanent&maintenancefreeandinits" setform", maintains constant earth resistance with time. shall be thermally stable between -10° C to $+60^{\circ}$ C ambient temperatures, shall not dissolve, decompose or leach out with time,

shall not require periodic charging treatment nor replacement and maintenance.

shall be suitable for any kind of electrode and all kinds of soils of different resistivity.

shall not pollute the soil or local water table and meets environmental friendly requirements forlandfill.

shallnotbe explosive.

shallnotcauseburns, irritation to eye, skinetc.

Marking: The Earthenhancement material shall be supplied in sealed, moisture proof bags. These bags shall be marked with Manufacturer's name or tradename, quantity etc.

Backfillmaterial

The excavated soil is suitable as a backfill but should be sieved to remove any large stones and placed around the electrode taking care to ensure that it is well compacted. Material like sand, salt, coke breeze, cinders and a shall not be used because of its acidic and corrosive nature.

DOUBLEWALLED CORRUGATEDHDPEDUCTS

- 0.1 Thisspecificationisissuedunderthefixedserialnumberfollowedbytheyearofadoptionas standard or in case of revision, the year of latest revision.
- 0.2 This specification requires reference to the following specifications.

(i)	IS:14930PtI	:	Generalrequirements of Conduits ystem for Electrical
			andCommunicationinstallation
(ii)	IS:14930PtII	:	Particularrequirements of Conduits ystem for
			ElectricalandCommunicationinstallation
(iii)	IS:2530:		$Method for test for {\sf Polyethylene} mould ingmaterials$
			and polyethylene compounds.
(iv)	IS:7328:		HDPEmaterialsformouldingandextrusion
(v)	IS:12063	:	Classification of degrees of protection provided by
			enclosuresofelectricalequipment
(vi)	IS:11000(Pt-		Glow-WireTestandGuidance,TestMethodsforFire
	2/Sec1)		HazardTesting
(vii)	ASTMD1693	:	Testmethodforenvironmentalstress-crackingof
			ethyleneplastics
(viii)	ASTMD 638	:	Standard test method for tensile properties of plastic
(ix)	ASTMD790	:	TestmethodforflexuralpropertiesofUnreinforced
			andReinforcedPlasticsandElectricalInsulating
			Materials.
(x)	ASTMD2240	:	StandardTestmethodforRubberproperty.
(xi)	ASTMD648	:	StandardTestmethodfordeflectiontemperatureof
			plasticunderflexureloadintheEdgewisePosition.

0.3 Wheneverreferencetoanyspecificationappearsinthisdocument,itshallbetaken asareferencetothelatestversionofthatspecificationunlesstheyearofissueofthespecificationis specificallystated.

1.0 SCOPE

This document specifies the requirement and testing for Double Walled Corrugated (DWC) HDPE Ducts buried undergroundincludingducts & duct fittings for protection where verrequired for all types of Signalling Cables.

2.0 TERMINOLOGY

TerminologyasdefinedinIS:14930shallbefollowed.

3.0 ABBREVIATIONS

- ASTM:AmericanSocietyforTesting&Materials.
- CC :CubicCentimetre.
- DSC :DifferentialScanningCalorimeter
- DTA :DifferentialThermalAnalyzer
- DWC:DoubleWalledCorrugated
- ESCR:EnvironmentalStressCrackResistance
- FTIR :FourierTransformInfraredSpectroscopy
- g : Gram
- HDPE:HighDensityPolyethylene.
- Hr : Hour
- IS :IndianStandard.
- Kg : Kilograms
- MFI :MeltFlowIndex.
- mm :Millimetre
- OIT :OxidationInductionTest
- SPN :SpecificationProvisionalNumber.
- UV :UltraViolet.

4.0 GENERALREQUIRMENTS

- 4.1 TheDWCDuctshallconsistoftwolayers,theouterlayerwillbecorrugatedandtheinnerlayershallbe plain and smooth.
- 4.2 DWC Duct and conduit fittings within the scope of this specification shall be so designed and constructed that in normal use their performance is reliable and without danger to the user or surroundings.
- 4.3 When assembled in accordance with manufacturer's instruction as part of a conduit system, hey shallprovidemechanical protection to Signalling Cables contained therein.
- 4.4 Within the conduit system there shall be no sharp edge, burrs or surfaceprojectionswhicharelikelytodamageinsulatedconductorsorcablesorinflictimpuritytotheinstall eroruser.
- 4.5 The protective properties of the joint between conduit and conduit fittings shall be not less then that declared for the conduit system.

- 4.6 The DWC Duct and fittings shall withstand the stresses likely to occur during transport, storage, recommended installation practice and application.
- 4.7 The DWC duct shall be supplied in continuous length in coil form or straight length, suitable for shipping and handling purpose.
- 4.8 For conduit systems that are assembled by means other than threads, themanufacturershall indicate whether the system can be disassembled and if, so, how this can be achieved.

5.0 REQUIREMENTSOFRAWMATERIALSUSEDFORTHEDWCHDPEDUCTS

- 5.1 ThebaseHDPEresinusedfortheouterandinnerlayeroftheDWCHDPEDuctshallconformto anydesignationofIS:7328ortoanyequivalentstandardmeetingtherequirementsgiveninTable No. 1, when tested as per the standards given therein. However, the manufacturers shall furnish the designation for the HDPE resin as per IS: 7328 as applicable.
- 5.2 Theanti-oxidantsusedshallbephysiologicallyharmless.
- 5.3 Noneoftheadditivesshallbeusedseparatelyortogetherinquantitiesastoimpairlongtermhysical andchemicalpropertiesoftheduct.
- 5.4 Singlepassreworkmaterialofthesamecompositionproducedfromthemanufacturer's ownproductionmaybeusedanditshallnotexceed10%inany case.
- 5.5 Therawmaterialusedforextrusionshallbedriedtobringthemoisturecontenttolessthan0.1%.
- 5.6 Suitable UV stabilizers shall be used only for manufacture of the non black coloured HDPE duct to protect againstUVdegradation, when stored inopenfor minimum8monthsperiod. The purchaser may ask for UV content test. The test result for UV Content test by FTIR method from any recognized laboratory shall be accepted and the Hindered Amine Light Stabiliser shall be minimum0.15%. UV Content test need not to be conducted in case of UV Stabilized raw material is used.

6.0 REQUIREMENTOFDWCHDPEDUCTS

- 6.1 VisualRequirement:Theducts shall be checked visually for ensuring goodworkmanshipthatthe ducts shall be free from holes, breaks and other defects. The ends shall be cleanly cut and shall be square withaxis of the ducts.
- 6.2 Colour: The colour of the duct viz. Green, Orange, Blue, Yellow, Brown, Violet, Grey and Red. The purchaser shall specify the colour of the duct at the time of ordering.
- 6.3 Dimensions: The dimensions of the DWC HDPE Ducts shall be as given in table- 2. Any other sizes other than those mentioned in Table- 2 shall be as per the agreement between the buyer and the seller. Compliance shall be checked as per procedure given in Annexure- A
- 6.4 Standards Length: Duct up to 50 mm OD nominal size shall be supplied in standard length of 100 mtr.
 ± 1% or 6 mtr ± 1 % and all other sizes will be suppliedinstandardlengthof6mtr.±1%
- 6.5 CompressionStrength:Theconduitsystemshallhaveadequatemechanicalstrength.Conduitswhen bent or compressed either during, or after, installation accordingtomanufacturer'sinstructions, shallnotcrackandshallnotbe deformed to such an extent that introduction of the insulated conductorsorcablesbecomesdifficultorthattheinstalledinsulatedconductors,orcablesarelikely to bedamagedwhilebeingdrawnin.Compliance may be checked with the applicationofforce which shall be at least 450 N, when reaching the deflection of 5%. Test shall be conducted in accordance to the method given in Annexure- B

