P & H HIGH COURT BAR ASSO. PROGRESSIVE LAWYERS COOP. SOCIETY LTD

TENDER NOTICE

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 21/02/2020 at # 2249, Phase-10, Mohali-160062** (Sh. Ranjivan Singh, Co-ordinator, 9815068816 either personally / through messenger or by registered post for preparation of Architectural Drawings, Structural Design and Construction of 170 Nos. dwelling units (4 bhk + Servant Room – 110 Nos. Built-up Area - 1800 to 1900 sq. ft. and 3 bhk + Servant Room - 60 Nos. Built-up Area- 1200 to 1300 sq. ft.), on **TURNKEY BASIS** for Multi-storeyed 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 group housing project of cost 80% each or four projects of cost 50% each and having minimum annual turnover of Rs. 25.00 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 Aluminium modular shuttering i.e. MIVAN technology. Drawings, eligibility documents, list of executed works in last 3 years along with list of technical staff and equipments must be attached with the tender application. The Technical Bid shall accompany a non refundable Process Fee of Rs. 30,000/- in the shape of DD and earnest money of Rs. 25.00 Lacs in the shape of deposit at call or bank guarantee in the name of president of the society. The Financial bid shall be enclosed in a separate Envelop. **Technical Bid shall be opened 22.02.2020 at Law Bhawan, Sector 37-A, Chandigarh at 11.00 am.** Visit **Plawyerssociety.org** for details. For any query, call: 1. Sh. R.P. Dangi at 9815360705 2. Sh. Baljeet Saini at 9814154255.

Estimated Cost of Work: Rs. 70 Crores.

.

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

CONTRACTOR **WITNESS** **SECREATRY**

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

NAME OF WORK		Preparation of Architectural Drawings, Structural Design and Construction of 170 Nos. dwelling units and every dwelling unit should receive adequate sun light (4 bhk + Servant Room – 110 Nos. Built-up Area-1800 to 1900 sq. ft. and 3 bhk + Servant Room- 60 Nos. Built-up Area-1200 to 1300 sq. ft.), 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 centre, 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, 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, 100% Power Backup, intercom system, electronic security system, Parks and Horticulture Works, Roof Top Rain Water Harvesting System, Solar Photovoltaic Power Plant, Gas Pipe Provisions and Broad Band optical fibre cable including Passenger Lift & Passenger Hospital Elevators and any other work/service contingent thereto, if necessary for completion of work up to the level of getting occupation/completion certificate from GMADA within the premises earmarked for above building blocks as Green Building with MIVAN technology/latest technology on turnkey basis.
EARNEST MONEY	:	Rs. 25.00 lacs at the time of submitting the tender in the shape of bank draft or Deposit at call by the scheduled bank.
TIME LIMIT	:	34 months
PLACE OF OPENING	:	Law Bhawan, Sector 37A, Chandigarh.
OFFICER IN CHARGE INVITING TENDERS	:	President, "The Punjab and Haryana High Court Bar Association Progressive Lawyer's Co-operative House Building Society Ltd", Chandigarh
ESTIMATED COST		Rs. 70.00 Crores

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

I N D E X

(SECTION – 1)

DETAILED

NOTICE INVITING TENDER

THE PUNJAB AND HARYANA HIGH COURT BAR ASSOCIATION PROGRESSIVE LAWYER'S CO-OPERATIVE HOUSE BUILDING SOCIETY LTD, PLOT NO. GH-1, SECTOR-8, ECO CITY PHASE 2 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 21/02/2020 at # 2249, Phase-10, Mohali-160062** (Sh. Ranjivan Singh, Co-ordinator, 9815068816 either personally / through messenger or by registered post for preparation of Architectural Drawings, Structural Design and Construction of 170 Nos. dwelling units (4 bhk + Servant Room – 110 Nos. Built-up Area - 1800 to 1900 sq. ft. and 3 bhk + Servant Room - 60 Nos. Built-up Area- 1200 to 1300 sq. ft.), on **TURNKEY BASIS** for Multi-storeyed 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 group housing project of cost 80% each or four projects of cost 50% each and having minimum annual turnover of Rs. 25.00 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 Aluminium modular shuttering i.e. MIVAN technology. Drawings, eligibility documents, list of executed works in last 3 years along with list of technical staff and equipments must be attached with the tender application. The Technical Bid shall accompany a non refundable Process Fee of Rs. 30,000/- in the shape of DD and earnest money of Rs. 25.00 Lacs in the shape of deposit at call or bank guarantee in the name of president of the society. The Financial bid shall be enclosed in a separate Envelop. **Technical Bid shall be opened 22.02.2020 at Law Bhawan, Sector 37-A, Chandigarh at 11.00 am.** Visit **Plawyerssociety.org** for details. .

1. Preparation of Architectural Drawings, Structural Design and Construction of 170 Nos. dwelling units and every dwelling unit should receive adequate sun light, (4 bhk + Servant Room – 110 Nos. Built-up Area - 1800 to 1900 sq. ft. and 3 bhk + Servant Room- 60 Nos. Built-up Area - 1200 to 1300 sq. ft.), 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 centre, 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 complete in all respects on turnkey basis, including providing infrastructure facilities namely Plumbing, Internal and External Water Supply, Internal and External Sewerage, Internal Electrical Conducting/wiring, Storm Water Drainage, Roads, Boundary Wall with Gates + Guard Rooms, Fire detection & fire alarm and suppression services, External Electrical Services, 100% Power Backup, intercom system, electronic security system, Parks and Horticulture Works, Roof Top Rain Water Harvesting System, Solar Photovoltaic Power Plant, Gas Pipe Provisions 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 level of getting occupation/completion certificate from GMADA within the premises earmarked for above building blocks as Green Building with MIVAN technology/latest technology on turnkey

basis.

2. The 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 construction committee.
3. The dwelling units shall be constructed as per 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 Construction Committee of the Society", as prepared and submitted by the firm in technical bid which will be capable for withstanding dead load, 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, 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, whereas 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.

4. 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, boundary wall, external electrical services, electric sub-station, 100% power back up, intercom system, electronic security system, all electric panels, lightning arrester, street lights and parks & other horticulture work, roof top rain water harvesting system, Solar Photovoltaic Power Plant, 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.

5. Only Lump sum financial bid including GST should be quoted by the Architects/Firms/Contractors/Joint Ventures/Individual(s) for Preparation of Architectural Drawings, Structural Design and Construction of project including services mentioned above. In case of increase or decrease of GST, the same shall be passed on to the Society.

6. Eligibility criteria & Earnest Money: Preparation of Architectural Drawings, Structural

Design and Construction of 170 Nos. / dwelling units and every dwelling unit should receive adequate sun light, (4 bhk+Servant Room – 110 Nos Built-up Area - 1800 to 1900 sqft and 3 bhk+Servant Room - 60 Nos Built-up Area- 1200 to 1300 sqft), on turnkey basis State of Art Multi-storeyed Group Housing Project at S.A.S Nagar, Mohali from reputed Architects/ firms/ contractors/Joint Ventures/ individual(s) having at least 5 years experience and who have executed at least two group housing project of cost 80% each or four projects of cost 50% each and in addition the agency should have minimum annual turnover of Rs. 25.00 Crore in each of last 3 years as per audited Balance Sheet. The process fee of Rs. 30,000/ shall be deposited in the shape of DD in favour of the President of the Society. The Earnest Money as per detail given below is to be deposited in the favour of **"President, The Punjab and Haryana High Court Bar Association Progressive Lawyer's Co-operative House Building Society Ltd"** payable at Chandigarh either in the shape of Bank Draft or Deposit at call:-

Site	**No of units**	**Minimum value of similar works completed during last 3 years**		**Annual turnover for the last 3 years (Rs. In Cr.)**	**Solvency (Rs. In Cr.)**	**Earnest Money (Rs. In Lacs)**
		Two works (Rs. In Cr.)	**4 or more works (Rs. In Cr.)**			
Site- Plot No. GH-1, Sector-8, Eco-city Phase 2, Greater Mohali.	170					25.00

- Number of Dwelling Units in totality may vary by +/-5%
- 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 five years.
- Tenderer should have necessary licenses for carrying out sanitary and electrical works etc. and should have necessary experience in the field.
- For solvency, the applicant will have to produce the bankers' certificate which should not be more than three months old.
- Completion period will be 34 months.

1.1 The proposals will be accepted in two separate envelopes up to 6.00 pm **on or before 21/02/2020 at # 2249, Phase-10, Mohali-160062** along with non refundable processing charges of Rs. 30,000/- (Twenty five Thousand Only) and Earnest Money of Rs. 25.00 Lacs in the shape of DD or Deposit at Call enclosed in envelope for Technical bid.

1.2 **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 multi storied buildings. Earnest money will also be enclosed in Envelope-A. The Technical Bids shall be opened **on 22.02.2020 at Law Bhawan, Sector 37-A, Chandigarh at 11.00 am.**

1.3 **Envelope B, Super scribed as "Financial bid**" will contain financial bid / offer.

1.4 The Architectural Drawing, Qualification document will be evaluated first. Financial bids of eligible and responsive applicants will be opened on the same day i.e. 22/02/2020 after evaluation of technical bids. The tenderer should come prepared for a short presentation of their project on the day of opening of tender.

1.5 Earnest money of Rs. 25.00 Lacs will be in the form of DD or Deposit at call or Bank Guarantee by scheduled bank to be made in favour of ***'President, The Punjab and Haryana High Court Bar Association Progressive Lawyer's Co-operative Society Ltd.*** The earnest money is to be deposited in **Envelope – A**. In case, any agency does not deposit the Requisite Earnest Money, in above form, its Price Bid will not be opened and processing fee will stand forfeited.

1.6 The Society 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.

1.7 The Society 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.

1.8 Performance Guarantee: Successful tenderer will deposit 3% performance Guarantee 50 % in the shape of Bank Guarantee by any Schedule Bank and 50% in the shape of Corporate Guarantee.

1.9 Mobilization advance 1% at the time of Signing of contract + 2% after getting of all statutory clearances i.e. total 1%+2%= 3% will be given to the successful bidder upon furnishing of unconditional Bank Guarantee (BG) of 50% amount and Corporate Guarantee of 50% for 1 year initially. On commencement of construction and submission of running bills 10% would be adjusted out of mobilization advance. There by reducing the BG and Corporate Guarantee successively for the period of time.

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

(SECTION –2)

INTRODUCTION AND

INSTRUCTIONS TO BIDDERS

INTRODUCTION & INSTRUCTIONS TO BIDDERS

1. GENERAL DESCRIPTION:

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 170 Nos. dwelling units and every dwelling unit should receive adequate sun light, (4 bhk + Servant Room – 110 Nos. Built-up Area - 1800 to 1900 sq. ft. and 3 bhk + Servant Room-60 Nos. Built-up Area - 1200 to 1300 sq. ft.), 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 centre, 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, intercom system, 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 Electrical Services, 100% Power Backup, intercom system, Electronic security system, Parks and Horticulture Works, Roof Top Rain Water Harvesting System, Solar Photovoltaic Power Plant, 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 level of getting occupation/completion certificate from GMADA within the premises earmarked for above building blocks as Green Building with MIVAN technology/latest technology on turnkey basis.

1.2 The work is proposed to be carried out at plot No. GH-1, Sector-8, Eco City Phase 2 Extension, Greater Mohali. Plans showing the location of site can be seen at website **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. INSTRUCTIONS TO BIDDERS

2.1 Lump sum Rates should be quoted for whole scope of work as per table provided in Section – 3.

2.2 Tender, not accompanied with full amount of earnest money of Rs. 25.00 Lacs and process fee of Rs. 30,000/, 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, availability of materials and other related problems under which the work has to be 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 at a later date.

2.5 The tenderer will associate experienced architect at his own level.

2.6 The tenderer shall have experience of Aluminium Modular Shuttering for executing the work on MIVAN technology.

2.7 The payments will be released as per payment plan prescribed in this document.

2.8 The tenderer shall obtain all information relating to local regulations, bye laws, application of any and 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/Completion certificate. The society will only be liable to bear the statutory /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**.**

2.9 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.

2.10 The tenderer shall initial all corrections / cuttings in his tender as regard to Lump sum rates as per financial bid. Non-compliance of this condition will render the tender liable to be rejected.

2.11 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.

2.12 The rates of the tenderers shall remain valid for a period of 180 calendars days from the date of opening of the price bid 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 stand forfeited without prejudice to other rights and remedies available to the society.

2.13 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 and remedies available to the society.

2.14 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.

2.15 **All sort of Taxes i.e. works contract Tax, Income Tax/Education Cess/Labour Cess Charges or any other levies imposed by Govt. at any stage** will be deducted as applicable from 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. However, any increase in any existing tax or if any new tax is levied by Central or State Govt. will be borne by Society. However, GST as per rate applicable at the time of tender will be borne by the tenderer, however, any increase in GST rates in future will be borne and paid by Society, directly to the relevant Govt. Authority and any decrease in GST rates in future, the difference will be passed to the society by the tenderer.

2.16 If the tenderer is an individual, he shall sign the tender documents above his full typewritten name with seal and current address.

2.17 If the tenderer is a proprietary firm, the tender documents shall be signed by the proprietor as above his full name / name of his firm with seal with its current address.

2.18 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 person holding power of attorney for the firm. In the later case a certified copy of the power 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.

2.19 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.

2.20 The tenderer is expected to examine carefully all instructions, conditions, Sections. Failure to comply with the requirements of bid submission will be at the bidder's own risk. Pursuant to various Clauses of these bid documents the bids which are not substantially responsive to the requirements to the Bid Documents will be rejected.

2.21 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.

2.22 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.

2.23 The bid prepared by the tenderer and all correspondence and documents relating to the bid shall be written in English or Hindi Language only.

2.24 No price escalation is permissible during the entire execution of the project.

2.25 No interest shall be paid on earnest money, security deducted and performance Guarantee.

2.26 The original bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to bind the bidder to the Contract. Proof of authorization shall be furnished 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.

2.27 All witnesses and sureties shall be persons of status and probity and their full names, occupations and addresses shall be stated below their signatures.

2.28 The price bids of the agencies who fail to meet the qualification criteria will not be opened.

2.29 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.

2.30 No bid shall be accepted unless it is properly sealed. Bidders shall not be allowed to fill in or seal their bids at office of the Society.

2.31 Tenderers are requested to submit the bids well in time on or before the stipulated due date and time.

2.32 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. Cost of Bidding

The tenderer shall bear all expenses associated 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 conduct or outcome of the bidding process.

4. Brand Names

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. Stamp Duty and Legal Charges

Whenever required, under Government regulations, it shall be incumbent on 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. Plants and Equipment mandatory required.

The tenderer will submit the list of plants and machinery required for execution of work

7. Bid Openings

7.1 The Construction committee of the society will open the first envelope containing the "Technical bids" in the presence of Bidders/ representatives who choose to attend the opening of the tender at # Law Bhawan, Sector-37A, Chandigarh at 11.00 am on 22/02/2020. The second envelope containing the "Price or financial bid" shall be opened on the same day i.e. 22/02/2020 after evaluation of technical bids. The tenderers /their representatives, who are present, shall sign a register evidencing their attendance. The tenderer should come prepared for a short presentation on the day of opening of tender.

7.2 The Construction Committee will examine whether 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.

7.3 At the bid opening, the Construction Committee will announce the tenderer's names in the presence of the tenderers or their authorized representatives.

8. Process to be Confidential

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 efforts by a bidder to influence the Construction Committee on matters relating to bids 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. Determination of Responsiveness

9.1 Prior to the detailed evaluation of Bids, Construction Committee will also determine whether each bid is substantially responsive to the requirements of bidding documents.

9.2 For the purpose of this clause, a substantially responsive bid is one which conforms to all the terms, conditions and specifications of the bidding 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 Construction Committee and may not subsequently be made responsive by the bidder having corrected or withdrawn the non-conforming deviation or reservation.

9.4 Construction Committee 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 with construction committee 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. RATE TO BE QUOTED

Rates shall be entered in words and figures (both) only in the space provided in price Bid. 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. Award Criteria

11.1 Construction Committee will award the Contract to tenderer whose bid has been determined to be substantially responsive to the Bidding Documents and who has offered the lowest Evaluated Bid Price provided further that the tenderer has the capability and resources to carry out the Contract effectively.

11.2 However, Construction Committee, reserves to itself the right of negotiations with all the bidders so as to arrive at actual bid cost.

12. Society's Right to Accept any Bid and to Reject any or all Bids

12.1 Construction Committee reserves the right to accept or reject any bid and to amend bidding process and reject all bids prior to award of contract without thereby 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. Notification of Award

13.1 Prior to the expiry of the period of bid validity prescribed by Society, the Society will notify the successful tenderer by mail to be confirmed in writing by registered letter that 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 Secretary of the Society.

15. Signing of Agreement

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

15.2 Failing to execute the Contract Agreement within the said period may result in forfeiture of bid security and disqualification.

Signature of Tenderer with seal President

SECTION – 3)

FINANCIAL BID / OFFER

SECTION - 3

FINANCIAL BID / OFFER

Name of work:- Preparation of Architectural Drawings, Structural Design and Construction of 170 Nos. dwelling units and every dwelling unit should receive adequate sun light, (4 bhk + Servant Room – 110 Nos. Built-up Area - 1800 to 1900 sq. ft. and 3 bhk + Servant Room- 60 Nos. Built-up Area - 1200 to 1300 sq. ft.), 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 centre, 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, intercom system, 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 + Guard Rooms, Fire Fighting Services, External Electrical Services, 100% Power Backup, intercom system, electronic security system, Parks and Horticulture Works, Roof Top Rain Water Harvesting System, Solar Photovoltaic Power Plant, 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 level of gettibg occupation/completion certificate from GMADA within the premises earmarked for above building blocks as Green Building with MIVAN technology/latest technology on turnkey basis.

Time limit: 34 Months

Eco-City Mohali	Lump Sum Amount to be quoted		
		In Figures	In Words
Plot No. GH-1, Sector-8, Eco-city Phase 2, Greater Mohali, Punjab	Dwelling units complete in all respects up to the level of getting Occupation/ Completion Certificate and also common area complete in all respect as per GMADA norms.		

Note:- **Time Extension up to 2 times of 3 months each can be granted by Construction Committee of the Society keeping in view the reasons beyond the control of contractor to the satisfaction of Society.**

Further, time extension can be granted by General Body of the Society only.

Signature of the Agency / Bidder

(SECTION – 4)

PAYMENT TERMS

SECTION -4

PAYMENT TERMS

1.	Earth Work, PCC & Anti-termite Treatment in Foundation	-	02%
2.	RCC Raft/Footing, Columns, RCC Walls, Chemical injection water Proofing and Basement Roof Casting Concrete and RCC Work	-	07%
3.	All RCC Works for Columns, Beams & RCC Slabs (Per Floor for 30 Slab)	-	1.25%
4.	All Internal & External Brick Work	-	1.5%
5.	All Internal Plaster Work and Finishing	-	1.75%
6.	All External Plaster Work and Finishing	-	02%
7.	Roofing and terrace Water Proofing	-	01%
8.	UPVC Doors & windows	-	04%
9.	All Internal & External Painting	-	02%
10.	CC Flooring & other Flooring Work in Basement	-	1.5%
11.	Flooring, Tiling & Stone Work in Superstructure	-	4.25%
12.	Wood Work, M.S. Work including Hardware	-	02%
13.	Internal Electrical Works	-	02%
14.	External Electrical Works	-	4.5%
15.	Sanitary Installation & Plumbing (Internal & External)Works	-	2.5%
16.	Fire Fighting & Fire Alarm and Suppression (Internal & External Works)	-	03%
17.	Road and Pavement	-	02%
18.	External water Supply	-	04%
19.	SWD work and Sewer Work	-	02%
20.	LPG Gas Pipe Supply	-	02%
21.	D.G Set Work	-	03%
22.	Lift	-	03%
23.	Horticulture, R.W.H. Boundary Wall, main Gate & Other Development Works	-	02%
24.	Any other External Development Works	-	1.5%
25.	On Full & Final Handover	-	02%
	TOTAL	**-**	**100%**

NOTE:-

a) *2.5% of security deposit will be deducted from each running bill up to a maximum of 2% of total cost of project. However, Rs 25 Lacs which has been deposited by successful bidder as earnest money, will be adjusted against the security deposit at the last.*

b) *75% of the security will be released after 3 months of 100% completion of all works and balance 25% will be released after defect liability period of two years as explained under special condition given in this tender documents / rectification of defects whichever is more. In addition to this, the contractor has also to give performance Guarantee of 3% in the shape of Bank Guarantee of 1.5% and Corporate Guarantee of 1.5% of amount of tender cost till successful completion of Defect Liability Period of two years as explained under special condition given in this tender documents / rectification of defects whichever is more.*

c) *GST will be borne and deposited by the contractor/contractual Agency to the concerned relevant authority which as per prevailing rates which is 18% any reduction in the said rates of GST, the benefit thereof would be passed by the agency to the society and any increase in GST will be borne*

by the Society, However, the contractor/contractual Agency shall submit the copy of each Challan and depositing of GST with the concerned relevant authority to Society on regular basis.

d) All other prevailing Taxes to be borne by Contractor.

e) T.D.S. will be deducted from each bill as per Govt. rules.

f) Mobilization advance @ 3% against bank guarantee of 50 % amount and corporate guarantee of 50% amount will be paid to contractor which is recoverable at 10% of each running bills till the recovery of complete amount.

(SECTION –5)

CONDITIONS

OF

CONTRACT

CONDITIONS OF CONTRACT
GENERAL

DEFINITION

Terms which are defined in the Contract have the following definitions:-

CPWD means Central Public Works Department.

The **Contract is the contract** between Secretary 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 been accepted by the Society.

The Construction Committee of the society is in -Charge of work.

The defect liability period is the time period as mentioned in the Special Condition for the Civil Works mentioned in this tender document. i. e. two years 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 **Construction Committee** is designated by the Society to carry out the work as contained in the bid documents.

Decision of Construction Committee: Except where otherwise specifically stated, **Construction Committee** will decide contract matter between the Society and contractor in the role of representing Society.

Delegation: Construction Committee may 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 payable subject 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 as aforesaid 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 work shall throughout

the stipulated period of the contract be proceeded with all due diligence (time being deemed to be the essence of the contract on the part of the contractor) and the contractor shall pay as compensation an amount equal to one percent which the Construction 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 one half of such time has elapsed and three-fourth of the work before three fourth such time has elapsed. In the event of the contractor failing to comply with this condition, he shall be liable to pay as compensation, an amount equal to one percent which the Construction 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 ten percent of the estimated cost of work as shown in the tender. The Construction Committee may on representation from the contractor, reduce the amount of compensation and his decision, in writing shall be final.

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 have power to adopt any of the following courses, as he may deem best suited in the interest of 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 part of the work debiting the contractor with the cost of the labour and the price of the materials (for the amount a certificate of the Construction Committee shall be final and conclusive, against the contractor) and crediting him with the value of the work done in all respects in the same manner and at the same rate as if it had been carried out by the contractor under the terms of his contract. The certificate of Construction Committee as to 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 Construction 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 Construction 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 work thereof, actually performed under this contract unless and until the Construction 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:** In any case in which any of the powers conferred upon the Construction Committee by clause 3 hereof shall have become exercisable and the same shall not exercised 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.

Power to take possession or require removal or sell contractor's plant: In the event of the Construction 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 Construction Committee where certificate thereof shall be final, otherwise Secretary 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 time to be specified in such notice and in the event of the contractor failing to comply with any such requisition, the Construction Committee may remove them at the contractor's expense or sell them by auction or private sale, on account of the contractor and at his risk in all respect and the certificate of the Construction Committee to the expenses for such removal and the amount of the proceeds and expenses, if any, shall be final and conclusive 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 construction 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 construction 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:** The contractor shall deliver in the office of Secretary 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 the value of such work 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 such monthly 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 Construction 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 the contractor. 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 Construction 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 shall have been completed and the certificate of completion given. But, in the case of work 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 Construction 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 re-erected 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, determine or effect in any way the powers of the Construction 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 bill shall be submitted by the contractor within one month of the date fixed for completion of the work, otherwise the Construction 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 Construction Committee within Thirty days of the presentation of the bill by the Construction Committee to the Society otherwise the amount already determined by the Construction Committee shall become binding on both parties. Both the Construction 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.

Clause 7(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-8 **Bills to be submitted monthly:** A bill shall be submitted by the contractor each month on or before the date fixed by the Construction Committee for all work executed in the previous month and the Construction Committee shall take the requisite measurement for the purpose of having the same verified and the claim, as far as admissible, adjusted if possible, 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 Construction 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 Construction Committee may prepare, a bill from such list which shall be binding on the contractor in all respect.

Clause-9 **Bills 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 specified in 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 Construction 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 Construction 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 to any such materials.

Clause –11 **Works 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 Construction 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-11A **Removal of employee workman and foreman:** The Construction Committee shall have full powers at all time to object to the employment of any workman, Foreman or other employees on the works by the contractor and if the contractor shall receive notice in writing from the Secretary 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 Construction 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 Secretary.

Clause –12 **Alterations in specifications and designs:** In case of any addition or alteration in original specifications, which result into expenditures of more than Rs. 2.00 lacs (Rupees Two Lacs) than the society will compensate for such additions etc. as per DSR on the date of tender.

Clause 13 **Deleted**

Clause 14 **Action and compensation payable in case of bad work:** If it shall appear to the Construction Committee of the Society, that any work has been executed with unsound, imperfect or unskillful workmanship or with material of any inferior description or that any material or article provided by him for the execution of the work are unsound or of a quality inferior to the contract or otherwise not in accordance with the contract, the contractor shall on demand, in writing, from the Construction Committee specifying the work, materials or articles complained or not withstanding that the same may have been inadvertently passed, certified and paid for the forthwith rectify or removed and reconstruct the work so specified in whole or in part as the case may require or as the case may be, remove the materials or articles so specified and provide other proper and suitable materials or article at his own charge and cost. In the event of its failing to do so within a period to be specified by the Construction Committee in his demand aforesaid then the contractor shall be liable to pay compensation at the rate of one percent on the amount of estimate of everyday not exceeding ten days, while his failure to do so shall continue and in case of any such failure the Construction 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.

Clause 15 **Work to be open to inspections, contractor or his responsible agent to be present:** 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 Construction 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 Construction Committee to visit the work shall have been given to the contractor either himself be present to receive orders and instruction, or have a responsible agent duly authorized, in writing, present for that purpose. Orders given to the contractor's agent shall considered to have the same force as they had been given to the contractor himself.

Clause 16 **Notice to be given before work is covered up:** The contractor shall give not less than Three working days notice in writing to the Construction 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 Construction 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.

Clause 17 **Contractor 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, enclosure or grass, land, cultivated ground or the premises on which 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 four months after 100% completion of all works as explained under Defect Liability period in special conditions of this tender Documents, the contractor shall make the same good at his own expenses and in default, the Construction Committee may cause the same to be made good by other workmen and deduct the expense (of which the certificate of the Construction 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 period is two years after 100% completion of all the works including getting all the approvals from all the Authorities by the contractor as explained in Detail under Special conditions of this tender document.

Clause 18 **Contractor 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 Construction Committee, as to any matter as to which, under these conditions he is entitled to be satisfied 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. Failing to do so, the same may be provided by the Construction 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.

Clause 19 No child labour shall be employed on the work.

Clause 20 **Work on Public Holiday & SUNDAYS:** No work shall be done on Public Holiday on which labour cannot be employed without the sanction, in writing, the Construction Committee.

Clause 20A **Contractor liable for payment of compensation to injured workman or in case of 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 and without prejudice to the right of the Society under section 12, sub section (2) of the said acts, The Society shall be at liberty to recover such amount or any part thereof by deducting 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 sub-section (1) of the said act except on the written request of the contractor and upon his giving request to the Society full security for all costs for which the Society might become liable in consequence of contesting such claim.

Clause 21 **Work not be sublet. Contract may be rescinded and security deposit forfeited:** The contract shall not be assigned or sublet without the written approval of the Construction Committee. And if the contractor shall reassign or sublet his contract or attempt to do so or become insolvent or commence any insolvency proceedings or make any composition with his creditors or attempts to do so or if any bribe, gratuity, gift, loan, reward or otherwise, shall either directly or indirectly be given, promised or offered by the contractor or any of his servants or agents to any public officer or person in the employment of the Society or members of the Construction Committee, in any way relating to his office or employment or if any such officer or person shall become in any way directly or the indirectly interested in the contract, the Secretary may thereupon by notice, in writing, rescind the contract and security deposit of the contractor shall stand forfeited and be absolutely at the disposal of the Society. The same consequence shall ensure as if the contract had been rescinded under clause 3 thereof and in addition the contractor shall not be entitled to recover or be paid for any work thereof actually performed under the contract.

Clause 22 **Sum 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 these condition shall be considered as reasonable compensation without reference to the

actual loss or damage sustained and whether or not any damage shall have been sustained.

Clause 22A Deduction of amounts due to Government on any account whatsoever to be recoverable from 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 any other 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.

Clause 23 **Changes 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 Secretary for his information.

Clause 24 **Work to be under directions of** the Construction Committee**:** All works to be executed, under the contract shall be executed under the directions of and subject to the approval of the Construction Committee for 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.

Clause 25: **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 Construction Committee or claims for compensation where work has been temporarily brought to a standstill for 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 Construction Committee.

Clause 25(A): Arbitration Clause:

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, related or pertaining to this contract, or as to the rights, liabilities and duties 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.

Clause 26 **Deleted**

Clause 27 **Deleted**

Clause 28 **Action where no specification:** All items mentioned in the Punjab Schedule of rate (PSR) 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 Construction Committee. The decision of the Construction Committee, given in writing shall be final.

Clause 29 **Deleted**

Clause 30 **Deleted**

Clause 31 Unless otherwise specified in the contract, the term “the Construction Committee” referred to in the tender and contract for the work means the Construction Committee of the Society.

Clause 32 The 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.

Clause 33 The contractor undertakes that he is not related to any member of the Construction Committee

Clause 34 No 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.

Clause 35 All 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.

Clause 36 The rates given are for the work inclusive of all material, all labour, all taxes i.e. octroi charges, sales tax, all duties and all other taxes as applicable including labour welfare cess. No hidden rate will be entertained.

Clause 37 It will be the responsibility of the contractor 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 Construction 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.

Clause 38 The contractor shall 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 Construction 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. Any dispute regarding this will be settled by the Construction Committee whose decision will be final and binding. Contractor will also follow the fair wage clause attached. All the rules of SHE (Safety, Health and Environment) as enforced by Govt. to by strictly followed by contractor.

Clause 39 **Deleted**

Clause 40 **Deleted**

Clause 41 No claim on account of fluctuation in prices due to war or any other cause will be entertained except for those of cement and steel which shall be as per Section-9 of this document.

Clause 42 The contractor shall be liable to make good all damages caused by breakage from the moment the stores are handed over to his charge.

Clause 43 **Deleted**

Clause 44 The contractor will inform the C.M.O about the employment of labourer on the work for carrying out Malaria Surveillance.

Clause 45 The terms and conditions of the agreement have been explained to me / us and I / we clearly understand them.

Clause 46 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 arrangements made by the contractor for execution of various items of the work shall be

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.

Clause 47 **Deleted**

Clause 48 In case where final bill is likely to be for a minus amount, the security deposit will be with held till the final bill is passed and the recoverable amount is first made good.

Clause 49 The work will be strictly carried out as per CPWD specification and conditions also.

Clause 50 During the defect liability period if the agency does not remove the defect as notified by the Construction Committee, the recovery will be made as per the PSR + prevailing ceiling premium for Punjab Schedule of Rate items and as per the market rate for Non PSR items or as per Actual Market Rates whichever is more and contractor will not have any objection to that .

Clause 51 The contractor shall at his own cost provide a fully furnished container office with AC at site for exclusive use of the Society or any Third Party so authorized by the society.

Clause 52 In case of flooding of site on account of rain, flood or any other cause or any 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.

Clause 53.a) In the interpretation of agreement the order of descending importance for any ambiguity or discrepancy shall be as follows :

- Additional conditions and additional specifications of contracts and drawings.
- CPWD standard specification latest book with up to date correction slips and CPWD specifications latest book with up to date correction slips.
- General Conditions
- B.I.S. Codes

Clause 53.b) The work will be carried out according to Punjab PWD specifications latest book which will form a part and parcel of this contract schedule of rates.

Clause 53.c) Item and materials not covered by the specification given in this contract as a whole shall be covered by the manufacturer's specifications along with relevant and latest Indian Standard Codes/other codes.

Clause 53.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 Construction Committee.

Clause 54 The contractor shall, within 30 days of the award of the work and release of 1% mobilisation advance, prepare and submit detailed work programmes based upon

Bar Chart/PERT/CPM Chart and obtain the approval of the Construction 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 progress of the work, he shall be required to modify and update the Bar 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 Construction 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.

Clause 55 Earnest Money Deposits and Refund: Deleted

Clause 56 Refund of Security deposits:

- 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.
- The balance amount of the "Security Deposit" will be released after the expiry of the defects liability period of thirty six months which will start from date of completion of 100% of all the works by the contractor at site which also includes approvals from 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.

Clause 57 The 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.

Clause 58 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 Construction Committee and as per the requirement of the Architect/Site Engineer free of cost.

Clause 59 All items of works, which are specialized in nature in the opinion of the Architects/ the Construction Committee such as pile foundation, fiber-glass work, aluminium fabrication, water proofing etc. shall be done by specialized and competent agencies/firms approved by the the Construction Committee and such works shall be executed as per approved fabrication drawings/specifications submitted by the specialized agencies and approved by the Architects/ the Construction Committee.

Clause 59 (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) Material at site including plants, machinery and other perishable item.

c) Injury to persons belonging to the Society, their employees, architects, the Construction 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 Crèche as per requirements to keep the children of labour employed at the site during the entire construction period.