- 6.6 Impact Strength: The conduit system shall have adequate mechanical strength. Conduits when exposedtoimpacteitherduring, orafter, installation according to manufacturer's instructions, shall not crack and shall not be deformed to such an extent that introduction of the insulated conductors or cables becomes difficult or that the installed insulated conductors, or cables are likely to be damaged while being drawn in. Compliance may be checked by ensuring there shall be no crack allowing the ingress of light or water between the inside and outside after the test. Test shall be conducted in accordance to the method given in Annexure-C
- 6.7 BendingStrength:Theconduitsystemshallhaveadequatemechanicalstrength.Conduits when bend either during, or after, installation according to manufacturer's instructions, shall not crack and shall not be deformed to such an extent that introduction of the insulated conductors or cables becomes difficult or that the installed insulated conductors, or cables are likely to be damaged while being drawn in. During the test sample shall not flatten Compliance shall be checkedbypassingaballhavingadiameterequalto95%minimuminner diameter of the sample declared by the manufacturer, through the sample whilst it is bent around the test apparatus. Testshall be conductedin accordancetothe method giveninAnnexure-D
- 6.8 Oxidation Induction Test (OIT):The OIT in a qualitative assessment of the level (or degree) of stabilization of material. The induction time in oxygen when tested with an Aluminium pan as per method given in Annexure- E shall not be less than 30 minutes.
- 6.9 Resistance To Flame Propagation: Non flame propagating ducts shall have adequate resistance to flame propagation. Samples of DWC HDPE Ducts shall be checked by applying a 1KW flame. Test shall be conductedinaccordancetothemethodgiveninAnnexure-FCombustionshallstopwithin30Seconds.
- 6.10 AntiRodentProperties: Safetyofductsfromthedirectattackofsubterraneanorganismanti rodent material is of utmost importance. These ducts shall be evaluated for their safety against rodents before laying them in the fields. Test shall be conducted in accordance to the methodgiven in Annexure- G
- 6.11 Resistance to External Influences on DWC HDPE DuctAccessories: The accessories in Clause 7.0 shall be tested for external influences as per IS-12063 for ingress of dust & ingress of water. DWC Duct systems when assembled in accordance with the manufacturer's instructions shall have adequate resistance to external influences according to the classification declared by the manufacturer with a requirement of IP 67. Test shall be conducted in accordance to the method given in Annexure- H
- 6.12 Marking Identification: The conduit shall be prominently marked at regular intervals along their length of preferably 1 mbut not longer than 3 musing indelible ink with following.
 - Manufacturersname
 - SpecificationNo.
 - Nameoftheductwithsize
 - LotNo.oftheProduct
 - Dateofmanufacture
 - ProductLength
 - Purchaser'sName/symbol

7.0 DWCDUCTACCESSORIES

7.1 Thefollowingaccessoriesarerequiredforjointingtheductsandshallbe supplied along with theductsagainstspecificorders. The manufacturers shall provide complete procedure and method for installation of the accessories. The required quantities of accessories are to be mentioned by

thepurchasingauthority in the purchase order.

- 7.1.1 PlasticCoupler:The coupler shall be of Push-fit type with O-ring. It is used for jointing two or more ducts. The design of this shall be simple, easy to install and shall provide air tight and water tight joint between the two ducts. The coupler shall insure that the two ducts are butted smoothly withoutanystepformationintheinnersurface.Thecouplermaybestraight,bands,T-jointstypeas per requirements of purchaser.
- 7.1.2 EndCap:Thiscapmadeofsuitableplasticmaterialshallbefittedonthebothendsofduct,coilafter manufacturing the duct. This shall avoid entry of dust, mud and rainwater into the duct during the transit & storage.
- 7.2 The dimensions of accessories shall be suitable for joining the ducts of dimension as per Cl: 6.3

8.0 PACKINGREQUIREMENT

Stores shall be supplied in standard size for delivery and shall be so packed as to permitconvenient handling and to protect against loss or damage during transit and storage.

9.0 TYPETESTS

9.1 Complete DWC Duct systems for each offered size of the duct on fresh samples shall be subjected to following tests minimum after 240 hrs of manufacture.

a)	VisualRequirement	(Cl.No.6.1)
b)	Color	(Cl.No.6.2)
c)	Dimension	(Cl.No.6.3)
d)	Standardslength	(Cl.No.6.4)
e)	CompressionStrength	(Cl.No.6.5)
f)	ImpactStrength	(Cl.No.6.6)
g)	BendingStrength	(Cl.No.6.7)
h)	OxidationInductionTest	(Cl.No.6.8)
i)	ResistancetoFlamePropagation	(Cl.No.6.9)
j)	Antirodent	(Cl.No.6.10)
k)	Resistanceto External Influences on DWC HDPE Duct	(Cl.No.6.11)

accessories

- 9.2 TheOxidationInductionTest,ResistancetoFlamePropagatingTest,AntiRodentTestontheDWC duct and Resistance to External Influences on DWC HDPE Duct accessories given in Cl. No. 6.8, 6.9, 6.10&6.11respectivelymaybeconductedatthemanufacturer'slaboratorybyinspecting authorityoratanyrecognizedlaboratory.
 - 9.3 TherawmaterialtestsoftheDWCductgiveninCl.No.5.0Table-1foreachgradeofrawmaterial shallbeconducted.Testmaybeconductedatthemanufacturer'slaboratorybyinspecting

authorityoratanyrecognizedlaboratory.

9.4 Unlessotherwisespecifiedeach testsshallbemadeon threenewsamples.

10.0 ACCEPTANCETESTS

10.1 The following test shall be carried after 240 hrs of manufacture on samples selected from the lot as per sampling plan given in Cl 13.0

a)	VisualRequirement	(Cl.No.6.1)
b)	Color	(Cl.No.6.2)
c)	Dimension	(Cl.No.6.3)
d)	Standardslength	(Cl.No.6.4)
e)	Compressiontest	(Cl.No.6.5)
f)	Impacttest	(Cl.No.6.6)
g)	Bendingtest	(Cl.No.6.7)
h)	ResistancetoFlamePropagation	(Cl.No.6.9)

- 10.2 TheResistancetoFlamePropagatingTestonDWCHDPEDuctgiveninCl.No.6.9maybeconducted atthemanufacturer'slaboratorybyinspectingauthorityoratanyrecognizedlaboratory.
- 10.3 Unlessotherwisespecifiedeachtestsshallbemadeonthreenewsamples.

11.0 ROUTINETESTS

11.1 Thefollowingtestsbecarriedoutbythemanufacturerafter240hrsofmanufacture:-

a)	VisualRequirement	(Cl.No.6.1)
b)	Color	(Cl.No.6.2)
c)	Dimension	(Cl.No.6.3)
d)	Standardslength	(Cl.No.6.4)
e)	Compressiontest	(Cl.No.6.5)
f)	Impacttest	(Cl.No.6.6)
g)	Bendingtest	(Cl.No.6.7)
h)	ResistancetoFlamePropagation	(Cl.No.6.9)

- 11.2 TheResistancetoFlamePropagatingTestonDWCHDPEDuctgiven inCl.No.6.9maybeconducted atthemanufacturer'slaboratorybyinspectingauthorityoratanyrecognizedlaboratory.
- 11.3 The Density and Melt Flow Index tests on raw material of the DWC duct given in Cl. No. 5.0 Table-1 for each grade of raw material shall be conducted.

12.0 INSPECTION

- 12.1 All the gauges/ test & measuring instruments shall be under calibration control at the time of inspectionandprooftothisofficeshallbeproduced.
- 12.2 Inspection and testing shall be carried out by the Management committee toensurethatall the requirements of thisspecificationare complied with for the acceptance of thematerials offered by the supplier for inspection.
- 12.3 TheManagement committeeshallhavefreeaccesstotheworksofthe manufacturer and tobe present at all reasonable times and shall be given facilities by themanufacturer toinspect manufacturing of the ductatany stage of manufacture. He shall have therighttorejectwholeorpart of any work or material that does not conform to the terms of this specification or any equivalent specification or requirement applicable and may order the same to be removed / replaced or altered at the expense of the manufacturer. All reasonable/complete facilities considered necessary by the inspecting authorities for the inspection of the ducts shall be supplied by the manufacturer free of cost.
- 12.4 The manufacturer shall supply the duct samples and samples of the raw materials free of charge as required by the inspecting authority and shall at his own cost prepare and furnish the necessary test pieces and appliances for such testing as may be carried out athisown premises in accordance with this specification. Failing the existence of facilities at his own premises for the prescribed tests, the manufacturershallbearthecostofcarryingoutthetestsinan approved laboratory, workshop or test house.

13.0 SAMPLING

- 13.1 Allthelengthofsamenominalsize, similar construction and class manufacture dfrom the same material under essentially similar conditions of production shall be grouped together to constitute lot.
- 13.2 Forjudgingtheconformityofalottotherequirementsoftheacceptancetests, samplingshall bedoneforeachlotseparately. Forthis purpose, the number of lengthstobes elected at random from the lot shall be in accordance with Table 3.
- 13.3 Theses lengths will be selected at random from the lot for taking samples. From each of these lengths, sampleof ducts hall be taken. The length of the sample shall be sufficient so as to provide test pieces of required lengths as laid down in various test clauses.