Clause 60 The contractor shall supply three sets of photographs of 12”x10” (colour) describing every important stages of work as per instructions of Architect/ the Construction Committee free of cost. The two sets of pictures shall be the property of the Society and one of the Architects. The photograph shall be maintained under album file cover.

Clause 61

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 at the 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 construction 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 whether original 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 Construction Committee and the decision by the Construction 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 the contract, PWD specifications of work, drawings and other documents relating to the work.

iii) Large size detail drawings shall take precedence over small drawings and in case of any difference the contractor shall get the same clarified before execution of the work.

Clause 62 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 Construction Committee. The contractor shall arrange the equipment and instruments at his cost.

Clause 63 The work shall be carried out under the direction, supervision and in stages as instructed by the Construction 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 Construction Committee for carrying out the work.

Clause 64 Contractor 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.

Clause 65 All relevant ISI codes as directed by the Construction Committee shall be kept by the contractor at his own cost in his office at site.

Clause 66 Testing of cement concrete cubes and other field tests shall be carried out at site for which the contractor shall establish and maintain a suitable laboratory at his own cost. Cube testing machine, weighing balance, weights etc. shall be got calibrated after every six months. However 5% of the total cubes shall be got tested in PWD lab or any other Government approved laboratory as approved by the Construction Committee.

Clause 67 a) Wherever pipes or any other members/frames are to be fixed to wall or RCC surfaces the contractor shall be required to use rawal plugs 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 otherwise authorised by Architect/ the Construction Committee nothing extra shall, however, be paid.

Clause 68 **Deleted**

SIGNATURE OF THE TENDERER **SECRETARY**

CONTRACTS LABOUR REGULATIONS

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 words and expression shall have the meaning given herein against them respectively that 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 in English 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. **FIXATION OF WAGES PERIODS:**

- The contractor shall fix wage periods in respect of which the wages shall be payable.
- No wage period shall exceed one month
- Wages of every workman employed on the contract shall be paid before expiry of ten days after the last day of wage period in respect of which the wage are payable.
- When the employment of any worker is terminated by or on behalf 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.
- All the payment of wages shall be made on working day.

6. **Wages book and wages slip etc.**

[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. Rate of daily or monthly wages or contract wages.
b. Name of work on which employed.
c. Nature of work on which employed.
d. Total number of days worked during each wage period and total amount payable for the work during wage period.
e. All deduction made from the wages with an indication in each case of the ground for which the deduction is made.

f. Wages actually paid for each wage period.

[2] The contractor shall also maintain a wage slip for each worker employed 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.
- Any other deduction which Punjab Government may from, time to time allow.

[2] No fine shall be imposed on a worker and no deduction for damage shall made be from his wages until the worker has been given an opportunity or showing causes against such fines or deductions.

[3] The total amount or fines 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 and omissions for which penalty or fine can be imposed. He shall 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 a view to ascertaining and enforcing due 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 and the 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 Labour commissioner but subject to such appeal, the decision of the officer shall be final and binding upon the contractor.

13 No party shall be allowed to be represented by a lawyer during any investigation or enquiry 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** – The contractor shall maintain and submit periodical return as may be specified from time to time.

16 **Amendment** –From time to time add or amend these regulations and or any question as to 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 shall be final.

17 The contractor shall be responsible to provide to the entire satisfaction of the Construction Committee at his own expenses the following amenities for the labour employed by him.

a. Suitable temporary hutting accommodation.
b. Trench Latrine, bathing enclosure, platforms, separately for men and women with regular clear Drinking Water.

In the event of his failure to provide any or all the amenities, 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 Construction 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 will not 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 at site during execution of work for which contractor/ executing agency will pay adequate compensation or any other relief required as per law or award by any court of law at his own cost & Society or its employees will not pay anything for it.

SIGNATURE OF THE TENDERER **SECRETARY**

FAIR WAGES CLAUSES

a) The contractor shall pay not less than fair wage 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 and where such wages have not been so notified, the wage 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 the contractor's part of this agreement the contract shall comply with or cause to be complied with the Public Works Department. Contractors' Labours Regulations made by Government 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) The Society shall have the right to deduct, from the money due to the contractor, 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 justified by the terms of the contract or for non-observance of the regulation is referred to in 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.

SIGNATURE OF THE TENDERER **SECRETARY**

AFFIDAVIT

(To be submitted on Non Judicial Stamp paper)

I _____ S/o Sh._____ resident of _____ 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 Punjab Govt. / Govt. of India from time to time never had any connection and interest in my business.
2. That the above said contractor / persons / firms do not have any substituting in my business
   and
3. That the said persons / firms are not employee of my firm and are not in any way connected with my business.

DEPONENT

WITNESS

DATED:

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

DEPONENT

WITNESS

DATED:

(SECTION –6)

SPECIAL CONDITIONS OF CONTRACT

SECTION - 6

SPECIAL CONDITIONS

1. GENERAL

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 specifications are not available, the decision of the Construction Committee, given in writing shall be final.

NOTE: CPWD Specifications means Central Public Works Department specifications with 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 Construction 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 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% l 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 Nothing extra shall be paid on account of any damage due to rain, flood or any other act of God.

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 No claim on account of fluctuation in prices due to any cause will be entertained except for steel and 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 existing structure shall remain the property of the Society. If deemed fit, the Construction 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 a suitable deduction shall be made in the rate of the items in which 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 Construction 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

obstruction to other traffic or causing accident. No claim whatsoever will be entertained on this account.

1.16 The contractor will take all safety precautions pertaining to construction of works such as excavation, 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 Construction 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 shall be 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 Construction 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 Contractor is required to work in two or more shifts (including night work), no claim whatsoever will be entertained on this account notwithstanding 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 Construction 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. Any dispute regarding this will be settled by the Construction Committee whose decision will be final and binding. Contractor will also follow the fair wage clause attached.

1.25 **Sample Flat**

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 brand of various materials incorporated as well as finishes will be approved by the Construction Committee.

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. EXECUTION OF WORK

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 Construction Committee) and the payment thereof shall be made to the contractor at reduced rates. The decision of the Construction 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, fire fighting, water supply, sanitary / sewerage works etc.

2.5 The Contractor shall engage specialized agency for executing the following items of work which has adequate technical capability and equipments and has the experience of having executed at least two similar items of work of similar magnitude:

(a) Anti-termite Treatment
(b) Water Proofing Treatment
(c) All Door Window shutters Factory Made.
(d) Internal Electrical work.
e) Plumbing / Sanitary work.
f) External water supply, sewerage etc.

2.6 The specialized agency for the work shall be got approved from the Construction 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 Plinth level of building should be higher from the road level as per drawings.

2.8 Plinth protection will be provided around the building as mentioned in drawing and conglomerate floor.

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 Construction Committee.

3.2 Architectural drawings shall take precedence over Contract or other services drawings as to all dimensions.

3.3 Contractor shall verify all dimensions at site and bring to the notice of the Construction Committee any or all discrepancy or deviations noticed. The decision of the Construction Committee shall be final.

3.4 All drawings approved by the Construction 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 Construction Committee.

REFERENCE DRAWINGS

3.6 The Contractor shall maintain one set of all drawings issued to him as reference drawings.

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.

COMPLETION DRAWINGS

3.8 Contractor will submit 3 set of “as built drawings” of all Architectural and civil works required for completion certificate and occupancy certificate of project.

Obtaining completion/ occupation Certificate within a reasonable period of 30 days from Estate officer, GMADA Mohali or any other local Authority as applicable, will be the liability of contractor and all related cost, if any to be borne by Contractor except compounding fees on account of carrying out of work as per architectural drawings. Any compounding fees on account of deviation of architectural drawings by the contractor at site will be borne by the contractor only.

Further, it will be exclusively contractor's responsibility to get released regular water and sewer connection from GMADA or electrical connection from Electricity Supply Authority/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 Completion drawings for water supply, sanitary work and external services: All the completion of the work and before issuance of certificate of virtual completion the contractor shall submit to the Construction 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 services as actually executed showing distances, invert and formation levels of the lines etc.
b) All floor plans showing layout of pipes, sanitary wares, valves etc.

4. MATERIALS

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 Construction 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 Construction Committee before use.

4.4 Contractor may be required to purchase such materials of particular make or from a particular source if in the opinion of the Construction Committee, the same is necessary and required for the proper and reasonable compliance of the specifications and in the interest of better quality of work.

4.5 Paint conforms to relevant IS specification and of make indicated in the contract, will be arranged by the contractor.

4.6 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. The material 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 Construction Committee give permission for its removal.

4.7 All material brought by the contractor to the site of work shall be open to suitable test by the Construction Committee and in accordance with the approved make. The contractor shall afford all such facilities and also bear the charges as the Construction Committee may require for collecting, forwarding and testing all such samples and shall hold the material represented by the sample until tests have been made the material found as per standard. The contractor will supply the material required for the test samples without any charges. No material, until it is approved by the Construction Committee, will be used on the work.

4.8 Any cement slurry added over base surface or for the continuation of concreting for better bond is considered to have been included in the Lump Sum Rate.

4.9 The contractor if required on the instructions of the Construction Committee will have to submit the proper record for procurement and use of materials and documentary proof in token of having purchased the cement, steel etc. in the shape of bill & delivery challan along with test report.

4.10 The consignment of steel procured by the contractor can be further got tested from approved laboratory. The cost of same shall be born by the contractor.

4.11 STEEL

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). The contractor will use TMT Fe 500 D steel or more.

v). Binding wire shall be used in double loop for binding the steel.

4.12 CEMENT

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) Cement from Mini cement plant shall not be 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/firms shall 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.

4.13 SITE LABORATORY

The contractor shall install the laboratory at sites of work having following machinery equipments for conducting day to day tests at his own cost :-

i) Machine for testing of compressive strength of cement concrete cubes.

ii) Slump test apparatus.

iii) Digital Weighing machines of 2 kg/10kg capacity.

iv) Oven

v) I.S. sieves

vi) Cube frames of size 150 mm

vii) F.M. Testing Machine.

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

5 STORAGE OF MATERIALS

5.1 All materials shall be stored in a proper manner protected from natural elements so as to avoid contamination and deterioration.

5.2 Contractor's stores shall be open to inspection by the Construction Committee at all reasonable hours.

5.3 Location of stores and storage yards shall be approved by the Construction Committee prior to construction and occupation.

5.4 Contractor shall take adequate protection of the stores maintained by him at his own expense.

6 INSPECTION AND TESTING OF MATERIALS

6.1 Contractor shall if required produce manufacturer's test certificates for the materials supplied by him. The test carried out shall be as per the relevant Indian Standards.

6.2 For examination and testing of materials and works at the site Contractor shall provide all testing and gauging equipment necessary for this purpose. All such equipment shall be tested for calibration at any approved laboratory, if required by the Construction Committee.

6.3 The Contractor shall carry out the various tests as enumerated in the technical specifications of this tender document and the technical documents that will be furnished to him during the performance 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 materials by the Contractor shall be carried out by the Contractor at his own cost.

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 tests will be recorded in the inspection reports, performa of which will be approved by the Construction 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. Supervision of works

7.1 ***The entire work shall be open for inspection at all times by the Construction Committee or any member of the Society and Third Party Inspection, Agency appointed by Construction 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 Construction Committee or its representative has inspected the form work 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 Society but 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 bound on the following lines:-

"I _____ son of Shri _____ resident of _____ do hereby undertake 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 Construction Committee which will be final and binding on us. I have no objection if all the recoveries are made from any other contract executed with Society as well as with other Organization."

8 METRIC CONVERSION

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 Construction Committee shall be final and binding on the Contractor.

9 REFERENCE POINTS

9.1 Contractor shall provide permanent bench marks, flag tops and other reference points for the proper 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 Construction Committee

10. SITE ORDER BOOK

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 of Work.*

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 Contractor is bound to carry out all such instructions given to him.

11 SITE CLEARANCE & CLEAN UP

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 or any adjacent land path or street which may be allotted or used for the 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 Construction 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 Contractors at his own cost. It includes clearance of site, jungle, bushes, undulations trees drains, culverts, temporary structures 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 LICENCES AND PERMITS

12.1 Contractor shall keep constant liaison with the GMADA/local municipal authority and all other statutory authorities (like Power Department) whose approvals and permissions are required before, 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 Construction 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 COMPLETION CERTIFICATE

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. This certificate shall be in the prescribed form as required by the local authority. The contractor shall be responsible for getting the entire installation duly approved by the authorities concerned and shall bear all expenses in connection with the same.

14 QUALITY CONTROL AND MONITORING

The Contractor shall guarantee that the materials and workmanship are the best of their respective 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 DEFECT LIABILITY PERIOD

a) *The defect liability period will be two years, which will start from the date of completion of 100% of all the works by the contractor at site which also includes approvals from 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 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 Construction 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 Construction 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)** Any structural damage / fault / defect to be rectified as soon as the same appears.
- **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)** Leakage of water of any kind in the building to be rectified immediately on priority.
- **vii)** All electrical / public health installations including wiring, pipelines etc. made in the building to be 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 Construction 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 Construction Committee can reduce this frequency in case of emergency. The contractor shall forward to the Construction 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 Construction Committee may issue notice to the contractor to carry out maintenance of defects, if any for brought to his notice. The contractor shall remove the defects within the period specified in the notice and submit to the Construction 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 Construction 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 Construction Committee and delivered to the contractor stating that the works have been completed and maintained to his satisfaction. The maintenance certificate shall be given by the Construction Committee.

16 PERFORMANCE GUARANTEE

The Contractor shall guarantee the performance of equipment / machinery / materials / system during the defect liability period of two years as specified above.

17 ACCESSIBILITY

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 Use of Fly Ash

Where ever 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 Construction Committee.

19 Detail of Engineers / foreman & supervisor to be employed by the contractor

The contractor will provide & depute atleast following staff 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. *2 Number Engineers holding diploma in civil engineering from a recognized university / institution with atleast 10 years experience in construction of Multistoried Buildings.*

3. *1 no. Engineers holding diploma in Electrical Engineering from a recognized university / 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 Construction Committee.*

The Construction Committee can demand for production of degrees and diploma of the engineers employed by contractor which will be produced with in 24 hour of its demand.

SPECIAL CONDITIONS FOR THE PLUMBING SYSTEM

1. GENERAL

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 Construction Committee.

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

2 TESTING UPVC & GI PIPES

2.1 Testing after installation shall be carried out as per relevant provisions of P.W.D. / B.I.S specifications.

2.2 A test register shall be maintained and all entries shall be signed and dated by Contractors and representatives of Construction Committee.

3 Contractor shall be responsible for damage / pilferage of the plumbing / sanitary fittings till the houses are handed over to the department.

3.1 4" i/d rain water pipes will be provided at one pipe per 400 sft. roof area.

3.2 Connection of rain water pipes to be made with rain water harvesting system.

SPECIAL CONDITIONS FOR ESTATE PUBLIC HEALTH SERVICES

A WATER SUPPLY PIPES & 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) Pipe will be arranged by the contractor at his own source.

iii) Pipe will be tested as per relevant IS code in factory premises by the Construction 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 Construction Committee.

v) Rate will includes all types of joints and jointing material.

vi) Suitability designed RCC thrust block and duly approved by the Construction 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 alternate arrangement be made at such locations similarly 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

xi) D.I. pipes will be as per IS 8329:1994 with upto date amendments in min. dia of 100mm i/d make electro steel.

xii) D.I. fittings will be as per IS 9523:1980 with upto date amendment.

xiii) D.I. pipes shall be laid as per IS 12288: 1987 and tested as per IS 8329: 1994 with upto date amendment.

The rubber Gasket shall be EPDM quality termite proof

The rubber Gasket shall be supplied duly manufactured by the following firms.

a) M/s Plasto Rubber Industries Kolkata.
b) M/s Paul Rubber Industries Pvt. Ltd., Kolkata.
c) M/s Durable Polymer Proudets Pvt. Ltd. Kolkata.

xiv) Horizontally cast double flanged pipes shall conform to 7181:1986 with upto date amendment.

xv) C.I. fitting will be as per IS 1538:1976 with upto date amendment.

xvi) Testing of all types of pipe shall be done as per PWD specification before installation.\

B. <u>SPECIAL CONDITIONS FOR UNDER GROUND TANK AND BOOSTING PUMPS</u>.

The capacity of under ground water 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 machinery shall be for six hours per day to fill the overhead tanks at terrace for each dwelling unit.

C <u>SPECIAL CONDITION</u> <u>SEWERAGE & STORM WATER DRAINAGE</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. Pipe will be arranged by the contractor as per approved specifications duly ISI marked.
3. Minimum width of trench excavated for pipe will be as per PWD specification.
4. All surplus earth will be disposed of at least 1Km away at a location to be specified by the Construction Committee. Back filling will be done in 15 cm layers which will be thoroughly rammed & watered so that no settlement taken place later on.
5. Stone ware glazed pipes will be as per IS 651-1980 with latest amendments. All pipe will be duly ISI marked & accompanied with BIS certificates. Laying of S.W. pipes will be done as per IS 4127-1983 with latest amendments.
6. SFRC manholes covers will be heavy duty and will be as per IS 12592 Codes.
7. Construction of Manholes will conform to IS 4111:1986 typical design approved.
8. Dewatering involved anywhere in any service & structure will be done by contractor at his own cost & nothing extra will be paid on this account.
   i) After a sufficient interval has been allowed for the joints to set, the pipes will be tested under a head of at least 1.20 m and in no case under a greater head than 6.00 meters of water above 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) The interior surface of each sewer shall be kept clear of all dirt, cement and superfluous materials of every description as the work proceeds.
9. After proper testing back filling etc. all pipes ends in manholes will be suitably plugged.