14.0 WARRANTY

Themanufacturershallwarrantthematerialcoveredbythisspecificationtobefreefrom defects indesign, material and work manship under ordinary use and service, his obligation under this warranty being limited to replace free of cost those parts which shall be found defective.

15.0 REJECTION

In case the duct tested and inspected in accordance with this specification, fail to pass the tests or complywiththerequirementofthespecification, the whole consignment shall be rejected subject to the discretion of the Management committee.

16.0 INFORMATIONTOBESUPPLIEDBYTHEPURCHASER

- 16.1 Normally the duct will be supplied as per the standard dimensions and length as mentioned in this document. However, purchaser may specify his own dimensions/lengths/packing requirementsetc. In such cases necessary tolerance shall also be specified by the Management committee.
- 16.2 Adequate quantity & type of duct accessories shall be supplied along with each lot. The Management committee may specify additional requirement.
- 16.3 Inspectingagencyforacceptanceofmaterial.
- 16.4 Colourofthe Duct.

DIMENSIONOFTHEDWCDUCT

- 1.0 Compliance of the outside diameters hall be checked using a ring gauge or vernier caliperorany suitable method.
- 1.1 Compliance of the minimum inside diameter shall be checked by measurement according to twoperpendicular diameters on the same section and calculating the average value.
- 1.2 Outsidediameterspecifiedarenominaldimensions.
- 1.3 Outsidediametermaximumisnominaloutsidediameter+(0.018xnominaloutsidediametervalues) rounded off to + 0.1 mm.
- 1.4 Minimuminsidediameterisnominal outsidediameterdividedby1.33

ANNEXURE-B

COMPRESSIONTEST

- 1.0 ConduitsaresubjectedtoacompressiontestasperIS:14930(Pt-II).Thetestsforconduitsshallnot be started until 240 hrs after manufacture.
- 1.1 Samplesshallbe200±5mmlong.
- 1.2 Before the test the outside and inside diameters of the samples shall be measure as described in clause 6.3
- 1.3 The samples shall be compressed between two flat steel plates having minimum dimensions (100x200x15mm), the length 200 mm being along the length of the sample. The sample shall be compressedatarateof15±0.5mm/minandtheloadrecordedattheverticaldeflection equivalent to5% of theaverage value of theoriginal insidediameter of the sample.
- 1.4 Whenreachingthedeflectionof5%,theappliedforce shallbeatleast450N
- 1.5 After the test there shall be no crack allowing the ingress of light or water between the inside and the outside.
- **1.6** The deflection is calculated with the inner diameter but the measurement of the outside diameter may be sufficient. Incase of doubt, it will be necessary to measure the inner diameter.

ANNEXURE-C

IMPACTTEST

- Twelvesamples of theduct each 200±5 mmin length or fittingsaresubjected toan impact test as per IS: 14930 (Pt-II) by means of the apparatus shown Figure-1.
- 1.1 Thetestapparatusshallbeplacedona firmflatsurface. Thesamplesshallbeconditioned ina cold chamber at a temperature of 5 ±1°C for 2 h. The samples shall be removed from the cold chamber and placed on the vee block holder of the impact tester as shown in Figure-1.
- 1.2 The striker shall fall once on each sample. The time between removal of the sample from the cold chamberandcompletionofimpactshallnotexceed10seconds.Theimpactheightandmassshallbe asfollows.

NominalSizeof Conduit	MassofStriker (+1% /-0%)kg	FallHeight (+0% /-1%)(mm)	Energy Joules
U pto60mm	5	300	15
61to90mm	5	400	20
91to140mm	5	570	28
Above140mm	5	800	40

- 1.3 The test sample shall be made on the weakest part of the Duct fittings except that itshallnotbeapplied within5mmof any sample entry. Samplesof ducts are tested onthecentreoftheirlength.
- 1.4 After the test, at least innine of the samples, there shall be no crack allowing the ingress of light or water between the inside and the outside.

ANNEXURE-D

BENDINGTEST

- 1.0 Thistestshallbecarriedoutonpliableconduits.
- 2.0 ThetestismadeonsixsampleshavinganappropriatelengthasperIS:14930(Pt-II).Threesamples shallbetestedatroomtemperature;theotherthree shall betestedat-5±1°C.Forthetestat -5°C, thesampleshallbe conditioned in a cold chamber for 2 hours. The test apparatus as shown in Figure-2shallallowtobendtheductwithabendingradiusequaltotheminimumbending radiusvaluesspecifiedbythemanufacturer.Oneoftheendsofthesamplesshallbefixedon the test apparatus by means of an appropriatedevice.Thesampleisthenbenttoapproximately90 degree (right angle) and hold.
- 2.1 Duringthetest,thesampleshallnotflatten.Complianceshallbecheckedby passingaballhavinga diameterequalto95%minimuminnerdiameterofthesampledeclaredbythemanufacturer, through the samplewhilstitisbent around the test apparatus.

ANNEXURE-E

OXIDATIONINDUCTION TESTPROCEDURE

- 1.0 A short length of completed duct (approximately 30 cm) shall be sealed at the ends and placed in an oven at temperature of 68 ± 1 °C for 8 hours. The sample shall thenbeallowedto coolatroom temperatureforatleast16hrs.Thesamplesshallbecleananddry.Thesamplesshallthenbetested by means of a Differential Scanning Calorimeter (DSC) or by Differential Thermal Analyzer (DTA).
- 2.0 InstrumentTestProcedure:
- 2.1 Cell Cleaning: The cell shall be held at approximately 400 °C for 10 minutes in Nitrogen. The cell shall be cleaned after standing over night and between testing of different formulations.
- 2.2 TemperatureCalibration:Thishastobedoneaccordingtotheinstrumentmanual.

Thetemperaturescaleshouldbeadjusteduntilthedeterminedmeltingpointofpure Indiummetal is 156.6 °Cata heat rate of5°Cperminuteor anyother heat rateas indicated inthemanualofthe equipment is permitted.

2.3 Aluminium Pan Preparation:Standard aluminium DSC pans as per ASTM D 4565 are required to hold

specimens during testing. A fresh pan shall be used for each test.

- 2.4 Sample preparation: Take the sample weighing about 5mg from the duct conditioned as indicated above. Position the sample in the centre of the pan.
- 2.5 Nitrogen Purge:Place the sample pan and reference pan in instrument cell. Flush for 5 minutes with cylinder of nitrogen (99.6% extra dry grade) at 60 ± 10 cc per minute.
- 2.6 OxidationTest:Rapidlyincreasethetemperatureofthesample(20°C/minorgreater)from 100 °C or lower initial temperature to 199 ± 1 °C. After thermal equilibrium is obtained (steady recorder signal) switch to 80 ± 20 cc per minute oxygen flow and simultaneously start time-base recording. The oxygen used for the test should be equivalent to or better than 99.6% extra dry grade.
- 2.7 Induction Period: The oxygen induction point shall be recorded as time zero, and the chart speed shallbesufficient to provide a clearly discernibles lope at the start of the exothermic reaction. The test in the pure dry oxygen atmosphere shall continue until the exothermic peak is produced. The intersection of the the the the the time from time zero to is intersection point is read from the base line and recorded as the oxidative induction time.

ANNEXURE-F

RESISTANCE TOFLAMEPROPAGATIONTESTPROCEDURE

- 1.0 SamplesofDWCHDPEDuctsshallbecheckedbyapplyinga1KWflame.
- 1.1 Asampleoflength675+10mmismountedverticallyinarectangularmetalenclosurewith one open face, as shown in Figure-3-2 in an area substantially free from draughts. The general arrangements is shown in Figure-3 Mounting is by means of two metal clamps approximately 25mm wide spaced 550 + 10 mm apart and approximately equidistance from the ends of the sample. Asteelrodof16+0.1mmispassedthroughthesample.It is rigidly and independently mountedandclampedatupperendtomaintainthesampleinastraightandverticalposition. Themeansofmountingissuchasnottoobstructdropsfromfallingontothetissuepaper.

A suitable piece of white pinewood board, approximately 10 mm thick, covered with single layer of white tissue paper is positioned on the lower surface of the enclosure.