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

SPECIAL CONDITIONS FOR HORTICULTURE

1. The height of plant should be less than 5ft and their steam should not be less than 20mm. 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. The plant shall be healthy and disease 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 Construction Committee. Contractor shall adhere to the different operation required in normal conditions during maintenance of the work.

   i) Mtc. of grassy lawn

      a) Grass cutting — Thrice in a week

      b) Watering — Thrice in a week

      The grass should be weed free

   ii) Mtc. of hedges :-

      Watering, hoeing, weeding and pruning — Once in 15 Days

   iii) Mtc. of edges :-

      Making proper edging along walk

      Flower beds flowering mound etc.

   iv) Mtc. of trees and shrubs: — Once in a 15 Days

   However depending the season and requirement the frequency of above operation may be increased as per instruction of the Construction Committee.

GRASSY LAWN AND RAILING

1. ***The Plants/ Grassy lawns will be maintained by the contractor/ Executing Agency at his 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 Construction Committee.***

SPECIAL CONDITION RAIN WATER HARVESTING

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 Construction Committee.

NOTE :- It will be contractor responsibility to obtain rain water harvesting well certificate from GMADA/ any other relevant authority as applicable after completion of same at his own cost for which Society will not pay anything.

SPECIAL CONDITIONS OF ELECTRICAL WORK

1. GENERAL

I All 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 Rules in force. The works shall also conform to any special requirement of local State Electricity Board. In any case, the above mentioned rules, regulations etc are not in accord, the decision of the Construction 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 Construction Committee. The Contractor should passes Class 'A' approved license issued from State Government

These Special Conditions of Contract shall be read in conjunction with the General Conditions of Contract, Technical Specifications, Drawings and other documents relating to the work and shall 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 Construction Committee.

vi. The work shall be executed as per the programme drawn or approved by the Construction 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 building work to be tenable except extension of time secured 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 Construction 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 Construction Committee for his approval. The contractor shall not commence the work until the samples are approved, in writing from the Construction 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 is as could be secured, but its complete accuracy is not for the assistance and guidance of 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. Clarifications of Discrepancies

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

5. Work and Workmanship

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 contractor and it shall be made good by him, at his cost, to the entire satisfaction of the Construction 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 Construction Committee.

6. Certificate of Inspection

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 etc shall 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 such time the installation is finally approved and the required certificate is issued. The contractor

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

iv. The Construction Committee shall have full powers to get the material or workmanship etc inspected and tested by an independent agency, at the contractor's expenses in order to ascertain their soundness and adequacy.

v. Liaisons with electricity supply authority for getting power connection of the site in a reasonable time of 30 days including submission of necessary test certificate 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 Construction Committee or its representative and all instructions given to the contractor will be recorded in the site 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 Construction 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) Test shall be carried out to ascertain that all the non-linked SP switches have been connected to 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 megger insulation tester, earth tester multi-meter, AVO meter etc for carrying out the above tests.

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 Construction Committee to his entire satisfaction and a completion certificate issued by the Construction 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. Additional Conditions

i) The whole work shall be carried out strictly in accordance with REC specification / standards (as applicable to state of punjab with upto 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 be given by the contractor, so as to find out the installations.

a) Earth resistance test.

b) Insulation test.

c) Polarity test.

iv) All cable connections with main switches and in pole junction boxes shall be through dowells or any 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 brought to the site of work.

vi) The contractor has to strictly follow the fair wages clause.

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 Construction Committee.

x) contractor would submit the test report after completion of work.

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 Construction 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. Preamble to schedule of quantities:

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 inspection together 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, if any.

iii. In order 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. The drawing and specifications lay down minimum standard of equipment and workmanship and the 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 equipments 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 period of 12 months from the date of the installation certified by the Construction Committee and taken over by the Society. During the guarantee period all the defects shall be rectified by the contract free of cost.

viii. The successful tenderer shall submit the shop drawings for wiring LT boards, distribution boards and 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 Construction 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 either site requirements or change in structural layout. All such changes from the position, shown in 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 quoting the rates, as no extra will be allowed on any ground arising out of or relating 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 Construction 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 cloth as well as three prints of each drawing showing the complete wiring diagram as executed at site drawn to scale approved by the Construction Committee after the completion of work but before completion certificate is given by the Construction Committee.

xiv. After laying and jointing the cables shall be subject to necessary tests as stipulated in 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 Construction 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 the specific make of material may be asked by the Construction 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 Construction 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. The contractor shall provide, within one month after completion of the work or alongwith the final bill, three sets of manuals properly bound which shall contain the following information:

a) Description of installation items using main items of equipments.

b) Description of all equipments and system operation with trouble shooting manuals.

c) Line diagram of each system including main feature of equipments and showing method of setting controls.

d) Method of fault finding, routine, adjustment and wiring diagram.

e) Description of routine maintenance, oil and greasing points and recommended lubricants.

f) Manufacturer service manuals for all equipments.

g) Spares reference manuals.

xix. The contractor shall provide the following at no extra cost to the Societyt:

a) Danger Notice Boards

b) Treatment for electric shock giving details of FIRST AIR TREATMENT with chart diagrams (mounted in suitable frame).

c) Line wiring diagrams of the electrical system mounted in suitable frame.

xx. The contractor will remove all the debris and surplus earth from work site (belonging to his work) free of cost.

10 TESTING OF INSTALLATION

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) Insulation resistance and wiring continuity test.
b) Earth resistivity and continuity test.
c) Test of polarity of non linked single pole switches.

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 Insulation Resistance Test

The insulation shall be measured between the earth and whole system 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 shall deemed to be that which is mentioned between the phase conductor and the neutral.

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 or to the other pole or phase conductor of the supply and its value shall not be less than that specified in above clause.

iii Testing of Earth Continuity Path

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 Testing of Polarity of Non-Linked Single Pole Switches

In a two wire installation the test shall be made to verify that all non-linked single pole switches 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 pole switch is fitted in a conductor which is labelled or marked for a connection to one of the outer or phase conductor of the supply.

v Load Balancing Tests

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

SPECIAL CONDITIONS FOR FIRE FIGHTING

1 General

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

2. Scope Of Work

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) Hose Reel
b) 2 ways fire brigade inlet
c) Fire extinguishers
d) Electrical panel and connected cabling works
e) Approval of entire installation contained in the contract from all agencies concerned.
f) Wet Risers.
g) Water tanks on roof top common pumping machinery.

3. Inspection and Testing of Materials

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 Construction Committee or his representative.

3.2 Tests shall be performed in presence of the Construction Committee or Representative of Construction 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 Construction Committee at site for measuring of the various articles, materials brought by him to the site of work for use on the work.

4. Completion Drawings

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 Construction Committee. These drawings shall have the following information:

a) Run of all piping with diameters on all floors vertical risers with line and levels.
b) Location of control valves, access panels.
c) Layout of equipment.
d) Wiring diagrams

4.2 All "warranty cards" given by the manufacturers shall be handed over to the the Construction 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. Licenses and Permits

5.1 Contractor must hold employ welders holding a valid radiography quality welding license from the recognized authority / organization.

5.2 Contractor shall keep constant liaison with the local authority and all other statutory authorities whose approvals and permissions before and after execution of the work are required.

5.3 It shall be the Contractor's responsibility to obtain the necessary approvals and permissions of 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 Government in stages and after completion of all fireworks at his own cost for which Society will not pay anything.

SIGNATURE OF TENDERER **SECRETARY**

Additional Special Conditions of Contract

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 and not received by him for whatsoever reason. It has been duly accepted that even the arbitrator will have no power to grant pre award interest i.e. interest from due date up till the date of award.

3. That since it is a turnkey project 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, therefore incase of any fault in the drawings resulting into some extra work or extra cost; the same shall be the sole responsibility and expense of the contractor. The society will not be liable to pay any extra amount for such work or cost. **Similarly if any item or quantities are found deficient, the same would be made good at his own cost and responsibility the contractor.**.

5. That in case of any ambiguity or items which has not been provided expressly but have to be undertaken or omitted by the contractor, the same shall be carried out without causing delay in the completion of the project. The price adjustment 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. 11.01.2020. In case such non scheduled item is not found in the CPWD Schedule of rates, then Delhi Schedule of rates of the same date will be applicable. In case the non scheduled is not mentioned in any of the above schedules, then the tender committee will fix the rate of such item by inviting 3 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 Haryana High Court at Chandigarh. During this period neither the contractor will stop the work nor will the society stop the due payment for the undisputed work being undertaken by the contractor.

(SECTION – 7)

SCOPE OF WORK & SPECIFICATION

FOR

CIVIL, ESTATE SERVICES, 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 AND RAINWATER HARVESTING.

SCOPE OF WORK

1 CIVIL WORKS

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 National Building Code as 3-dimensional MIVAN structure/latest technology and earthquake resistant. The Architectural Drawings Structural design & Drawing will be provided by Agency and **Agency will get the said Architectural Drawing approved from GMADA and the said Structure Design & Drawings checked and vetted from IIT Delhi/IIT Ropar/PEC 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, sky walk and fine-dining at roof and every dwelling unit should 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 documents.
The following facilities will be provided complete in all respect:-

a) Club House;
b) Swimming pool;
c) Children Swimming pool;
d) Toddlers Splash pool;
e) Covered Parking as per ESS- 112*2+58*1.5=311;
f) Guest Parking – 32;
g) Consultant Cabins;
h) Shops/shopping area;
i) Guest House;
j) Driver Dormitory;
k) Yoga Centre;
l) Meditation Centre;
m) Indoor Gymnasium;
n) Open Gymnasium;
o) Acupressure Bed;
p) Kids play area;
q) Sand pit;
r) Children Library;
s) Badminton Court;
t) Basket Ball Court;
u) Tennis Court;
v) Jogging Track at Ground;
w) Floor Fountain;
x) Party Deck;
y) Amphitheatre;
z) Spill Out;
aa) Deck with sunself;
bb) Plumbing;
cc) Internal & External Water Supply;
dd) Sewerage;
ee) Internal Electrical Conducting;
ff) Strom Water Drainage;
gg) Roads
hh) Boundary Wall with Gates +Guard Room;
ii) Fire Fighting, Fire Alarm and Suppression Services;
jj) External Electrical services;
kk) DG sets of !00% Power Backup;
ll) Parks & Horticulture;

mm) Roof top Rainwater Harvesting;
nn) Solar Photovoltaic Power Plant;
oo) Gas Pipe Provisions;
pp) 3 Nos. Passenger Lifts &3 Nos. Passenger Hospital Elevators;
qq) Intercom System;
rr) Electronic Security System;
ss) Dry Type Transformer;
tt) The middle will be kept vacant for re-creational purpose.
uu) Development of Sky walk & Fine Dining at Terrace;
vv) Foyer Lobby, Banquet Hall, Party Halls,
ww)Green Building with MIVAN technology.

2 ESTATE SERVICES:

a. Water Supply: The scope of work includes laying of water supply network of D.I. pipes with C.I./D.I. specials & sluice valves designed as per CPHEEO norms at a suitable depth with minimum cover of 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 storage of 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. Sewerage: 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. Storm Water Drainage: 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 design of RCC slab 1:11/2:3 over drain should be structurally safe. In addition, provision for RCC pre-cast grating should also be made to take the rain water into drain at a suitable distance. The design of section of drain / gradient, structure and distance of gully grating is subject to the approval of the Construction Committee.

e. Estate Electrification: 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. Internal Roads: 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 Construction Committee.

g. Horticulture: 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 by the Construction Committee. The earth filling where ever required to develop the open areas and 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 slab water leakage proof, laying of drainage pipes to flush out the excess water after irrigation as

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. **Boundary Wall:** The scope of work includes the construction of Brick Masonry, boundary wall with R.C.C. column / plinth beam as per the standard x- section and specification approved by the Construction Committee and fixing of mild steel gates, as per the design approved by the Construction Committee.

i. **Rain Water Harvesting**: As per provisions and recommendations of Central Ground Water Board. Design of Rain Water Harvesting structure will be got approved from concerned competent authority/the Construction Committee.

j. **Gas Pipe provisions in Kitchen:** As per provisions and recommendations of Gas Authority of India Limited, will be got approved from concerned competent authority/ the Construction 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. **Lift:** The lifts as per technical specifications will be installed by the contractor from renowned lift manufacturer as per approved makes mentioned in this tender document. NOC/ Registration will be taken from lift / fire Authority by the contractor and submitted to the Society at his own cost.

l. **Solar Photovoltaic Power Plant:**, The agency has to install minimum Kilo Watt Peak (KWP) Solar Photovoltaic Power Plant in Site No. GH-1, Sector-8, Eco City Phase 2, Greater Mohali, as notified by Punjab Govt. Renewable Energy Department for Green Building.

m. **Solar Water Heating Plant:** The agency has to install minimum capacity Solar Water Heating Plant Plant in Site No. GH-1, Sector-8, Eco City Phase 2, Greater Mohali, as notified by Punjab Govt. Renewable Energy Department for Green Building.

n. **Fire Fighting system:**

- The fire fighting system will be carried out as per the National Building Code and BIS specifications. 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 are to be borne by 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. INTERNAL WATER SUPPLY

Internal water supply will be provided as per CPWD specifications and specifications provided in this document. The sizes 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) Distribution system from main supply headers to all fixtures and appliances for cold/hot water.
b) Cold water supply lines from city water connections to fire and underground water tanks.
c) Municipal water connections to U.G. water tanks.
d) Garden irrigation system
e) Excavation and refilling of pipes trenches.
f) Insulation to hot water pipes.
g) Pipe protection and painting.
h) Control valves, masonry chambers and other appurtenances.
i) Connections to all plumbing fixtures, tanks, appliances and Municipal mains

2. INTERNAL PLUMBING WORKS

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

i) Sanitary Fixtures.
ii) Soil, Waste & Vent and Rain Water Pipes and fittings.

iii) Water Supply System (Cold & Hot).
iv) Sewerage & Storm water drainage system
v) Garden Irrigation System
vi) Water Supply Pumps & Water treatment Equipments

3. INTERNAL ELECTRICAL WORKS

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

4. D.G. SETS

The 2 nos D.G sets of 100% backup capacity shall be provided as per the 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.

The Earthing System shall in totally comprise the following:-

a) Earth Electrodes
b) Earthing Leads
c) Earth Conductors

All three phase equipment shall have two separate and distinct body earths and single phase equipment shall have a single body earth.

6. LIGHTENING PROTECTION WORKS

The work to be done under this section comprises the supply & installation necessary for the complete installation of the lighting protection systems as per French Standards.

IMPORTANT NOTE:-

1. The scope of work also includes providing and constructing expansion joint in basement including filling & finishing the same as detailed architectural drawing supplied by agency and approved by the Construction 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 the date of handing over of possession to Society ie from the date of start of defect liability period as already explained in detail in special condition of this tender for which nothing will be paid extra .

4. Scope of work also include carrying out complete work required for fixing of Split A.C in all the Bed rooms, Servant room, Drawing room and Dining room separately which includes providing and fixing of underground copper pipe of relevant size, Providing and fixing of underground PVC drain pipe of relevant size and providing and fixing of suitable size electrical wire in conduit with earthing arrangement and separate power switch for each split A.C. complete in all respects. In other words, all the works for fixing of split A.C except fixing of A.C unit has to be carried out by Contractor for which nothing will be paid extra.

5. Scope of work also includes providing and fixing independent good quality water supply control valves to the satisfaction of the Construction Committee for each toilet and kitchen of flats at all floor levels in the external water supply pipe coming from roof top to each toilet and kitchen so that

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

6. Scope of work also include, providing wiring for intercom facility in complex complete with conduits, wiring in all units, guardrooms, society manager and service room, all lifts and control rooms complete in all respects to the satisfaction of Construction Committee for which nothing will be paid extra.

7. Scope of work also include swimming pool in the Society, complete with main pool, Children pool and toddlers splash pool, plant room along with all swimming pool machinery complete in all respects to the satisfaction of Construction Committee. All finishing as per approved architectural drawings.

8. Scope of work also include construction of guard room, ESS rooms, ramps covering with polycarbonate sheets with adequate steel structure to hold the polycarbonate sheets as per design in complex complete in all respects to the satisfaction of Construction Committee for which nothing will be paid extra.

9. 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 Construction Committee for which nothing will be paid extra.

The contractor will submit, within 30 days of award of work, shop drawings of door / window, plumbing work, internal & external electrification, Fire Fighting system, water supply distribution system with clear water tank, pumping machinery, sewerage system, storm R.C.C. pipe drains, horticulture works, roof top rain water harvesting system etc detail shop drawings of various services and any other shop drawings as required by Construction 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 Construction Committee and after approval. Contractor has to submit co-ordinated shop drawings of all the Services Co-ordinated with Civil drawings for approval from the Construction 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 deemed to 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 Construction Committee in writing from time to time during the progress of work. The Construction Committee will have the right to make such amendments to any of 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 Construction Committee.

Such approval of drawings and design will not be taken as constituting any expression or in any opinion of the Construction Committee as to performance of shop drawings in any way as relieving the contractor from his responsibilities and obligations under the contract. The contractor will supply 6 sets of finalized design and shop drawing at his own cost for the use of Construction Committee before start of the work. If the Construction 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.

The responsibility of performance of all the service systems 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 this document, shall be carried out by the agency as per Punjab PWD specifications and relevant IS Code and at its own cost as per the direction of the Construction Committee as per drawings issued or to be issued by Architect of the Project.

SPECIFICATIONS

SPECIFICATIONS FOR BUILDING WORKS

Earth Work in Excavation as per CPWD Specifications

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 Construction Committee , within a lead of 30 meters.

Earth Filling as per CPWD Specifications

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-Termite Treatment

Supplying and Injecting chemical emulsion (Chlorpyriphos / Lindane emulsifiable concentrate of 20%) for pre-constructional 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 :*The work is to be carried out as per CPWD specifications (with latest edition).*

PCC in foundation as per CPWD Specifications

Cement concrete 1:4:8 or 1:2:4 or 1:3:6 with stone ballast 40 mm or 20mm nominal size respectively in foundation and plinth.

DPC as per CPWD Specifications

Damp proof course, 40mm thick, of cement concrete 1:2:4 using stone aggregate 20mm nominal size with 2 coats of bitumen 20/30 penetration at 1.65 kg per sqm laid hot and sanded.

C.C. FOR FOOTING as per CPWD Specifications

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.C SLAB as per CPWD Specifications

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 .

RCC FOR WALLS,COLUMNS, FACIA, PARAPET and SHELVES as per CPWD Specifications

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:- All RCC mixes and PCC mixes will be design mix batched by automatic batching plants.

BRICK WORK as per CPWD Specifications

First class brick work laid in cement sand mortar 1:5 in foundation and plinth.

First class brick work laid in cement sand Mortar 1:5 in superstructure complete in all respects at all 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.

CEMENT PLASTER as per CPWD Specifications

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

12mm thick cement plaster on walls in cement sand mortar 1:5 complete in all respects at all heights.

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

Note :

- **Only Fe-500 TMT Steel of companies TATA, TISCO, SAIL, RINL to be used.**
- **All the above work is to be carried out as per PWD specifications.**

Top roof Terracing as per CPWD specifications

Providing and laying integral cement based water proofing treatment including preparation of surface, 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.

UPVC PIPE AND BENDS FOR RAIN WATER & BALCONY DRAIN

Providing and fixing of 110 mm dia UPVC pipes (conforming to IS: 4985-2000) of approved make embedded in wall or fixed 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 manufacturer, including cost of

cutting and wastage etc. and cutting holes in walls, roofs and floors etc. and making to its original condition to the satisfaction of Construction Committee.

Providing and fixing PVC bends in position with gutter etc. (for 110mm dia pipe)

Khurras as per CPWD specifications

Top khurra 0.6m x 0.6m for rain water pipe In 25 mm thick cement concrete 1:2:4 over 50mm thick cement concrete 1:8:16.

Bottom khurra on ground 1.2mx0.6m consisting of brick-on-edge laid in cement mortar 1:3 over 75mm cement concrete 1:8:16 including 12mm thick cement plaster 1:3.

CC Gola as perC PWD specifications

Cement concrete 1:2:4 gola 10cm x 10 cm quadrant along junction of roof with parapet wall finished smooth.

Flooring as per CPWD specifications

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

Ceramic Glazed Floor Tiles

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 Construction Committee.

Conglomerate floor 40mm thick cement Concrete topping 1:2:4. with matching skirting.

Inter lock 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**.**

Polished vitrified tiles:

Providing and laying polished vitrified double charged floor tiles in different 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).

Granite stone flooring.

Providing laying in position granite stone flooring on 20 mm to 25 mm thick cement mortar 1:4 (1 cement : 4 coarse sand) including grinding and polishing complete in all respect in stair case and common area as per architectural drawings

Ceramic Wall Tiles:

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.

Granite Flooring and Dado:

Providing and fixing 20 mm to 25 mm thick black granite stone in any pattern, over base of 20 mm / 12 mm 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.

Trimix Concreting:

M-35 grade trimix concreting on road top surface will be done in 4m x 4 m panels by getting the same 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 and all 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 thick TAPECRETE cement plaster 1:3 with a flush coat of neat cement with water proofing. The walls of basement shall have 3" Brick wall cladding over RCC wall and shall be plastered 1:4 with wall finish in Apex Asian paint finish.

The ramp down to basement shall be in M-35 grade Interlocking pavers of 60 mm thickness of Reputed make over inclined RCC slab as given in Section-8 in the list of Approved makes as per choice of Construction Committee.

All above work is to be carried out as per Punjab PWD specifications and detailed approved drawing.

PAINT as per CPWD specifications

Applying pink primer of aluminium priming coat on all wood work including preparation of surface, 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

Applying priming coat with metal primer on all new steel or iron work including preparation of surface. (With 1st quality)

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

Acrylic emulsion paint (of approved manufacturer) three coats excluding priming coat on new work with P.O.P puning on walls and wherever required

White washing three coats in lift shafts.

All outer and exterior sides of all the towers/ buildings including all walls of all balconies of 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 Construction Committee.

Painting two coats, excluding priming coat, with synthetic enamel paint in all shades on new wood work 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: - All colours and shades and makes shall be as approved by the Construction Committee.

DOORS

(i) ENTRANCE DOOR ALONG WITH WIREMESH DOOR:- Providing & fixing of Panel 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 Construction Committee.

(ii) ALL OTHER INTERNAL DOORS:- *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/WINDOWS AS PER CPWD SPECIFICATIONS

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.

DOOR FRAMES/CHOWKATS

Internal door frames/ Chowkats of 100mm x 62.5 mm section of Ivory coast teak wood as per drawing.

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)

STEEL WORK FOR GRILLS, RAILING, GATES ETC. AS PER PWD SPECIFICATIONS

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 welding rods 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 & WINDOW FITTINGS like Tower Bolts, Handles, Sliding Bolts etc will be as per Punjab PWD specifications/DSR Specifications and as per list of make and model

GLASS PANES AS PER PWD SPECIFICATIONS

Supply and fixing of glass panes of 5mm thick including metal sash putty, clips etc. of approved make.

THERMO-MECHANICALLY TREATED BARS FOR RCC WORK

Fe-500 grade, TMT Bars of companies TATA, TISCO, SAIL, RINL , will be used.

POP / CORNICES

All walls and ceilings will have P.O.P. punning and cornices in lift lobbies and corridors or wherever required complete in all respects as per detailed drawings to be supplied..

THERMAL INSULATION OF TERRACES:

Top of roof to be P.U. thermal insulated by some specialized agency with guarantee of minimum 10 years.

WATER PROOFING OF TOILET / KITCHEN / TERRACE / BALCONY :

Toilet / Kitchen / Terrace/ Balconies, & swimming pools to be water proofed as per Haryana PWD specifications and shop drawings approved by the Construction Committee.

All above work is to be carried out as per CPWD specifications as applicable to the satisfaction of the Construction Committee.

SPECTIONS FOR PUBLIC HEALTH SERVICES

All the pipe ducts on outer facia will be covered with R.C.C jali or openable and removable any type of material as per approved drawings issued by the Construction Committee. The contractor will not have any objection and will not be paid any extra cost for any type of material as per approved drawing.

WATER STORAGE TANK

Water storage tank will be of R.C.C. as per approved drawings.

SPECIALS FOR DI PIPES AS PER CPWD SPECIFICATION

Drilling & tapping ductile iron pipe lines of all diameters and screwing in ferrule and connections:-

Cutting holes upto 23 cm through brick work in cement walls for pipes and making good including re-pointing, re-plastering and finishing according to existing finish where required as complete in all respect to the entire satisfaction the Construction 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 gun metal gate valve with C.I. Wheel of approved quality (screwed end)

WASH BASIN

The basin shall conform to BIS 2556 and shall bear the mark of firm manufacturing 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, 1¼" 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.

INTERNAL WORK (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 (connection between CPVC & Metal pipes / GI) i.e. Brass adapters (both Male & Female threaded and all conforming to ASTM D-2846 with only CPVC solvent cement conforming to 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 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 Construction Committee.

GI PIPES (EXTERNAL WORK)

Providing, laying, jointing, fixing and testing G.I. Pipe (Class 'B') lines complete with G.I. Specials and fittings 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 Construction Committee.

50mm diameter nominal bore

63mm diameter nominal bore

80mm diameter nominal bore

100mm diameter nominal bore

EARTH WORK FOR PIPES AND MANHOLES as per CPWD 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.

SW PIPES JOINTING

Providing, laying and jointing glazed stoneware pipes Grade 'A' with stiff mixture of cement mortar in 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 Construction Committee.

CC 1:4:8 AROUND SW 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 Construction Committee, complete in all respect to the entire satisfaction of the Construction Committee

MANHOLE CHAMBERS as per CPWD specification

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 with 2 coats of sodium silicate, c.c 1:6:12 below bed and foundations. C.C 1:2:4 in benching, 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.

INSPECTION CHAMBER as per CPWD specification

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 thick with 455mmx455mm/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 Construction Committee.

KITCHEN SINK

Providing and fixing salem stainless steel A ISI 304 (18/8) kitchen sink double bowl as per I.S 13983 with C.I. brackets and stainless steel plug 40mm including painting of fittings and brackets, cutting and making good the walls wherever required with drain board mixers, accessories etc. complete in all respect to the entire satisfaction of the Construction Committee in every kitchen.

SOIL AND DRAIN/SULLAGE PIPES

Providing and fixing of UPVC pipes 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 original condition to the satisfaction of the Construction Committee and of following minimum sizes:-

(a) 110mm dia (Soil Pipe)

(b) 110mm dia. (Waste and other)

CC 1:5:10 AROUND UPVC 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 Construction Committee, around

(a) 110 mm dia

(b) 75 mm dia

(c) 63 mm Dia

(d) 40 mm Dia

DOOR TRAP AS PER CPWD SPECIFICATION

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

GULLY TRAP AS PER CPWD SPECIFICATION

Providing and fixing in position S.W. gully traps 150 X 100mm fixing in cement concrete 1:4:8 complete with C.I. grating 150mm x 150mm cast iron cover.

MIRROR AS PER CPWD SPECIFICATION

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 Construction Committee) as complete in all respect to the entire satisfaction of the Construction Committee as detail given below:-

TECHNICAL SPECIFICATION FOR ESTATE SERVICES

1 WATER SUPPLY

EXCAVATION FOR PIPELINE as per CPWD specification

Excavation for pipelines running under pressure in trenches and pits, in open areas, where disposal of surplus earth is done alongwith 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 DI specials including cost of rubber ring/ gas-ket for jointing complete in all respect duly tested to the entire satisfaction of the Construction Committee(including cutting & jointing etc). The Rubber ring shall be ISI marked and of food grade.

100mm internal diameter of pipes

150mm internal diameter of pipes.

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

100mm internal diameter of pipes

150mm internal diameter of pipes

CI FOOT 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.

CI SLUICE 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.

CC IN FOUNDATION AS PER CPWD SPECIFICATION

Cement concrete 1:8:16 with stone ballast 20mm nominal size in foundation and plinth is to be provided.

CC TOPPING AS PER CPWD SPECIFICATION

Conglomerate floor 40mm thick cement concrete topping 1:2:4 is to be provided.

BRICK WORK FOR CHAMBER / HOUDI AS PER CPWD SPECIFICATION

First class brick work laid in cement sand mortar 1:5 in foundation and plinth is to be provided.

CEMENT PLASTER & CEMENT RENDERING AS PER CPWD SPECIFICATION

12mm thick cement plaster 1:3 plus 1mm thick cement rendering on plaster.

RCC SLAB AS PER CPWD SPECIFICATION

Cement concrete 1:1.5:3 or richer grade with 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.

DI SPECIALS

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 Construction Committee.

i) D.I Tee 100mm x100mm x 100mm

ii) D.I. Collars 100mm

iii) Cross tee 100mm x 100mm x 100mm x 100mm

iv) D.I. Bend 100mm x 90 degree

v) Tail pieces (F/P)

vi) Nut & Bolt

2. SEWERAGE

EXCAVATION OF TRENCHES FOR SEWER.

SW PIPE

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 rest on the bed at every point through-out its length and to ensure this, it shall be grouted in without extra 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 at an angle of 45 degree with 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 finishing the cut surface to a uniform finish and roughing the part of pipes if any entering the sockets of the adjacent pipes complete, to the entire satisfaction of the Construction Committee. PCC 1:4:8 as per section shall be used. Minimum size of SW pipes to be used in External Services will be 200 mm i/d.

Note : **In case sewer is to be laid under water, provision for dewatering of Sub Surface / 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.**

MANHOLE CHAMBERS

Constructing brick masonry manholes chambers of standard design as per manual of sewerage and treatment issued by CPHEEO and shall consist the following specification.

LEAN CONCRETE AS PER CPWD SPECIFICATION

Cement concrete 1:6:12 with stone aggregate 20mm nominal size in foundation and plinth in 9 inch depth.

BED & BENCHING AS PER CPWD SPECIFICATION

Cement concrete 1:11/2:3 with stone aggregate 20mm nominal size as per design approved by the Construction Committee.

RCC SLAB OVER MANHOLE CHAMBER AS PER CPWD SPECIFICATION

RCC 1:1½:3 for slab (7 inches or 175mm thick) including steel reinforcement, centering and shuttering 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.

Brick work in first storey upto 4 mtr above plinth level.

CEMENT PLASTER & CEMENT RENDERING AS PER CPWD SPECIFICATION

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

Manhole Covers & frames

Providing and fixing in cement sand mortar 1:2, setting the same to correct lines and levels heavy duty SFRC manhole cover and frame, Heavy Duty , duly approved by the Construction Committee.

MASONRY PLUGS AS PER AS PER CPWD SPECIFICATION

Providing masonry plugs to ends of sewer of all types with 11.43cm thick brick wall in cement sand mortars 1:7 with 12mm thick cement plaster 1:6 required by the Construction Committee.

CI / SFRC STEP

Providing & fixing of C.I or M/I/ SFRC steps including carriage and setting in 1:2 cement sand mortar complete in all respect as desired by the Construction Committee.

3. STORM WATER DRAINAGE

EXCAVATION OF EARTH WORK as per CPWD specification

Excavation of trenches in open areas for storm drain as per design.

BRICK WORK FOR BRICK DRAIN AS PER CPWD SPECIFICATION

First class brick work laid in cement sand mortar 1:5 in foundation and plinth is to be provided.

CC 1:8:16 IN F&P AS PER CPWD SPECIFICATION

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

CC 1:2:4 IN FLOORING AS PER CPWD SPECIFICATION

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

RCC SLAB OVER BRICK DRAIN AS PER CPWD SPECIFICATION

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

CEMENT PLASTER IN BRICK DRAIN AS PER CPWD SPECIFICATION

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

REMOVABLE SLAB

Removable slab in 30% length shall be provided.

TECHNICAL SPECIFICATIONS FOR INTERNAL PLUMBING WORKS

1.0 GENERAL REQUIREMENTS

1.1 Scope of Work

1.1.1 The form of Contract shall be according to the "Conditions of Contract". The following clauses shall be considered as an extension and not in limitation of the obligation of the Contractor.

1.1.2 Work under this contract shall consist of furnishing all labour, materials, equipment and appliances 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. Plumbing Works

i) Sanitary Fixtures.

ii) Soil, Waste & Vent and Rain Water Pipes and fittings.

iii) Water Supply System (Cold & Hot).

iv) Sewerage & Storm water drainage system

v) Garden Irrigation System

vi) Water Supply Pumps & Water treatment Equipments

1.1.4 Services rendered under this section shall be done without any extra charge.

1.2 Specifications

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. Execution of Work

1.3.1 The Contractor should visit and examine the site of work and satisfy himself as to the nature of 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 Contractor shall verify all dimensions at site and bring to the notice of the Construction Committee all discrepancies or deviations noticed. Decision of the Construction 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 Inspection and Testing of Materials

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) Dumpy level
c) Weighing machine
d) Plumb bobs, Spirit levels, Hammers
e) Micrometers, Tachometers
f) Thermometers, Stoves
g) Hydraulic test machine
h) Smoke test machine

1.5.3 All such equipment shall be tested for calibration at any approved laboratory, if required by the Project Manager.

1.5.4 All Testing Equipment shall be preferably located in a special room meant for the purpose.

1.5.5 Samples of all materials shall be got approved before placing order and the approved samples shall be deposited with the Construction Committee. Any materials declared defective by the Construction Committee shall be removed from the site within 48 hours.