The assembly of sample, rod and clamping apparatus is mounted vertically in the centre of the enclosure, the upper extremity of the lower clamp being 500 + 10 mm above the internal lower surface of the enclosure.

- 1.2 Theburnerissupportedso thatitsaxisis45+2°to thevertical.Theflameisapplied to the sample so that thedistance fromthe top of theburner tubetothe samplemeasuredalongtheaxis of the flame is 100 + 10 mm and the axis of the flame intersects with the surface of the samples at a point 100 + 5 mm from the upper extremity of the lower clamp, and so that the axisoftheflameintersectswiththeaxisofthesample.
- 1.3 The test is carried out on three samples. The flame is applied to the sample for theperiodspecified in Table - 4 and is then removed. During the application of the flame, it shall not be movedexcepttoremoveitattheconclusionoftheperiodofthetest.Aftertheconclusionof thetestandafteranyburningofthesamplehasceased,thesurfaceofthesampleiswiped clean by rubbing with a piece of cloth soaked with water.

1.4 All three samples shall pass the test. If the sample is not ignited by the flame, it shall be deemed to have passed the test.

If the sample burns, or is consumed without burning, the sample shall be deemed to have passed the test if after burning has ceased, and after the sample has been wiped in accordance with 1.3 there is no evidence of burning of charring within 50 mm of the lower extremity of the upper and also within 50 mm of the upper extremity of the lower clamp.

If the sample burns, it shall be deemed to have failed the test if combustion is still in progress 30 seconds after removal of the flame.

If the tissue paper ignites, the sample shall be deemed to have failed the test. For the parts of the samebelowtheburner, the presence of moltenmaterial on the internal or external surfaces shall not entail fail ure if the sample itself is not burned or charred.

2.0ComplianceofDWCHDPEDuctfittingsischeckedbyusingtheglowwiretestIS:11000(Part 2/Sec1).The glowwireshallbeapplied oncetoeachsample inthemostunfavourableposition of its intended use, with the surface tested in vertical position, at a temperature of 750°C. The sample is deemed to have passed this test if there is no visible flame or sustained glowing or if flames or glowing extinguishes within 30s of the removal of the glow wire.

ANNEXURE-G

ANTIRODENTTESTPROCEDURE:

Thetestagainstrodentmaybeconducted asperfollowingprocedures:

Theducts aretobelaidundergroundinfieldsandalsonearurban orrural settlements. Therefore they should be exposed to 3-4 most predominant rodent species inhabiting these locations. The testrodent species may include the lesser bandicoot rat, Bandicotabengalensis, TheIndiangerbils, tatera indica, thesoftfurred field rats, Millardia meltada and the house rats, Rattus rattus.

The test ducts should be exposed to these rodent species housed individually in iron mesh cages under laboratory conditions. Only freshly capture rodent are tobe utilized for the study. The rodents are first acclimatized in laboratory cages for 7-10 days and then the tests be initiated. For each trial, 3-4 rodents of uniformbodyweightaretobeusedforthetrial. Two different types of testes may be undertaken for all the ducts.

ChoiceTests:Inthistrialtheductsof15-30cmlength(onesampleeachoftreatedand untreated/control sample)areexposedtothetestrodentsalongwithfood,thustherodenthadachoicebetweenthefoodand thetestduct.Thistestmayberunforlongerperiods (30-45days).Tapwatershouldbeprovidedadlibitum to the rodents.

NOChoiceTest:Therodentsareexposedtothetestductsonlyandnofoodisgiventothe rodents during the period of trial. The test ducts (one sample each of treated and untreated /control sample) are to the exposedtothetestrodents. Thistrailmay berunfor 5-7 days depending upon the health status of starved test rodents. Tap water should be provided ad libitum to the rodents.

Observationontoothmarks, rodent behaviour toward exposed ducts relative extent of damage in treated and untreated samples should be computed for both types of ducts. Health status of test animals in choice and no choice test must also be monitored for the record any ill effect of exposure of treated / control ducts on the sean imals. Number of cases and the extent of rodent bites / scratchmarks in control and

antirodent treated ducts may indicate the relative deterrent/repellent properties of the test ducts.

ANNEXURE-H

EXTERNALINFLUENCESTESTPROCEDURE

- 1.0 TheaccessoriesinClause7.0shallbetestedforexternalinfluencesasperIS-12063foringressof dust & ingress of water. DWC Pipes systems when assembled in accordance with the manufacturer's instructions shall have adequate resistance to external influences according to the classification declaredby themanufacturer with a requirement of IP 67.
- 2.0 Degree of Protection-Ingressof Foreign Solid Objects.
- 2.1 An assembly is made of DWC Pipes fittings with a short length of DWC Pipes assembled in each entry.Wherenecessary,theopenendsoftheassemblyarepluggedorarenotpartofthe test.
- 2.2 Theassemblyshallbetestedin accordancewith theappropriatetestoflS12063.
- 2.3 Theassemblytestedfornumeral6,shallbedeemedtohavepassedthetestifthereis no ingress of dust visible to normal or corrected vision without magnification.
- 3.0 Degree of Protection-Ingressof Water.
- 3.1 An assembly is made of a DWC Pipe fittings with a short length of DWC Pipes assembled in each conduitentry.Wherenecessary,theopenendoftheDWCPipeisplugged,orisnotpartofthetest.
- 3.2 Theassemblyshallbetestedin accordancewith theappropriatetestoflS12063.
- 3.3 Theassemblytestedfornumeral7shallbedeemedtohavepassedthetest,ifthereisnotsufficient ingressofwatertoformadropvisibletonormalorcorrectedvisionwithoutmagnification.

RAWMATERIALREQUIRMENT

(Cl.5.0)

S.No.	Parameter	SpecifiedLimit	TestMethod
1	Density	0.940to0.958g/ccat 27ºC	IS:2530orIS:7328
2	MeltFlowIndex	0.2to1.1g/10min at190ºC,5kgload	IS:2530
3	TensileStrengthaYield	20N/mm ² Minimum	ASTMD638-IV
4	ElongationatBreak	600%Minimum	ASTMD638-IV
5	HardnessShoreD	Between60and65units	ASTMD 2240
6	EnvironmentalStressCrack Resistance	Nocrackingafter96hrs.	ASTMD 1693
7	Flexuralmodulusat1%strain	690N/mm ² minimum	ASTMD 790
8	Heat DeflectionTemperature at45 g/mm ²	65ºCminimum	ASTMD 648
9	OIT(inAluminumPan)	30minutesminimum	AsperAnnexure-E

DIMENSIONS

(Cl.6.3)

NominalSize	OutsideDiameter	OutsideDiameter	MinimumInside
(mm)	(mm)	Tolerance(mm)	Diameter(mm)
(1)	(2)	(3)	(4)
40	40	+0.8	30
50	50	+1	37
63	63	+1.2	47
75	75	+1.4	56
90	90	+1.7	67
110	110	+2	82
120	120	+2.2	90
125	125	+2.3	94
140	140	+2.6	106
160	160	+2.9	120
180	180	+3.3	135
200	200	+3.6	150
225	225	+4.1	170
250	250	+4.5	188
315	315	+5.7	237

SCALEOFSAMPLING

(Clause-13.0)

LotSizo	Fordimensionalre	Other	
LOUSIZE	Samplesize of Defectives	PermissibleNumber	Acceptancetests
(1)	(2)	(3)	(4)
Upto300	13	0	2
301to500	20	0	3
501to1000	32	1	4
1001to3000	50	2	5
3001andabove	80	3	7

TIMEOFEXPOSUREOFTHESAMPLETOTHEFLAME

(Clause-6.9)

Material	Thickness(MM)	Flame Application (Tolerances+1sec.)
Over	Upto	
(1)	(2)	(3)
-	0.5	15
0.5	1	20
1	1.5	25
1.5	2	35
2	2.5	45
2.5	3	55
3	3.5	65
3.5	4	75
4	4.5	85
4.5	5	130
5	5.5	200
5.5	6	300
6	6.5	500



BRIEFSPECIFICATIONOFBUILDINGWORKS

Sr.	Requirements	
Α	CivilWorks	
1	Floor to Floor Height	Maximum3.05Mtrs.atalllevelsexceptatgroundfloorwhich shallbe3.35measuredonceandbasementsasspecifiedin drawings.
2	RCC	AsperStructuralDesign(designmixfromapproved laboratory) and specifications by Structural Consultant. AllRCCworksshallbeconformingtoISStandards.
3	Reinforcement	Asperrequirementofdesign,approx.6kg/sq.ft.ofbuiltup area.Theactualreinforcementconsumptionshallbeasperthe structuraldrawing/BBS.
4	Brick work with Coarse Sand	AsperspecifiedinDrawings(approvedAACblocks.)cement mortarorasrecommendedbyStructuralConsultant.
5	PlasterwithCoarse Sand	lasterisnotrequiredforaluminiumshuttering.If thequalityofR.C.C.isnotuptothemark&plasterisneeded thenitwillbecontractor'sscopeatnoextracost.Contractor willdoexternalplasterwhereverconventionalshutteringwill beusedbutthequalitywillbesameasofaluminium shuttering.
6	Flooring and Skirting	 For Flats - Vitrified tiles in all areas (except balconies & toilets)of approved make. Ceramic tiles in balconies/wash area (with adequate slope & spout to drain out of water) & toilets of approved make. For Master Bedroom – Laminated Wooden Flooring ofapproved make (Type). Forliftlobbies–OnallFloors–G r a n i t e / BarodaGreenwith combination of Tiles, stones (Flooring and Dado & Lift facia) as approved by owner. Main Staircase & Fire Escape Staircase –Granite/Kota Stone on all floors (treads&risers(insinglestone),landingsandskirting). StaircaserailingwillbeofMS.Weightofrailingapprox.10kg. per RM. For Foyer / Entrance Area – Granite/Kota Stone with combination of Tiles, stones (this may include Italian stone, Granite, Imported vitrifiedTiles.)Glazing, p a n e l i n g ,Falseceilingasper drawing/approvalofconsultant/owner.
7	Dado/WallTiles	CeramicTilesofapprovedmake(uptodoorheight)andmatchingflo ortilesintoiletsandupto2'abovekitchen platformandbelowsinkarea.

8	Kitchenplatform& Kitchen sink	As per design platform of Granite top with moulding and SS sink (as approved by owner), required plumbing with CP sink cockasperapprovedsamplefittoplacemodularkitchen underneathit with all kitchen appliances chimney hob and gas stove etc.
9	Door (With H.W.Red Marandi Frames)	 Main door shutter-35 mm thick paneled Masonite type of 2400mm (Approx) height (with all sides shall be polished insamecolor),4nos.of5"SShinges(asapprovedmake), Mortice lock of approved make. Internal doors-35 mm thick flush Type of 2200mm (Approx) height with (all sides in same color), 4 nos. of 5" SS hinges (make as approved), SS cylindrical locks with key in case of room doors & without key in case of toilet doors of approved make. Main Entrance Door frames shall be of double patam having 6"x2½"sizeandInternalDoorframeshallbeofsinglepatam having4"x2½"sizeofRedMarandiwoodincludingwooden beading.
10	Windows, Ventilators and sliding doors	For rooms – UPVC with fixed and open able panels with float glass as per Drawings/BIS Code. Windows placed on external wall surface shall have toughened glass as approved by owner. Fortoilet-LouveredwindowsofUPVCwithfloatglass.
11	Painting–External	Weather shield PaintwithSmoothorTexturedfinishof approvedmakeas per drawing with 2coat ofputty&primer having rates as Rs. 16/- per SQ.FT. exclusive of Taxes.
12	Painting-Internal	OilBounddistemperofapprovedmakeforwallsandceilings afterPOPPunningonthewalls
13	BalconyRailing	CompleteMSRailingwithemulsionpaintedasperdrawing. Weightofrailingapprox.10kgpersq.mt.
14	StiltParkingArea	FinalfinishasperapprovedDesign.Wallsandceilingfinish– SmoothorTexturedasperarchitectdesign.
15	BasementArea	With Tremix Flooring as average 100mm thick as perapproved DesignwithCheckeredTilesontheramp.Wallsandceiling– Whitewashed.
В	Electrical	
1	Switches	LegrandMosiacorapprovedequivalent(ISIMarked)
2	Wires	RRcable,Finolex,Polycab,Hawellsmake(allcopperwiresand smokefree)
3	Fixtures(Common Area)	LEDFixturesasperapprovedmakeforcommonareasonly (Basement,Stilt,Liftlobbies,staircaseetc.).
4	NumberofPoints	AsperelectricaldrawingsforFlatsandcommonareas.
5	Telephone&Cable TV Networking	RRcable/Finolex/IndoAsian/Polycab(Onlyconduiting willbeinscopeofcontractor,restwillbeinthescopeofowner.)
6	SwitchFuseUnit	L&T/EnglishElectric
7	MCB/ELCB	Legrand/Standard/IndoAsian/Anchor/ABB.
8	AviationLighting	Cableshallbelaidofaviationlightandtobeconnectedwith commonarealighting.
9	LighteningArrestor	LayingofGIstripof50x6mmsizefixedbyverticaland horizontalArrestoruptoearthpit.
10	Lights/FanFixture	OneTubelightinallrooms&Toilet.AlsooneCFLlightineach balcony(tobecomparedwithsurroundingsites).

С	Plumbing	
1	Watertanks-OH	RCCwatertankatterraceasperplananddesign
2	Sanitaryware	Asapprovedbyowner.
a)	WC	WallMountedEWCofapprovedmakeincludingaccessoriesas perClient.
b)	WashBasin	With Pedestal or Counter Top as per approved make & Model Complete bathroom set with conventional fittings of make. (Countert op inMasterBathroom&asperdrawinginother toilets.)
c)	CPFittings	Jaquar/Plumberorequivalent(excludingaccessoriestowel rod/rack/mirror).
4	Watersupply	WithCPCasperapprovedmake,concealedforinternal& includingterraceloopinganddeliverylinefromgroundfloorto OHtankofGIB-Classasperdrawings.
5	Drainage	WithUPVCpipesforinternalpipingincludingsuspendedline inceilingcoveredwithfalseceilingandshaftpipingofCI.
6	ExternalPlumbing	Uptofirstchamberofrequireddepthoneachlineoftoilet/ kitchenusingSW pipes.
D	General	
1	Anti-termite treatment	To be provided as pernormal practice with 10 yrs. Guarantee.
2	DampproofCourse (DPC)	Asperrecommendation by Structural Consultant.
3	Waterproofing	Brick bat Coba for Terrace and balconies. Chemical waterproofing with polymer modified membrane for toilets. Forbasementasmentionedindrawings.10yearsGuaranteeshall b e providedforeachlocationasrecommendedby Architectconsultants.

LISTOFAPPROVEDMAKES

CIVILWORKS

S.No.	DESCRIPTION	SPECIFICATION	MAKES
1	Structure	RCCstructurewithMIVAN Shuttering ,Zone-4	AsperISISpecifications
2	Basementfloor	VDSflooring(TrimixConcrete)M-25	Do
3	Drawing/diningfloor	CementFlooring	Do
4	Kitchenfloor	DoublechargedVitrifiedtile(800X800)	RAK,Nitco ,Kajaria,Somany
5	Allbedrooms&toiletsfloor	CementFlooring	AsperCPWDSpecifications
6	RoomFloorandotherinternal flooring	Tiles	RAK,Nitco ,Kajaria,Somany
7	Toilet floor	Antiskidceramictile(300X300)	RAK,Nitco ,Kajaria,Somany
8	Balcony,Servantroom,Store	Cementfloor)	
9	Toiletwalltile	Glazedwalltile (300X600)	RAK,Nitco ,Kajaria,Somany
10	AboveKitchencounterwalltile	Glazedwalltile (300X600)	RAK,Nitco,Kajaria, Somany
11	Entrancelobby,corridor,staircase	PrepolishedGraniteStone	Asapprovedsample
----	---	--	---
12	Lift Facia	PrepolishedGraniteStone	Asapprovedsample
13	Stilt/Podiumfloorusedfor parking	VDSflooring(TrimaxConcrete)M-35	AsperCPWDSpecifications
14	Front/Internaldoorframe	Saal,Teakwood(Ivorycoast)	Asapprovedsample
15	Externaldoor& window	UPVCsectionwiththreetrackwith6mm plain toughened glass (with wire mesh shutter)	Finista,glassofModiguardmake, Saint Gobbin
16	Doorshutter	BWPflushdoorwithteakveneeronboth faces as per approved design	Duro,Merino,Century
17	Mortiselock&door, windows hardware accessories	SSfinished(Whitemetal)	Godrej, Doorset, Harrison
18	StaircaseRailing	M.S.railingwithenamel paint	Jindal(Hissar)
19	Balcony railing	M.S.railingwithenamelpaintasper approveddrawing.	Jindal(Hissar)
20	AllInternalwall&ceilingfinished wherever required	PlasticEmulsionwithPOPPuning	AsianfromRohtak, Berger,nerolac,Dulux
21	AllExternalwallsfinished	Texturepaint	Asian, Unitile, Berger, nerolac, Dulux
22	Basementwall, Ceiling& shafts	ApexAsianpaint-2 coats	AsperCPWDSpecifications
23	Lift	SShairlinefinishwithSShandrail	Mitsubhisi/Schindler/Otis/Kone/TKE