1.6 Metric Conversion

1.6.1 All dimensions and sizes of materials and equipment given in the tender document are commercial metric sizes.

1.6.2 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.

1.7 Reference Points

1.7.1 Contractor shall provide permanent Bench Marks, Flag Tops and other reference points for the 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 Architectural and Plumbing drawings.

1.8 Reference Drawings

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. All changes to be made shall be initialled by the Construction Committee.

1.9 Shop Drawings

1.9.1 The Contractor shall submit to the Project Manager three copies of the shop drawings.

1.9.2 Shop drawings shall be submitted under following conditions:-

(a) Showing any changes in layout in the plumbing drawings.
(b) Equipment layout, piping and wiring diagram.
(c) Manufacturer's or Contractor's fabrication drawings for any materials or equipment supplied by him.

1.9.3 The Contractor shall submit two copies of catalogues, manufacturer's drawings, equipment characteristics data or performance charts as required by the Construction Committee.

1.10 Completion Drawings

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 Construction Committee. These drawings shall have the following information.

a) Run of all piping, diameters on all floors, vertical stacks and location of external services.
b) Ground and invert levels of all drainage pipes together with location of all manholes and connections upto outfall.

c) Run of all water supply lines with diameters, locations of control valves, access panels.
d) Location of all mechanical equipment with layout and piping connections.

No completion certificate shall be issued unless the above drawings are 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 Construction Committee.

1.11. Contractors Rates

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 Rates quoted are for all heights and depths and in all positions as may be required for this work.

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 same with cement mortar/concrete/water proofing of appropriate mix and strength as directed by the Construction 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 Construction 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 he may be called upon to be carried out.

1.12 Testing

1.12.1 Piping and drainage works shall be tested as specified under the relevant clause(s) of the specifications.

1.12.2 Tests shall be performed in the presence of the Construction 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 Contractor shall perform all such tests as may be necessary and required by the local authorities to meet Municipal or other bye-laws in force.

1.12.5 Contractor shall provide all labour, equipment and materials for the performance of the tests.

1.13 Site Clearance and Cleanup

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 License Permits and Authorities

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 Recovery of Cost for Materials issued to Contractors Free of Cost

1.15.1 If any materials issued to the Contractor free of cost, are damaged or pilfered, 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, import duty etc. plus 100%. The decision on the actual cost given by the Society shall be final and binding on the Contractor.

1.16 **Cutting of Water Proofing Membrane**

No walls, terraces shall be cut for making and opening after water proofing has been done without written approval of the Construction 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 Construction Committee.

1.17 Cutting of Structural Members

No structural member shall be chased or cut without the written permission of the Construction Committee.

1.18. Materials Supplied by Owner

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 Construction Committee.

1.19 Materials

1.19.1 Unless otherwise specified and expressly approved in writing by the Construction 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 Construction Committee and returned to the Contractor at the appropriate time.

2.1 BASIS OF DESIGN

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

2.1.1 Requirement of adequate and equal pressure availability of cold water lines in Toilets, Pantry/Kitchen etc.

2.1.2 Adequate storage of water in underground domestic water tanks.

2.1.3 Levels of roads / pavements and other services in the area.

2.1.4 Landscape layout.

The execution of works and materials used shall be as per the latest relevant I.S. specifications.

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 CONCEPT OF THE SYSTEM

The following services are envisaged for the complex:

2.2.1 Domestic water supply through Gravity System for making water available at the residual pressure 1.5 to 2.0 kg / sq.cm.

2.2.2 Sewage and Sullage collection system based on IS:1742 and applicable standards for domestic drainage.

2.2.3 Storm / Rain water drainage system from various levels of the building and disposal to available municipal storm water disposal and recharge wells.

3.0 WATER STORAGE & DISTRIBUTION SYSTEM:

3.1 Water Requirement

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 Source of Water

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

3.3 Water Storage

Adequate storage is planned to meet the peak demand of water in the complex.

3.4 Water Quality

The domestic water supply will be as per BIS standard for potable water.

3.5 Water Distribution

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

Following components shall be included in the water supply system for efficient functioning:

i. Air vent at each of the high point.

ii. Flow meter.

iii. Pressure Gauge.

iv. Anchor block / thrust block.

4.0 SEWAGE, SULLAGE AND STORM WATER

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 Design Limitations

The system is designed considering the following:

a. High thrust developed at soil & water pipe connections.

b. Termination of vent cowl/Maxi vents at terrace level.

c. Provision of adequate slope for horizontal header pipes for achieving self-cleaning velocity in the pipes.

d. Provision of cleanout plug.

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 Construction Committee. All materials and/or Workmanship which in the opinion of the Construction 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

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 Construction Committee.

As and when required by the Construction 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 Construction 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 Construction Committee. To prove that the materials used are as specified the contractor shall furnish the Construction Committee with original vouchers on demand.

A. SANITARY FIXTURES & CP FITTINGS

1. Scope of Work

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) Chromium plated fittings
c) Porcelain or stainless steel sinks
d) Accessories e.g. toilet paper holders, soap dispensers, hand dryers etc.

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. General Requirements

2.1 Sanitary fixtures shall be of best quality approved by the Construction Committee. Wherever particular makes are mentioned, the choice of selection shall remain with the Construction 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, bath tubs, 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 of fixing is given below for the contractor to understand the scope and extent of the work.

4. **European W.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 Plastic seat covers shall be so fixed that it remains absolutely stationery in vertical position without falling down 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 frame work 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. **Lavatory Basin**

5.1 Lavatory basins shall be white glazed vitreous china of size, shape and type specified in the drawings.

5.2 Each Basin shall be provided with brackets and clips of approved and securely fixed. Placing of Basins over the brackets without secure fixing shall not be accepted.

5.3 Each Basin shall be provided with a 32 mm dia waste with overflow, pop-up waste or rubber plug and chain mentioned in the drawings, 32 mm dia CP brass bottle trap with pipe to wall and flange.

5.4 Each basin shall be provided with mixing fitting as specified in the drawings.

5.5 Basins shall be fixed at proper heights as shown on drawings. If height is not specified, the rim level shall be 79 cms or as directed by the Construction Committee.

6. **Sinks**

6.1 Sinks shall be stainless steel or any other material as specified in the drawings.

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 Construction Committee.

6.3 Supply fittings for sinks shall be mixing fittings or C.P. taps.

7. **Accessories**

7.1 Contractor shall install all Chromium Plated and porcelain accessories as shown on the drawings or directed by the Construction 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 Construction Committee.

7.3 C.P. accessories shall be fixed in walls and set in cement mortar 1:2 (1 cement: 2 coarse sand) and fixed in relation to the tiling work as per Interior Designer'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 & RAINWATER PIPES & FITTINGS

1. **Scope of Work**

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

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

Vertical and horizontal soil, waste and vent Pipes, and fittings, joints, clamps, connections to fixtures.

Connection of pipes to sewer lines as shown on the drawings at ground floor levels.

Basement drainage, channels, gratings and floor drains.

Floor and urinal traps, cleanout plugs, inlet fittings and rainwater heads /Khurras.

Testing of all pipe lines.

2. **General Requirements**

2.1 All materials shall be new of the best quality conforming to specifications and subject to the approval of the Construction Committee.

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

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

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

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. shall be clearly reported to the Society in the form of shop drawings so that other agencies are instructed to provide the same.

3. **Piping System**

3.1 **Soil, Waste and Vent Pipes**

a) The soil and waste pipe system above ground has been planned as a "Two pipe system" having separate pipes for waste for janitor sinks, wash basins, drains and floor drains and soil from the WCs and Urinals, and or a "Single stack system" 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) Toilet layouts have been so arranged that the W.C outlets shall be with "P" trap above ground 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 **Rainwater Pipes**

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

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

c) Rainwater in open courtyards shall be collected in catch basins and connected to the storm 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/Planter Drainage**

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 Construction Committee.

3.4 **Soil Waste and Rain Water Pipes**

All horizontal/Vertical soil, waste & rain water piping work inside toilets, basement ceiling, vertical in shaft and ground floor level 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 UPVC PIPES AND FITTINGS

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

3.5.1 **Floor Traps**

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 **Floor Trap Inlet**

Bath room traps and connections shall ensure free and silent flow of discharging water. Where specified, Contractor shall provide a special type of floor or manhole inlet fitting fabricated from UPVC pipes as specified in drawings without, with one, two or three inlet sockets welded on side to 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 Plugs**

Floor Clean Out Plug

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

3.7 **Encasing in Cement Concrete**

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

Soil and waste pipes under floor

Pipes laid in sunken slabs and in wall chases (when cut specially for the pipe) shall be encased in cement concrete 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 12mm size) 75mm in bed and all round. When pipes are running well above the structural slab, the encased pipes shall be supported with suitable cement concrete pillars of required height at intervals of 1.8m. All drainage pipes except when fixed above ground or in exposed locations shall be encased in cement concrete as specified above for soil and waste pipes. The bed and encasing thickness shall however be 150mm in bed and all round as shown on the drawing.

3.8 **Cutting and Making Good**

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 : 4 stone aggregate 20mm nominal size) or cement mortar 1:2 (1 cement : 2 coarse sand) and the surface restored as in original condition.

3.9 **Sleeves/Cutouts**

Contractor shall utilize all cutout and sleeves provided during construction to prevent breaking. The annular space between the pipe and the sleeve shall 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 Construction Committee.

4.0 Testing

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 materials obtained and used on site must have manufacturers hydraulic test certificate for each batch of materials used on the site.

4.1 Measurements

4.1.1 General

a) Rates quoted for all items shall be inclusive of all work and items given in the specifications and Drawings.
b) Rates are applicable for the work in basements, under the ground, floors, in shafts at 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 Rates are inclusive of pre testing and on site testing of the installations, materials and commissioning of the works.

4.1.4 Pipes (unit of measurement. Linear meter to the nearest centimetre)

4.1.5 Soil, waste, vent, anti syphonage, rain water pipes, and drainage pipes shall be measured net when 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 bolts and nuts embedded in masonry walls with cement concrete blocks and nothing extra will be paid for making good the same.

4.1.8 Fittings (excluding pipe fittings) (Unit of measurement by numbers)

Urinal traps, trap gratings, hoppers, cleanout plugs shall be measured by number per piece and shall include all items described in the relevant specifications.

4.2 Excavation for soil pipes:

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 Air Admittance Valves (AAV)

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's to have following performance parameter:

- Temperature range: -20 degree Celsius to 60 degree Celsius.
- Open pressure: -70 pa (-0.010 psi)
- Max. Pressure rating tightness: 10,000 pa (1 m/40" h2o) at 0 pa or higher

4. INTERNAL WATER SUPPLY SYSTEM

1.1 **Scope of Work**

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) Distribution system from main supply headers to all fixtures and appliances for cold/hot water.
k) Cold water supply lines from city water connections to fire and underground water tanks.
l) Municipal water connections to U.G. water tanks.
m) Garden irrigation system
n) Excavation and refilling of pipes trenches.
o) Insulation to hot water pipes.
p) Pipe protection and painting.
q) Control valves, masonry chambers and other appurtenances.
r) Connections to all plumbing fixtures, tanks, appliances and Municipal mains

1.2 **General Requirements**

1.2.1 All materials shall be new of the best quality conforming to specifications. All works executed shall be to the satisfaction of the Construction Committee.

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

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

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

1.2.6 Clamps, hangers and supports on RCC walls, columns and slabs shall be fixed only by means of approved made of expandable metal fasteners inserted by use of power drills.

1.2.7 All pipe clamps, 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 **Water Supply System**

1.3.1 Contractor should study the site plan and water supply system diagram for an overview of the system.

1.3.2 Source

Water supply will be acquired from GMADA/Municipal Corporation water mains to a service connection and collected in water storage tanks located in basement.

1.4 **Water Supply Piping System**

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 CPVC Pipes & 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 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 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 Construction Committee.

. **Joining Pipes & Fittings**

a. Cutting:

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

b. Deburring / Beveling:

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

c. Fitting preparation:

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

d. Solvent Cement Application:

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

e. Assembly:

After applying the solvent cement on both pipe and fitting socket, pipe should be inserted into the fitting socket within 30 seconds, and rotating the pipe ¼ 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 cement should be evident around the joint and if this bead is not continues remake the joint to avoid potential leaks.

Set & Cure times:

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

Minimum Core prior to pressure testing at 150 PSI

Ambient Temperature during Core period	**Pipe Size**	
	½ " - 1"	**1.¼" - 2"**
Above 15 deg. C	1 Hr	2 Hrs
4-15 deg.C	2 Hrs	4 Hrs
Below 4 deg C	4 Hrs	8 Hrs

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

f. Testing

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

g. Transition of Flow guard CPVC to Metals

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

Threaded Sealants

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

Solvent Cement

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

Diameter of pipe in inch (flow guard)	½"	¾"	1"	¼"	1½"	2"
Approx. nos. of joints which can be mode per litre of solvent cement.	200 No.	180 No.	150 No.	130 No.	100 No.	70 No

Hangers and supports

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

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

Supports should be as per the below mentioned table:

Size of Pipe	**21°C**	**49°C**	**71°C**	**82°C**
Inch	**Ft.**	**Ft.**	**Ft.**	**Ft.**
½"	5.5	4.5	3.0	2.5
¾"	5.5	5.0	3.0	2.5
1"	6.0	5.5	3.5	3.0
1¼"	6.5	6.0	3.5	3.5
1½"	7.0	6.0	3.5	3.5
2"	7.0	6.5	4.0	3.5

SCHEDULE – 40							
Recommended Support spacing (in feet)							
Nom. Pipe Size		**Temperature ^{o}C**					
(In)	**(mm)**	**23**	**38**	**49**	**60**	**71**	**82**
2 ½	65	7 ½	7	7	6 ½	6	3 ½
3	80	8	7	7	7	6	3 ½
4	100	8 ½	7 ½	7 ½	7	6 ½	4
6	150	9 ½	8	8	7 ½	7	4 ½
8	200	9 ½	8	8	7 ½	7	5

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 in accordance with layout and alignment shown on 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 Construction 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.

Anchor Fasteners

All pipe supports, hangers and clamps to be fixed on RCC walls, beams, columns, slabs and masonry 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 Construction 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 valve to I.S.780. and C.I. butterfly valve to IS: 3095.

1.5 Valves

Ball Valves

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)

Butterfly Valves – Slim Seal Type

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.

Butterfly valve shall be of best quality conforming to IS: 13095.

Non Return Valve (Dual Slim Type)

Where specified, non return valve shall be provided through which flow shall occur in one direction 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

All pipes, fittings and valves, after fixing at site, shall be tested by hydrostatic pressure of 1.5 times the working pressure or 7 kg / sq.cm whichever 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.

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

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

Hot water pipes chased into the walls shall be provided with a 6mm thick insulation with elastic flexible material having hermetic closed cell structure of expanded synthetic material rated for 60ºC 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.

Rate quoted for supports & hangers shall be inclusive of :

a) Expandable anchor fastens.
b) Galvanising of all supports & hangers.

c) Cutting holes in walls, ceilings on floors and making good where permitted.
d) Nuts, bolts and washers for fixing and assembling.
e) Wooden / PVC pipe saddles for vertical or horizontal runs.

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/pipe protection/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

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

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 Construction Committee or any inspecting authority. At least five working days notice in writing shall be given to the inspecting parties before performing any test.

Water flow rates of all equipment and in pipe lines through valves shall be adjusted to design conditions. Complete results of adjustments shall be recorded and submitted.

Contractor shall ensure proper balancing of the hydraulic system and for the pipes / valves installed 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 Construction Committee.

Three copies of all test results shall be submitted to the Engineer in A4 size 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:

Prior to start-up and hydraulic testing, the Contractor shall clean the entire installation including all fitments and pipe work and the like after installation and keep them in a new condition. All pumping systems shall be flushed and drained at least once through to get rid of contaminating

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) All strainers shall be inspected and cleaned out or replaced.

b) Check all clamps, supports and hangers provided for the pipes.

c) Check all the equipment, piping and valves coming under hot water 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 FINAL ACCEPTANCE TESTS

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 Construction 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 Contractor shall 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 REJECTION OF INSTALLATION / PLANT

Any item of system or component which fails to comply with the requirements of this Specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site may be rejected by the Construction Committee either in whole or in part as it considers necessary/appropriate. Adjustment and/or modification work as required by the Construction 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 Construction Committee.

After works have been accepted, the Contractor may be required to carry out assist in carrying out additional performance tests as reasonably required by the Construction Committee.

5. WARRANTY AND HANDOVER

The Contractor shall warrant 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. HANDING OVER OF DOCUMENTS

All testing and commissioning shall be done by the Contractor to the entire satisfaction of the Construction 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. PIPE COLOUR CODE:Color code to confirm to IS: 2379:1990

S.No.	Pipe Lines	Ground / Base Color	First Color Band	Second Color Band
1	Drinking Water (All cold water lines after filter)	Sea Green	French Blue	Single Red
2	Treated Water (Soft Water)	Sea Green	Light Orange	
3	Domestic Hot Water	Sea Green	Light Grey	
4	Drainage	Black		

LIST OF BUREAU OF INDIAN STANDARDS CODES

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. **Pipes and Fittings**

IS : 458 Specification for precast concrete pipes (with and without reinforcement)

IS : 651 Salat glazed stone ware pipes and fittings.