24	waterproofingcompound		Dr.Fixit/SIKA/FOSROC/Pidilite/Cico
25	Upvcpipesforsanitary		Supreme,polypack,Finolex,AkG
26	Glpipe		Tata, Jindal (Hisar)
27	Cpvcpipeforwatersupply		Prince,Supreme,Asteral AkG
28	chinaware		Hindware,Parryware,cera,Jaquar
29	Concealedcistern		Hindware,Parryware,cera,Jaquar
30	CP fittings		Hindware,Parryware,cera,Jaquar
31	Modularswitch&socket		Legrand,Schneider,Crabtree
32	Electricwire		L&T,Finolex,Delton,KEI,
33	Watersealingfloortraptotrap cockroaches		Chilly
34	Cement	OPC	J.K.Ambuja,Ultratech,Lafarge,Wonder
35	Structuresteel	fe- 500 TMT	SAIL/RINL/TATA/Jindal/TISCO/Surya
36	ReinforcementSteel		SAIL/RINL/TATA/Jindal/TISCO/Jyoti/El electrosteel/Fortune
37	ConcreteAdmixture		Dr.Fixit/SIKA/FOSROC/Pidilite/ACC

38	WaterProofingcementpaint	-	Supersnowcempaints
39	WhiteCement,putty		J.K.,Birla, Asian
40	Sink	StainlessSteel	Jayana,Neelkanth,Nirali
41	Antitermite		Chlorpyrophose20% EC
42	Clear/Float/FrostedGlass		Modi/SaintGobain(SG)
43	MosaicTiles		RAK,Nitco ,Kajaria,Somany
44	/,Silicone,Sealant,Silicon Spray, Ploysulphinde Sealant		Pidilight/Fosroc/Latiicrete/Bal endura
45	Laminate		Merino,Duro,Century
46	PatchLock,plateArticutureBolt, Top, Bottom Patch		Godrej, Doorset, Harrison, Yale
47	FalseCeiling/GypsumBoard		Lafarge/USGBorale
48	ToughenedGlass		SaintGobain/Modiguard
49.	FireRatedDoor		Navair/Sukriti/Shakti

NOTE:-Basementrampsshallbeof60mmthickM-35gradeinterlockingpaversofReputedmakeover RCC inclined slab as per choice of Management committee.

PUBLICHEALTHWORKS

<u>S.No</u>	ltem	Make
1	PVCWATERSTORAGETANK	SINTEX/FRONTIER
2	GUNMETALVALVES(C.I)	ZOLOTO/KIRLOSKAR/L&T,
3	BRASSGATEVALVE	ZOLOTO/KIRLOSKAR/L&T,
4	S.W.PIPE	PERFECT,ISIMARKEDA-CLASS
5	GULLYTRAPS/INSPECTIONCHAMBERCOVER	RIF/SKF/NECO/NIF
6	WATERCLOSET(ORISSA)INCLUDINGPVCCISTERN	HINDWARE,PARRYWARE,CERA,JAQUAR
7	C.PBRASSTAP/PILLARTAP	CERA, PARRYWARE JAQUAROPELSINGLELEVER
8	C.PBRASSBRASSSHOWERROSE	CERA,PARRYWAREJAQUAROPEL
9	C.PBRASSBRASSBIBCOCK	CERA/PARRYWARE, JAQUAROPELSINGLE LEVER
10	C.PBRASSBRASSLONGBODYBIBCOCK	CERA/PARRYWARE, JAQUAROPELSINGLE LEVER
11	C.PBRASSBRASSCONCEALEDSTOPCOCK	CERA/PARRYWARE, JAQUAROPELSINGLE LEVER
12	C.PBRASSBRASSANGELVALVE	CERA/PARRYWARE,JAQUAROPEL
13	TOWELRAIL/TOILETPAPERHOLDER/SOAP CONTAINER	CERA/PARRYWARE,JAQUAROPEL
14	BALLVALVES	ZOLOTO/KIRLOSKAR/L&T,
15	(A). E.W.C.WALLMOUNTEDVITREOUSCHINA	HINDWARE,PARRYWARE,CERA,JAQUAR
	(B). E.W.C.FLOORMOUNTEDVITREOUSCHINA	HINDWARE, PARRYWARE, CERA, JAQUAR
16	PVCFLUSHINGCISTERN	PARRYWARE/SUPREME/JAQUAR
17	STROMWATERDRAINAGEPIPE	PRAGATICONCRETEUDVOG/JKSPUN,ISI
	(R.C.C.NP2)	APPROVED
18	SFRCCOVERANDFRAME	SKF,KKMANHOLEISIMARKED

19	HORIZONTALSOIL, WASTEHANGINGSUPPORTS	CHILLY/LOVELY
20	VITREOUSCHINAWASHBASIN	HINDWARE,PARRYWARE,CERA,JAQUAR
21	STAINLESSSTEELKITCHENSINKASPERIS:13983	JAYANA,NEELKANTH,NIRALI
22	MIRRORGLASS	ATUL/MODIGUARD
23	SOILWASTEPIPECENTRIFUGGALYCASTIRONS&SIS 3989	НЕРСО
24	CENTRIFUGGALYCASTIRONFITTINGIS3989	НЕРСО
25	MS/GIPIPES	JINDAL/SURYA
26	MS/GIFITTING	"R"BRAND/ZOLOTO'M'/UNIK
27	FLOORGRATINGS/COCKROACHCONTROLLAR	CHILLEY
28	WATERSUPPYPUMP	KIRLOSKAR,MATHERPLATT
29	UPVCPIPESFORSANITARY	SUPREME, PRINCE, POLYPACK, FINOLEX
30	CPVCPIPESFORWATERSUPPLY	SUPREME,PRINCE,SUPREME,ASTERAL
31	HDPEPIPE	PRINCE,SUPREME,ASTERAL

FIGHTINGWORKS

<u>S.NO</u>	ITEM	MAKE
1	GI/MS Pipes	Jindal(Hissar)/ Tata
2	MalleableGlfittings	Zoloto/Unik
3	Butterfly/CheckValve	Audco/S.K.S
4	GUNMETALVALVES (C.I)	SANT/ZOLOTO/LEADER/Newage
5	Sluice,ButterflyandNonReturnValves/Air Release Valve/Ball Valve	Zoloto/Kartar/Leader/ Newage
6	SingleheadedFireHydrantValve,Three way Fire Brigade inlet, Shut off Nozzle	SKG, Minimax/ Newage
7	RRLHose	ANExflame,Minimax
8	BranchPipe	SKG, Minimax/ Newage
9	GMCoupling	Minimax
10	FireExtinguishers	ANExflame/ Geetach/Safegard
11	RubberTubeforHosereel	SKG/ Jyoti/Maruti
12	EnamelPaintforpipes	Asian/J&N/Nerolak
13	Weldingrods	Victor/Maruti
14	Fasteners(Galvanised)	Fischer/GKW/Canon
15	Dash fastners/clamps	Cannon/Chilly
16	HoseBox/Hosereeldrum	SKG/ Newage/Minimax
17	Antivibration pads	Kanwal/Dunlop
18	PressureGauge	H.Guru/Fiebig
19	Pressureswitch	Guru/ Indfoss
20	Cables/wire	Skyton/National
21	PVCconduit	AKG/BEC
21	ManualCall point/Hooter/Sounder /ResponseIndicator/FaultIsolatorswith Base	Cooper/Honeywell/Agni
22	Controlpanel(FIRE)/RepeaterPanel	Cooper/Honeywell/Agni
23	TelephoneHandset/Receiver	Cooper/Honeywell/Agni
24	Microphone/speaker	Cooper/Honeywell/Agni/Philips

25	Amplifier	Philips
26	MechanicalSeal	AsperOEM Cert./Duramat
27	Pumps	Kirloskar
28	Motor	ABB/Crompton
29	Engine	Kirloskar/Koel
30	InstallationControlValve	Safeguard/SKG
31	PipeSupports(BandHanger)	Chilly
32	Flowswitch	Safex/SystemSensor
33	PipeFittings	"R"BRAND/ZOLOTO'M'/UNIK
34	Sprinklers	HD

INTERNALELECTRICALWORKS

Sr.No.	Detailsofequipment/Material	ManufacturersName
1	MSblackenamelled/galvanizedERW conduits	BEC,Steel-Craft,
2	GI pipes	Jindal (Hissar), Tata,
3	PVC Conduit (ISI Marked), PVC Trunking&CableManagement System	Havells, BEC, Precision, PolyPack, Polycab
4	PVCConduitAccessories	AKG,Polypack,BEC,,
5	MSConduit accessories	Sharma, Rama, Noble
6	FRLScopperconductorwires	KEI,Finolex,Havells,R&Rcable, Polycab
7	Modular switches, socket outlets and wiringaccessorieswithmouldedcover plate, Call Bell Push Button, Telephone/TV Sockets, Metallic Box	Havells, Legrand (Myrius), Schneider (ZENcelo), Crabtree (Murano), MK (Blenze), Polycab
8	IndustrialSockets& Plugs	Havells,Legrand,Siemens,Hager,Schneider,Polycab
9	LightingFixtures	Bajaj/Havells/Philips
10	Heavydutymetalcladsocketoutlets with MCB in MS housing	Legrand, Siemens, Hager, Schneider, Polycab
11	Weatherproofsocketoutlets	Legrand,Neptune,Siemens,L&T Hager
12	MiniatureCircuitBreaker/RCCB	Legrand(DX3),Hager,Schneider(Acti9),Siemens Beta Guard 10KA,
13	EarthLeakageCircuitBreaker	Havells, L&T , Legrand(DX3),Hager, Schneider(Acti9),SiemensBetaGuard10KA,
14	Timers	L&T,Legrand(DX3),Hager,Schneider(Acti9), Siemens Beta Guard 10KA
15	Tag Block	Krone
16	MCBDistributionBoardsinsheetsteel housing (double door)	Schneider, L&T,Legrand(DX3),Hager, Schneider(Acti9),SiemensBetaGuard10KA, 17Optipro(Indo Asian, Polycab
17	Singlephasepreventer(currentbase)	L&T,Minilec
18	Telephonewires/Co-AxialT.V.Cable	Delton, Finolex, Polycab, R&R cable, Havells

19	TelephoneTagBlocks	Krone,Pouyet,TVS,Hensel
20	Tapoff/Splitter	Catvision, Shyam
21	CableTV wire	Catvision,Bhansali,Skyline,FinolexComm-scope, Delton, Rallison
22	MouldedCaseCircuitBreakers(with rotary handle) (variable settings)	L&T(d–sine),Siemens-3VA,ABB(T-Max), Schneider (CVS) , Legrand-DPX,/ C & S
23	AirCircuitBreaker(ACB)	L&T-UPower,SIEMENS-3WL,SCHEINDER-MVS, ABB (E-MAX)) C&S
24	Switchfuseunits(FN type)	LarsenToubro,Siemens,Schneider(MG),GE,ABB
25	HRC fuses	Siemens,L&T–HNtype,GE
26	ProtectiveRelays(Microprocessor)	ABB,L&T,LarsenToubro,Alstom,Siemens
27	MVSwitchboards/Risingmains (powder coated)	AmbitSwitchgearPVTLtd/MilestonesSwitchears PVt./Advance panels & switchgears/ Electro system devices /Adlec systemsprivate Itd/Shivalic power control pvt Itd /Conquerent Control System Pvtltd (Madhu Group)Indo Asian/S.B .Electricals
28	MVContactors, Timers (Solidstat)	CTX ³ ,Schneider(TesysK,D,F),L&T-MNXABBAF
29	1100voltsgradeXLPEcables	Universal(Unistar),Skytone,Havells,Polycab, R &Rkable,
30	1100voltsgradePVCcontrolcables	Universal(Unistar),Havells,Skytone,Polycab, R &Rkable,
31	Cablelugs/Thimbles	Dowells/Comet
32	CableDoubleCompressionGlands with earthing links	Peeco,Comet
33	PowerContractors/CapacitorDuty Contractor/Capacitor Bank/Active Filters/Hybrid Filters	L&T,ABB,Legrand,Ducati,Epcos,Vishay.Schneider
34	CastresinCurrentTransformers	L&T,AutomaticElectric,Kappa,GilbertMaxwell,
35	MeasuringMeters(Digital)	L&TRishab, Automatic Electric, Siemens, Enercon, Caddle
36	SelectorSwitches	Kaycee,L&TSalzer, Siemens
37	Indicationlamps(LEDtype)andPush Buttons &Pilot Lamps	L&T,Siemens, Vaishno
38	Cabletray	Pilco,Ricco,Slotco,MMEnterprises,Bharti, BEC,

		OBO-bettermann,LegrandCablofil
39	Energyanalyzermeter	Secure,Enercon,L&T,
40	KWHEnergyMeter/Metering Instrument	ABB, Rishab, L&T, Crystal, HPL, Genus, Elmeasure
41	CeilingFans/WallFans/Exhaust Fan/Air Circulator	CromptonGreaves/Usha/Havells/Bajaj
42	ControlCables	KEI/Polycab
43	TerminalBlocksandConnectors	Wago/ConnectWell
44	Indoor/OutdoorEndTermination Straight through Joints	Dowel/Action/Comet/3M
45	LTElectricalpanels/MeterBoard Panels/Feeder Pillars	VidutControl/SPCElectrotech/DynamicPower projects/Deltech Engineers/Precision
46	StreetLights&HorticultureLights	Wipro/Bajaj/Havells
47	StreetOctagonal/DecorativePoles	Bajaj/Surya/Philips
48	Lifts/Elevators,SShairlinefinishwith SS handrail	Mitsubhisi/Schindler/Otis/Kone
49		

We have noted the above and confirm that our tender is based on the approved makes indicated above.

EXTERNALELECTRICALWORKS

<u>Sr.No.</u>	DetailsofEquipment/Material	ManufacturersName
1	MouldedCaseCircuit Breakers	L&T(d-sine),Siemens-3VA,ABB(T-Max), Schneider (CVS) , Legrand-DPX,C& S
2	Switchfuseunits(FN type)	LarsenToubro,Siemens,Schneider(MG),ABB
3	HRC fuses	Siemens,L&T– HNtype
4	415voltAirCircuitBreakers. -Incomer& BusCoupler	L&T-UPower,SIEMENS-3WL,SCHEINDER-MVS, ABB (E-MAX) , C& S
5	- Outgoings	L&T-CPower,SIEMENS-3WL,SCHEINDERMVS, ABB, C& S
6	ProtectiveRelays(Microprocessor)forL.T. Panel	Larsen&Toubro,Alstom,Siemens, ABB,Schneider
7	APFCRelay(Microprocessor)	L&T,Neptune-Ducati,Siemens(EPCOS), ABB,Schneider
8	MVSwitchboards(powdercoated)	Ambit Switchgear PVT Ltd/Milestones Switchears PVt./Advance panels & switchgears/ Electro system devices /Adlec systemsprivateLtd/SudhirSwitchGearLtd/S.B .Electricals/ConquerentControlSystemPvt
9	1100voltsgradePVCA/XLPEcables	Havels/KEI/Polycab,Universal(Unistar), Skytone,Polycab, kei, Havells
10	1100voltsgradePVCcontrolcables	Universal(Unistar),Skytone,Polycab, Havells,kei
11	1100voltsgradePVCA/XLPEcables	Universal (Unistar), Skytone, Polycab, Havells,
12	Cablelugs	Comet, Dowells
13	Cablecompressionglands	Peeco,Comet
14	11kVXLPEcables	Universal(Unistar),Skytone,Polycab,kei, Havells
15	11kVVacuumCircuitbreakers/RMU	Siemens,ABB,Scheinder,
16	11kVCablejoints(Heat shrinkable)	Denson,Raychem,Mahindra.Birla-3M
17	ProtectionRelayfor11KVVCBPanel	Siemens,ABB, Alsthom,Schnieder
18	11kVPotentialTransformers	Pragati, ECS, Nortex, Savior, Vishal
19	Packagesub-Stationwith(Oiltype) Transformers 11 kv	Ambit Switchgear PVT Ltd/ABB/ Sudhir Switch Gear Ltd/ Schneider/ Conquerent Control SystemPvt&transformer-Voltamptransformer Ltd. /Sudhir Power/Cromption/Kiloskar/Cotson/Infraviduit/ Muskain's