IS : 1239 (Part 1) Mild steel, tubes, tubulars and other wrought steel fittings: Part 1 Mild Steel tubes.

IS : 1239 (Part 2) Mild Steel tubes, tubulars and other wrought steel fittings:
Part 2 Mild Steel tubulars and other wrought steel pipe fittings.

IS : 1536 Centrifugally cast (spun) iron pressure pipes for water, gas and sewage.

IS : 1537 Vertically cast iron pressure pipes for water, gas and sewage.

IS : 1538 Cast Iron fittings for pressure pipes for water, gas and sewage.

IS : 1879 Malleable cast iron pipe fittings.

IS : 1978 Line pipe

IS : 2501 High test line pipe.

IS : 2501 Copper tubes for general engineering purposes

IS : 2643	(Part 1) Dimensions for pipe threads for fastening purposes: Part 1 Basic profile and dimensions.
IS : 3468	Pipe nuts.
IS : 3589	Seamless or electrically welded steel pipes for water, gas and sewage (168.3 mm to 2032 mm outside diameter).
IS : 3989	Centrifugally cast (sun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.
IS : 4711	Methods for sampling steel pipes, tubes and fittings.
IS : 6392	Steel pipe flanges
IS : 7181	Specification for horizontally cast iron double flanged pipe for water, gas and sewage.

2. **Valves**

IS : 778	Specification for copper alloy gage, globe and check valves for water works purposes.
IS : 780	Specification for sluice valves for water works purposes (50 mm to 300 mm size).
IS : 1703	Specification copper alloy float valves (horizontal plunger type) for water supply fittings.
IS : 2906	Specification for sluice valves for water works purposes (350 mm to 1200 mm size)
IS : 3950	Specification for surface boxes for sluice valves.
IS : 5312	(Part 1) Specification for swing check type reflux (non return) valves : part 2 Multi door pattern.
IS : 5312	(Part 2) Specification for swing check type reflux (non return) valves : part 2 Multi door pattern.
IS : 12992	(Part 1) Safety relief valves, spring loaded : Design
IS : 13095	Butterfly valves for general purposes.

3. **Sanitary Fittings**

IS : 771	(Part 1 to 3) Specification for glazed fire clay sanitary appliances.
IS : 774	Specification for flushing cistern for water closets and urinals (other than plastic cistern)
IS : 775	Specification for cast iron brackets and supports for wash basins and sinks
IS : 781	Specification for cast copper alloy screw down bib taps and stop valves for water services.
IS : 1700	Specification for drinking fountains.
IS : 2556	(Part 6 Sec 2) Specification for vitreous sanitary appliances (vitreous china) part 6 Specific requirements of urinals, section 2 half stall urinals.

IS : 2556 (Part 6 Sec 4) Specification for vitreous sanitary appliances (vitreous china) Part 6 specific requirements of urinals, section 4 partition slabs.

IS : 2556 (Part 6 Sec 5) Specification for vitreous sanitary appliances (vitreous china) Part 6 Specific requirements of urinals, section 5 waste fittings.

IS : 2556 (Part 6 Sec 6) Specification for vitreous sanitary appliances (vitreous china) Part6 Specific requirements of urinals, section 6 water spreaders for half stall urinals.

IS : 2692 Specification for ferrule for water services

IS : 2717 Glossary of terms relating to vitreous enamelware and ceramic metal systems

IS : 5961 Specification for cast iron gratings for drainage purposes.

IS : 6249 Specification for gel-coated glass fibre reinforced polyester resinbath tubs.

IS : 6411 Specification for gel-coated glass fibre reinforced polyester resin bath tubs.

IS : 8931 Specification for copper alloy fancy single taps, combination tap assembly and stop valves for water services.

4. **Water Quality Tolerance**

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

IS : 10500 Drinking Water

5. **Pumps & Vessels**

IS : 2002 Steel plates for pressure vessels for intermediate and high temperature sevice including boilers.

IS : 2825 Code for unfired pressure vessels.

IS : 5600 Specification for sewage and drainage pumps

IS : 8418 Specification for horizontal centrifugal self priming pumps.

6. **General**

SP : 6 (1) Structural Steel Sections

IS : 325 Three Phase Induction Motors

IS : 779 Specification for water meters (domestic type).

IS : 782 Specification for caulking load.

IS : 800 Code of practice for general construction in steel

IS : 1068 Electroplated coatings of nickel plus chromium and copper plus nickel plus chromium.

IS : 1726	Specification for cast iron manhole covers and frames.
IS : 1742	Code of practice for building drainage.
IS : 2065	Code of practice for water supply in buildings.
IS : 2104	Specification for water meter for boxes (domestic type)
IS : 2373	Specification for eater meter (bulk type)
IS : 2379	Colour code for identification of pipe lines.
IS : 3114	Code of practice for laying of cast iron pipes
IS : 4127	Code of practice for laying glazed stoneware pipes.
IS : 4853	Recommended practice for radiographic inspection of fusion welded butt joints in steel pipes.
IS : 5455	Cast iron steps for manholes.
IS : 7558	Code of practice for domestic hot water installations.
IS : 8321	Glossary of terms applicable to plumbing work.
IS : 9842	Preformed fibrous pipe insulation.
IS : 10221	Code of practice for coating and wrapping of underground mild steel pipelines.
IS : 10446	Glossary of terms relating to water supply and sanitation.
IS : 11149	Rubber Gaskets
IS : 11790	Code of practice for preparation of butt-welding ends for pipes, valves, flanges and fittings.
IS : 12251	Code of practice for drainage of building basements.
IS : 5572	Code of practice for sanitary pipe work.
BS : 8301	Code of practice for building drainage.
BSEN : 274	Sanitary tap were, waste fittings for basins, bidets and baths.

TECHNICAL SPECIFICATION FOR ROADS

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 Construction 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 soil not exceeding of 150mm in thick which in the opinion of the Construction Committee are unsuitable for incorporation of the works from the area 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 Construction 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 (in 2 layers and each layer of 100 m) Wet mix macadam (WMM) confirming to clause-406 of MORTH specification.

   (c) 200 mm trimix of M-35 grade concrete on metal width will be provided on all the roads as per MORTH specifications

4. The side slops should be 2 Horizontal:1 vertical and camber complete will be 2.5% minimum.
5. No earth to be lifted from the 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. Field density will not be less than 97% of dry density determined in lab.
8. Nothing extra will be paid for any unforeseen circumstances regarding land compensation of earth 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 Construction 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. The material and general requirements of earth work in embankment for construction.
    a. Physical requirements shall be as per MORTH clauses no.305.2.1.1 to 305.2.1.5.
    b. Compaction requirement of embankment & sub grade shall be as per table 300.2
    c. Spreading of material in layers, bringing to appropriate moisture contents and compaction shall 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 Construction Committee. Similar written permission from the Construction Committee shall be obtained in respect of all other item of work prior to proceeding with the next stage of construction.
13. Wherever in the description of the item in the bill of the quantities the specification clause No. 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 Construction 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 line etc. 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 Construction 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 Construction 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) Pre Mix carpet: - one test per 50 meter cube and not less than two tests per day.
22. At the time of start of work, the contractor shall get a sample work done in presence of the Construction 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 Construction 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 the site, of work and shall fully acquaint/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 what so ever 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 :-** Trimix concreting will be done by some specialized agency with V.D.S. method.
    i. All W.B.M. surface will cleaned 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 Construction Committee.
29. At least one authorized representative of the contractor should always be available at site of work to take instructions from departmental officers and ensure proper execution of work is done in the absence of the contractor. Separate site order books will be maintained at plant and 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 Construction Committee shall check the contractor's work and notify the contractor any defects that are found. Such checking shall not relieve the contractor/contractors responsibility/responsibilities. The Construction Committee may instruct the contractor to search for defect and to uncover and test any work that the Construction Committee considers may have a defect.

(B) Correction of defects: -The Construction 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 Construction Committee notice. If the contractor has not corrected a defect within the time specified in the Construction Committee notice, the Construction 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, of MORT&H (Road wing) Specification (IVth revision of 2001/ latest edition.)

35. No extra payment on account of quality control measures shall be paid to the contractor.

36. The Construction 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. The riding quality of each and every reach will be strictly as per specifications.

38. Kerb & channel of M-30 concrete will be provided on one side of roads.

BOUNDARY WALL

Boundary wall of complex where dwelling units are to be constructed as per PWD specification and design / drawings / x-section approved by the Construction Committee.

TECHNICAL SPECIFICATION FOR HORTICULTURE & RAIN WATER HARVESTING

HORTICULTURE

1. The height of plant should be less than 5ft and their steam should not be less than 20mm. 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. The plant shall be healthy and disease 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 Engineer-in-Charge. Contractor shall adhere to the different operation required in normal conditions during maintenance of the work.

i) Mtc. of grassy lawn

a)	Grass cutting	Once in a week
b)	Watering	Twice in a week

The grass should be weed free

ii) Mtc. of hedges:-

Watering, hoeing, weeding and pruning	Once in 15 Days

iii) Mtc. of edges:-

Making proper edging along walk

Flower beds flowering mound etc.

iv) Mtc. of trees and shrubs: Once in a 15 Days

However depending the season and requirement the frequency of above operation may be increased as per instruction of the Construction Committee.

SPECIFICATION FOR GRASSY LAWN AND RAILING

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.

RAIN WATER HARVESTING

1. 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 Construction 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.**

SPECIFICATIONS OF LIFTS

A. GENERAL SPECIFICATIONS; -

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 Good Lifts. 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 upto date 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 workmanship than 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 The work 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 (12 inches or 30.48cms)
Sq.Ft.	-	Square Feet
Sq.Mt (M^2)	-	Square Metre.
Cu. Ft.	-	Cubic Feet.
Cum (M^3)	-	Cubic Metre.
Kg.	-	Kilograms (Equivalent to 1000 gms)
T.(M.T.)	-	Tonne (Equivalent to 1000 Kgs.)
No.	-	Numbers.
Cm.	-	Centimetre.
M or R.M.	-	Metre or Running Metre.

2.0 CONTRACTOR'S DRAWINGS :-

a) **Drawings provided to the CONTRACTOR:-** The CONTRACTOR will got approved the documents and drawings listed together with any further drawings issued under conditions of 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 Construction Committee before commencing fabrication/manufacture of the equipment. Such shop drawings shall be based on the requirements laid down in the specifications and as per site conditions. The manufacture of

equipment shall be commenced only after the shop drawings are approved in writing by the Construction 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 Work Drawings:-** The CONTRACTOR shall provide drawings showing the exact dimensions 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 Construction 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 Construction 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 Construction 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 exact scope details of the Operating Instructions shall be agreed with the Construction Committee

After approval by the Construction Committee the CONTRACTOR shall forward to the Construction 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 files on computer disk shall also be forward.

(e) **Approval of Drawings :-**

i) All drawings prepared by the CONTRACTOR shall be submitted to the Construction Committee within ten days from actual date of award of letter in phased manner agreed and approved by Construction Committee and this will be the only accepted and contractual method. The Construction 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 Construction 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 Construction Committee's instructions and no claim for extra payment shall be allowed for any reason in this respect.

iii) Should the Construction Committee instruct the alteration or amending of any drawing prepared by Contractor/Manufacturer, then the CONTRACTOR shall ensure that this is done immediately in

order to avoid any delay to the construction programme and no claim for extra payment or 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 Construction Committee's order to commence the works. The programme, which will be subject to the scrutiny of the Construction 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) Dates on which the CONTRACTOR shall commence the drawings/ materials/ deployment of skilled and unskilled worker.

b) Dates on which the CONTRACTOR shall submit the drawings / materials/ deployment of skilled and unskilled worker to the Construction Committee.

c) Reasonable period for the Construction Committee to check and approve the submitted schedule of drawings / materials/ deployment of skilled and unskilled worker.

d) Date of commencement of the relevant as appropriate in their proper sequence.

e) All trades and / or elements as appropriate in their proper sequence.

f) Key approval dates for long delivery items.

g) Any other information the Construction Committee may request.

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 Construction Committee

The detailed programme shall reflect the requirements for production of information to permit timely co-ordination with all trades and other agencies working at site.

NOTE :- The CONTRACTOR'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 addition to 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 number etc.

vi) All drawings by the CONTRACTOR shall be orientated to match the design drawings and shall have 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) The CONTRACTOR shall submit to the Construction Committee a disk copy and two prints of each 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, four prints and one reproducible copy of the approved drawing or document to the Construction 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 Construction 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 an even 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 working drawings 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 Construction 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 Construction 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 QUALITY OF MATERIALS & GENERAL STANDARDS OF WORK :-

The CONTRACTOR under this contract commits himself to use first class materials and assumes full responsibility for the quality of all materials 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 Construction Committee.

5.0 BAR CHART FOR EXECUTION OF WORK :-

The Contractor shall submit within one week of the acceptance of the tender, a BAR Chart to Construction 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 Construction 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 Construction Committee.

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

6.0 CIVIL WORKS TO BE DONE BY LIFTS CONTRACTOR: -

Contractor shall provide /carry out the following at his own cost.

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) A suitable vertical iron ladder for access to the pit.

7.0 WORK NOT INCLUDED IN LIFTS CONTRACT

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 OBTAINING CLEARANCES/CERTIFICATES FROM AUTHORITIES

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 Construction Committee, on completion of the works, the final inspection and approval from the concerned Authorities including Registration certificate and NOC from Chief lift inspector for operation at his own cost for which the Society will 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. The Contractor shall defend and keep Construction Committee harmless from loss,

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

9.0 FEES/CHARGES/DEPOSITS TO BE PAID TO AUTHORITIES

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 Construction Committee on submission of documentary evidence by the Contractor.

10.0 PROJECT EXECUTION AND MANAGEMENT

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 be replaced 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 occurs due to work performed by others. Responsibility entails daily inspection by the supervisor / 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 date of acceptance of the elevator system. Call back service shall 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 with in 2 Hours and service involving more than one stalled or erratic elevator shall be immediately provided regardless of the time of day or night. Emergency call back service for trapped passengers 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 the elevator system in a professional, first class 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 reasonable number of spare parts, at his own cost, on site in a self 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/ POWDER COATING

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 mineral sprits, wire brushed and spot painted over the affected areas, then coated with enamel paint/powder coated to match the finish over the adjoining shop painted surface.

13.0 IMPORT LICENSE

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 Construction Committee for any deviation if required by manufacturer.

15.0 STRUCTURAL REQUIREMENTS

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 supply and installation in the hoistway shall be the responsibility of the contractor.

B. PARTICULAR SPECIFICATIONS

1.0 GENERAL: -

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

2.0 SIZE & SPEED: -

2.1 Two Passenger Lifts shall be for 8 Persons (544 Kg) and two Passenger Lifts shall be for 10 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 Machine Speed shall be 1.5 MPS for all passenger lifts and 1.0 MPS for all hospital and freight lift.

3.0 TRAVEL: -

3.1 The travel of lifts shall be as mentioned in schedule of requirement.

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 International Standards 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 : 8 Passengers (544 Kg)

(b) Car Entrance : 800 x 2100 mm.

Passenger Lift

(a) Lift Capacity : 10 Passengers (680 Kg)

(b) Car Entrance : 900 x 2100 mm.

Hospital Lift

(a) Lift Capacity : 15 Passengers (1020 Kg)

(b) Car Entrance : 1000 x 2100 mm

Freightl Lift

(a) Lift Capacity : 20 Passengers (1360 Kg)

(b) Car Entrance : 1200 x 2100 mm

3.3 Shafts Sizes :

The clear finished available hoist way size shall be as per schedule of requirement.

4.0 DRIVING MECHANISM: -

The lift shall be provided with A.C, variable voltage, variable frequency, microprocessor controlled motion and drive control system. The tenderer shall 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 car cannot be started unless the car door is in the closed position and all hoist way doors for that car are locked in the closed position.

5.3 All the lifts shall be provided with fireman switch and all requirements of CFO.

5.4 All the lifts should follow standard codes of safety and services.

6.0 OPERATION WITH ATTENDANT: -

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 registration either car or landing calls to indicate the travel direction of the car. The attendant shall operate the lift normally in the direction indicated by the direction -jewel. Travel may be realised by the pressure of a car button for a landing in that 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 only from its car button and shall be entirely independent of the other car. The other car shall 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 Planned heavy duty steel tee-sections as specified in IS - 1173 shall be provided as car and counter-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 ore weights in structural steel frame. Counter weight shall be equal to the weight of the car plus 40% of the contract load.

10.2 A metal wire mesh counter-weight guard at the bottom of the hoist way.

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 Governor ropes shall be of multi-strand steel wire.

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 HOIST WAY ENTRANCE: -

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 Each hoist way door shall be equipped with a hoist way door interlock by a cam on the car.