20	Capacitors	Ducati,Legrand,Epcos,Vishay,Schneider
21	CastresinCurrentTransformers	Rishbah/L&T/Kappa / Pragati/ECS/Savior/ Nortex/Avcon

	DetailsofEquipment/Material	<u>ManufacturersName</u>
22	MeasuringMeters(Digital)	L&TRishab,AutomaticElectric,Siemens, Enercon, Schneider
23	Trivectormeter	Secure/Enercon/,Schneider

24	GasInsulatedVCB	ABB/Siemens/Schneider
25	DB/MCB	Legrand(DX3),Hager,Schneider(Acti9)
26	SelectorSwitches	Kaycee,L&TSalzer, Siemens,Schneider
27	Indicationlamps(LEDtype)andPush Buttons	L.T/Siemens/Vaishno,Schneider
28	Cabletray	Ricco,Indiana,Pilco,Slotco,M.M.Enterprises, BEC, OBO Beterman,Legrand
29	11KVHTmeteringpanel	Approved aspert helocal electricity supply

NOTE:Allmakesshallconfirmtostandardspecificationsofeachitemsasenclosed with the tender documents.

FORD.G.SET

1.	DIESELGENERATOR(OEMS)	SUDHIR/KIRLOSKAROREQUIVALENT
2.	DIESELENGINE	CUMMINS/PERKINS/KIRLOSKAR/CATERPILLAR
3.	ALTERNATOR	KIRLOSKAR/STAMFORD/CROMPTONGREAVES
4.	AMFPANEL	SIEMENS/L&T/ABB/SCHNEIDER/GE
5.	BATTERIES	Exide,
6.	PUMPSWITHELECTRICMOTOR	KIRLOSKAR/KSB/GRUNDFOS
7.	MINERALWOOL(COMPRESSEDTYPE)	LLOYD/MINWOOL/ROCKWOOL
8.	BUTTERFLYVALVES	AUDCO/ADVANCE/ZOLOTO
9.	GATEVALVES/BALLVALVES	R-B/ZOLOTO/CIM-BERIOI
10.	AUXILIARYRELAYS(COMPATIBLEWITH PLC ETC.)	SIEMENS/L&T
11.	POTSTRAINER	SANTIND/JAYPEE/EMERALD
12.	ALUMINIUMSHEET	INDALCO/HINDALCO
13.	FUELLINE(ERWASPER IS:1239)	JINDAL-HISSARUPTO150mmdia&JINDAL– GBDABOVE150mm dia/BST
14.	MSPIPE(ERWASPERIS:1239)	JINDAL-HISSAR/BST
15.	MSSTEEL(ANGLE,CHANNEL,STRIP SHEET)	TATA/SAIL/JINDAL-HISSAR
16.	BALANCINGVALVE	AUDCO/ADVANCE
17.	NON-RETURNVALVE(WATERTYPE)	AUDCO/KIRLOSKAR
18.	ANTI-VIBRATIONPADS	GERB/DUNLOP/CUMMINS
19.	PRESSUREGAUGES	FEBIG/H.GURU/BICOL
20.	MAGNETICLEVEL CONTROLLER(FLOAT TYPE)	NANDSHYAM/V-AUTOMAT
21.	DIESELFLOWMETER	KENT/AQUAMETRO(SANSAG)
22.	FLAMEPROOFMOTORS	KIRLOSKAR/CROMPTON/ABB/SIEMENS
23.	RUST PREVENTING POLYMERIC TAPE & PRIMER FOR BURIED PIPING	PYPECOT/LOATAX/IWL
24.	MCCB	SIEMENS/L&T/ABB/SCHNEIDER/GE
25.	MEASURINGINSTRUMENTS (DIGITAL TYPE)	MECO/ENERCON/L&T/AEI
26.	CONTROLMCB'S	SIEMENS/HAGER/LEGRAND(MDS)
27.	CT'S(CASTRESIN)	AEI/KAPPA/GILBERT

28.	BRASSCOMPRESSIONGLAND (HEAVY DUTY)	COMMEX/GRIPWELL
29.	SELECTORSWITCH	SALZER/SIEMENS/BCH
30.	MCB(10KA)	SIEMENS/L&T/ABB/GE
31.	CRIMPLINGLUGS/THIMBLES	DOWEL/GRIPWELL
32.	TERMINALSTRIP	CONNECTWELL/ELMEX
33.	CONTRACTORS	SIEMENS/L&T
34.	GI/CUSTRIP&EARTHINGMATERIAL	BHARATI/INDIANA/SLOTCO
35.	BATTERYCHARGER	CHHABI/AMARAJA/BCH/UPTRON/JAKSON
36.	LEADACIDAUTOMOTIVETYPE	AMCO/FURUKAWA/HITACHI/GLOBAL/ YUASA/EXCIDE
37.	COPPERCONTROLCABLE	SKYTONE/NATIONAL/RALLISON
38.	POWERCABLES	CCI/NICC/UNISTAR/RALLISON/POLYCAB/KEI
39.	ALUMINIUMGRILLS	GARRYAIRE/RUVISTAR
40.	D.G.SETENCLOSURE	JAKSON,SUDHIR,CONSTORIUMACOUSTIC SYSTEMS
41.	G.I.SHEET	JINDAL(HISSAR)/TATA/SAIL/NIPPON/BHUSAN STEELS

Note: The above written approved brands can be replaced with their equivalent alternatives as per market standards with due intimation of the same and reason for replacement be provided to management.

QUALITYCONTROL

- 1. Society will engage any Third Party Inspection Agency for quality control and conducting as many number of tests as required / deemed fit at all stages of construction during and after execution of work for which contractor will not have any objection at all and will render full Co-operation to the third party inspection agency so engaged by Society.
- 2. <u>Identify defects</u>: The Management committee or Third Party Agency engaged shall check the contractor's work and notify the contractor any defects that are found. Such checking shall not relieve the contractor responsibility. The Management committee may instruct the contractor to search for defects and to uncover and test any work that the Management committee considers may have defect.
- ii) <u>Correction of defects</u>:- The Management committeeshall give notice to the contractor of any defects before the end of defects liability period/ maintenance period which begins at completion as per detailgiven inscopeof work. The defect liability period/ maintenanceshall be extended as long as defects remain to be corrected. Every time notice of a defect is given, the contract shall correct the notified defects within the limit of time specified by the Management committeeor his authorized representative notice. If the contractor has not corrected a defect within the timespecified in Management committee notice, the Management committeewill assess the cost of having the defect corrected and the contractor will pay the amount as assessed.
- iii) The contractor shall have to provide a full fledged field laboratory fully equipped with all the instruments required for setting up of laboratory at work site and at batch mix plant for conducting all the relevant tests mentioned in the code subject to the approval and satisfaction of the Management committeeand Third Party Inspection Agency appointed by Society. The record of such tests is to be maintained in proper register duly signed by the contractor or his authorized representative, which will be come the property of Society. The contractor will be a rall the running expenses for conducting such tests. All the tests will be carried in the presence of Management committee. All the entries are to be signed by the contractor or his authorized *representativeandManagement* committee.In caseoftestsforwhichthereisnoarrangementat contractor's lab, the same will be got carried out from PEC University of Technology/ any IIT/CRRI/ Shri Ram Institute/ RITES/WAPCOS or any other agency approved by Society and testing charges for such tests from outside laboratory and cost of samples shall be exclusively borne by the contractor and nothing will be paid by Society for such tests.
- iv) The quality control tests will be got done by Management committee and Third Party Inspection agency and the material for such tests will be supplied by the contractor free of cost.In case, the material is not found up to the requirement, the same will be rejected. The Cost of such testswill also be borne by contractor only.
- 6. VariousqualitycontroloperationswillbemaintainedasperclausesofconcretecodeSpecification with latest revision amendments.
- 7. Contractorshallprovidesuitablemeasuringarrangementandlevelinginstrumentsoflatestquality approved by the Management committee at the site of work.
- 8. Noextrapaymentonaccountofqualitycontrolmeasuresshallbepaidtothecontractor.