13.0 DOOR OPERATOR: -

13.1 Door operator shall be positive acting and powered by an A.C. motor rigidly connected to the door and controlled by a VVVF unit. Operator shall simultaneously open the car and hoist 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 be checked 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 the safety devices operate or 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 feedback from 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 $\pm$ 2 mm.

14.6 The acceleration and deceleration shall be adjustable at site using a service tool.

14.7 A reverse phase relay shall be provided on the controller which shall be designed to protect the lift equipment against phase reversal and phase failure.

15.0 HALL POSITION INDICATOR: -

Digital car position indicators in Halls and luminous hall buttons 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 Hospital lifts.

16.3 A flush type Stainless Steel "car operating panel" with the following devices shall be fitted in all the cars:

a) Bank of call buttons corresponding to landings served. Button illumination to be by LED’s and not incandescent bulbs.

b) Alarm button.

c) Fan /Blower switch.

d) Open door button.

e) Close door button.

f) "Up" & "Down" direction indicators.

g) Key operated switch for "Attendant" and "Automatic" operation.

h) A non-stop button.

i) Fire mains switch shall by-pass all landing calls and lift will travel to ground floor in case of fire.

j) A stop switch to stop the car at some particular floor.

k) Provision in car to be connected with P.A. System / Machine Room & Fire Control Room or BMS Control Room.

l) Overload panel along with audio /visual indication.

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 A scrolling digital car position indicator with LED/LCD illumination shall be provided in each passenger car indicating the landing at which the car is stopped or passing.

16.5 Car entrance shall be protected by stainless steel doors of the same size as landing doors for 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 CAR SAFETY AND GOVERNOR: -

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 Door Hangers & 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 CAR SAFETY: -

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 operation and 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 MICRO SELF-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 FIRE PROTECTION: -

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 top of lift well to allow any accumulation of smoke there in to escape to the open air. 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 ELECTRICAL EQUIPMENT AND WIRING: -

24.1 **Scope:**

The scope of this section comprises supply, installation and wiring of all electrical equipment including control wiring. Power supply at 415 V, 3 phase, 50 Hz, 4 wire with double earthing will 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.

Lift machine room ventilation requirement shall be specified by the Contractor.

24.2 **Wiring:**

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 Construction Committee before delivery.

All control wiring shall be of copper.

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

Travelling cables shall be of flat type with flame & moisture resistant properties for the service and shall originate at machine room and at steel junction boxes on the car, hung so that the proper size 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.

Earthing of all equipment is in the scope of the contractor.

SCHEDULE OF REQUIREMENT

1.0 PASSENGER LIFT

1.	Capacity / Weight	:	8 persons (544 kg)/10 Persons (680 Kg)
2.	Quantity	:	As per requirement.
3.	Speed	:	1.5 MPS
4.	Type of Drive	:	ACV3F
5.	Location of Machine Room	:	ABOVE
6.	Travel	:	As per approved drawings.
7.	Serving	:	As per approved drawings.
8.	Floors	:	As per approved drawings.
9.	Well Size	:	As per approved drawings.
10.	Car Size (Approx.)	:	800 mm WIDE x 800 mm DEEP x 2300 mm HIGH/900 mm WIDE x 900 mm DEEP x 2300 mm HIGH. Deviations, if any, shall be mentioned by bidder and shall not be less than as specified by Bureau of Indian Standards.
11.	Car Enclosure	:	Stainless Steel Panel SS 304 grade in hair line finish.
12.	Flooring	:	25 mm thick granite stone as approved by the Client. (Matt finish).
13.	Electric Light	:	Compact fluorescent lights to maintain 50LUX illumination.

14.	Fan	:	300 mm sweep twin blower silent fan.
15.	No. of Car Entrance	:	One location front - Centered
16.	Entrance Door	:	Centre opening power operated doors in Stainless Steel SS 304 grade hairline finish – Design as/arch Approval with $^1/_2$ Hour fire resistant.
17..	Hoist way door		Stainless Steel SS 304 grade hairline finish
18	Clear Entrance	:	800/900 mm WIDE x 2100 mm HIGH
19.	Operation	:	Automatic
20.	Control	:	Alternate floor Collective duplex Controller (with Lift P2) with 32 bit micro processor with or without Attendant. (Staggered starting when generator switches on).
21.	Indicator (Car & Landing) & Features	:	▪ Digital direction and position. ▪ Signal Fixture in finish – As/Arch. Approval ▪ Inverter based unit recessed emergency light in to the car ceiling ▪ System capable of withstanding +10% to -10% supply voltage fluctuation. ▪ Fireman switch. ▪ VF door operator. ▪ Inverter based emergency alarm linked to technical alarm panel. ▪ Hall Lantern & Gong – As/Arch. Approval ▪ Inverter based, press & speak intercom and programmable hands free emergency telephone panel connected to reception /hotline phone. ▪ Self levelling accuracy of +/- 2 mm. ▪ Full Ht. car operating panel with space for lift inspector's certificates. ▪ Load weighing device with overload indicator (warning light and sound) ▪ Car door - Frequency variation operator, heavy traffic obstacle detector using photo electric cell curtains. ▪ Adjustable guide shoes and guides in profiled steel. ▪ 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. ▪ Lift car with control device working with key in emergency. ▪ 2 Hour fire resisting Lift landing door linked to fire safety system. ▪ Folding steel ladder on car top for car escape.
22.	PIT Depth	:	1600 mm

2.0 HOSPITAL/FREIGHT ELEVATOR

1.	Capacity / Weight	:	15 Persons (1020 Kg)/20 Persons (1360 kg)
2.	Quantity	:	As per requirement
3.	Speed	:	1.0 MPS
4.	Type of Drive		ACV3F
5.	Location of Machine Room	:	ABOVE
6.	Travel	:	As per approved drawings.
7.	Serving	:	As per approved drawings.
8.	Floors	:	As per approved drawings.
9.	Well Size	:	As per approved drawings.
10.	Car Size (Approx.)	:	1000 mm WIDE x 2400 mm DEEP x 2300 mm HIGH/1200 mm WIDE x 2400 mm DEEP x 2300 mm HIGH Deviations, if any, shall be mentioned by bidder and shall not be less than as specified by Bureau of Indian

			Standards.
11.	Car Enclosure	:	Stainless Steel Panel SS 304 grade in hair line finish.
12.	Flooring	:	25 mm thick granite stone as approved by the Client. (Matt finish).
13.	Electric Light	:	Compact fluorescent lights to maintain 50LUX illumination.
14.	Fan	:	300 mm sweep twin blower silent fan.
15.	No. of Car Entrance	:	One location front - Centered
16.	Entrance Door	:	Centre opening power operated doors in Stainless Steel SS 304 grade hairline finish – Design as/arch Approval with $^1/_2$ Hour fire resistant.
17..	Hoist way door		Stainless Steel SS 304 grade hairline finish
18	Clear Entrance	:	1000/1200 mm WIDE x 2100 mm HIGH
19.	Operation	:	Automatic
20.	Control	:	Full Collective Simplex Controller with 32 bit micro processor with or without Attendant. (Staggered starting when generator switches on).
21.	Indicator (Car & Landing) & Features	:	▪ Digital direction and position. ▪ Signal Fixture in finish – As/Arch. Approval ▪ Inverter based unit recessed emergency light in to the car ceiling ▪ System capable of withstanding +10% to -10% supply voltage fluctuation. ▪ Fireman switch. ▪ VF door operator. ▪ Inverter based emergency alarm linked to technical alarm panel. ▪ Hall Lantern & Gong – As/Arch. Approval ▪ Inverter based, press & speak intercom and programmable hands free emergency telephone panel connected to reception /hotline phone. ▪ Self levelling accuracy of +/- 2 mm. ▪ Full Ht. car operating panel with space for lift inspector's certificates. ▪ Load weighing device with overload indicator (warning light and sound) ▪ Car door - Frequency variation operator, heavy traffic obstacle detector using photo electric cell curtains. ▪ Adjustable guide shoes and guides in profiled steel. ▪ 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. ▪ Lift car with control device working with key in emergency. ▪ 2 Hour fire resisting Lift landing door linked to fire safety system. ▪ Folding steel ladder on car top for car escape.
22.	PIT Depth	:	1600 mm

TECHNICAL SPECIFICATION FOR INTERNAL ELECTRICAL WORKS

1.0 WIRING

1.1 GENERAL

Technical Specifications in this section cover the Internal Wiring Installations comprising of:

- Wiring for lights and convenience socket outlets etc. in concealed/surface conduit/raceways.
- Wiring for telephone outlets.
- Wiring for fire detection system
- Submain wiring.

1.2 STANDARDS AND CODES

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 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.

660/1100 V grade PVC insulated wires.	IS 694 : 1990
Rigid steel conduits for electrical wiring.	IS 9537 : Part I 1980
	IS 9537 : Part II 1981
Accessories for rigid steel conduits	IS 3837 : 1990
Flexible steel conduits for electrical wiring	IS 3480 : 1990
Rigid PVC conduits	IS 9537 : Part-III
Switch socket outlets	IS 4615 : 1990
Switches for domestic and similar purposes	IS 3854 : 1997
Boxes for the enclosure of electrical accessories	IS 5133 : Parts I &II 1969
Code of practice for personal hazard	IS 1644: 1998
fire safety of buildings	
Code of practice for electrical installation	IS 1646 : 1997
fire safety of buildings	
Code of practice for electrical wiring installations	IS 732 : 1989

CONDUITS/ RACEWAYS

1.3.1 **Steel Conduits**

These shall be of mild steel 16 gauge upto 32mm and 14 gauge for sizes above 32mm, electric resistance welded (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 manufactured form. Wherever so specified, the conduit shall be galvanized. All conduits used in this work shall be ISI embossed.

1.3.2 **PVC Conduits**

Conduits shall be heavy gauge rigid PVC of minimum thickness of 2mm**.** Conduits shall be ISI marked confirming to IS : 9537 (Part-3)-1983. All conduit and conduit accessories shall be of PVC**.** Conduits shall be joined together by a vinyle type cement / solvents**.** Minimum size of conduit shall be 25mm. Conduit shall be fixed on ceiling or wall**.** All conduits shall be concealed in wall ceiling etc. or fixed on surface of wall with clamps at regular interval as called for elsewhere. For termination of PVC conduits into switch outlet boxes, PVC female adopters shall be used. Wherever conduit run exceeds 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 Construction Committee**.** Conduits shall be bend using suitable size springs. Long radius bends shall be provided. Heating shall not be used to bend the conduits**.** Size of conduit shall depend upon number and size of wires to be drawn.

1.3.3 **Steel Conduit Connections**

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 shall be 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 **Conduit Accessories.**

1.3.5.1 **Standard accessories**

Heavy duty black enamel painted standard conduit fittings and accessories like standard/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 Construction Committee before use.

1.3.5.2 **Fabricated accessories**

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 the 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 **Outlet Boxes For Light Fittings**

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 **Outlet Boxes For Ceiling**

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 securely tied to the top reinforcement of the concrete slab for a length of minimum 150 mm on either side. 3 mm thick Perspex/hylam sheet cover of matching colour shall be provided.

1.3.5.3 **Boxes For Modular Wiring Accessories**

1.3.5.3.1 **Switch Boxes - 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 /are to be provided at a later dated, 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 **Modular Type Boxes For Socket/ Telephone/Call Bell Outlets**

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 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. These 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 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 **Cross Section**

The conduits shall be of ample sectional area to facilitate simultaneous drawing of wires and permit 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.

Maximum no of PVC insulated 660/1100 V grade aluminium/copper

Conductor cable conforming to IS : 694 – 1990

Normal Cross Sectional area of conductor in sq. mm	20 mm		25 mm		32 mm		38 mm		51 mm		64 mm	
	S	B	S	B	S	B	S	B	S	B	S	B
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

Note :

1. The above table shows the maximum capacity of conduits for a simultaneous drawing in of 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. Conduits sizes are the nominal external diameters.

1.4 WIRES

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 COAXIAL CABLES

The coaxial cables shall be of wideband type with operation up to 300 MHz capability. Aging resistance shall comply with DIM 472.52 part 2 e.i. maximum 5% increase in attenuation at 200

MHz measured by artificial aging (14 days at 80°C) cables shall meet all exceed following specifications

Center core Dia	0.8 mm
Diaelectric Dia	4.8 mm
Dielectric	PE
Outer Conductor Dia	5.4 mm
Outer Dia	7.0 mm
Bending radius	more than 30 mm
Impedance	75 ohms
D.C Resistance	50 ohms/KM
Screening factor	more than 50
Attenuation	
50 Mhz	6.5
100 Mhz	9
200 Mhz	13
300 Mhz	16

1.6 LAYING OF CONDUITS

- Conduits shall be laid either recessed in walls and ceilings or on surface on walls and ceilings or partly recessed and partly on surface, as required.
- Same rate shall apply for recessed and surface conduiting in this contract.
- Stranded copper conductor insulated wire of size as per schedule of quantities shall be provided in entire conduiting for loop earthing.
- GI wire of suitable size to serve as a fish wire shall be left in all conduit runs to facilitate drawing of wires after completion of conduiting.

1.6.1 Recessed Conduiting

Conduits recessed in concrete members shall be laid before casting, in the upper portion of slabs or 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 chases shall be of sufficient width to accommodate the required number of conduits and of sufficient depth to permit full thickness of plaster over conduits. The conduits shall be secured in the chase

by means of heavy duty pressed steel clamps screwed to MS flat strip saddles at intervals of maximum one metre. The chases shall then be filled with cement and coarse sand mortar (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 before casting 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 than 25 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 Construction 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 **Surface Conduiting**

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 surface conduiting work is of particular importance. The entire conduit work shall be in absolute line and plumb.

1.6.3 **Fixing of conduit fittings and accessories**

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

Loop earthing wire shall be connected to a screwed earth stead inside outlet boxes to make an effective contact with the metal body.

1.6.4 **Painting and Colour coding of conduits**

Before laying, conduits shall be painted specially at such places where paint has 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	**Code colour**
Low Voltage	Grey
Fire alarm	Red
Telephone	Black

PA system	Brown
Earthing system	Green
Control system lighting	Purple

1.6.5 **Protection of Conduits**

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 **Cleaning of Conduit Runs**

The entire conduit system including outlets and boxes shall be thoroughly cleaned after completion of erection and before drawing in of cables.

1.6.7 **Protection Against Dampness**

All outlets in conduit system shall be properly drain and ventilated to minimize chances of condensation/sweating.

1.6.8 **Expansion Joints**

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 **Loop Earthing**

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 LAYING AND DRAWING OF WIRES

1.7.1 **Bunching of Wires**

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 **Drawing of Wires**

The drawing of wires shall be done with due regard to the following precautions:-

- No wire shall be drawn into any conduit, until all work 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 insulated wires into the conduits, care shall be taken to avoid scratches and kinks which cause breakage of conductors.

- There shall be no sharp bends.
- 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 **Termination /Jointing of Wires**

- 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 reason shall be made by approved connectors. Specific prior permission from the Construction 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.
- Strands of wires shall not be cut for connecting terminals. All strands of wires shall be twisted round at the end before connection..
- Conductors having nominal cross sectional area exceeding 4 sq. mm shall always be provided with crimping sockets.
- At all bolted terminals, brass flat washer of large area and approved steel spring washers shall be used.
- Brass nuts and bolts shall be used for all connections.
- The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less.
- Switches controlling lights, fans, socket outlets etc. shall be connected to the phase wire of circuits only.
- Only certified valid license holder wiremen shall be employed to do wiring / jointing work.

1.7.4 **Load Balancing**

Balancing of circuits in three phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

1.7.5 **Colour Code of Conductors**

Colour code shall be maintained for the entire wiring installation - red, yellow, blue for three phases, black for neutral and green for earth.

2 **Wiring**

All the wiring installation shall be as per IS: 694/IS:732 with latest amendment. FRLS PVC insulated copper conductor cables as specified in bill of 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 Construction Committee. No reduction of strands are permitted at terminations. No wire smaller

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 required regular 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 distinct sources of supply or from different distribution boards or through switches or MCBs shall not 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 Luminaries/Fans

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/CFL Lamp Luminaries

Luminarie shall be supplied as per the design approved by the Construction 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 dust proof cover stove enameled to white shade shall be provided to form the channel 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 provided with an earthing terminal for bonding the body of the luminarie to earth. Luminaries shall be installed as specified on the drawings. Wherever luminaries are fixed on the false ceiling, suitable supporting and fixing arrangements independent of the frame work of false 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.

Luminaries shall be suspended true to alignment, plumb and level and capable of resisting all lateral 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.

Incandescent Lamp Luminaries

Incandescent lamp luminaries shall be supplied as per the design and type mentioned approved by the Construction Committee. Incandescent lamp luminaries shall be provided with lamp holders suitable for lamps with standard bayonet cap upto 200 watts. Incandescent lamp luminaries shall

be complete with reflector shade, decorative attachment (if any) and cover as specified and required. Incandescent lamps shall conform in all respects to BS:161.

Fans (Ceiling Fans)

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 be provided with bottom cover and top canopy. Electronic stepless regulators shall be provided, with every fan. Ceiling fans shall be suspended from the special hooks or special fan hook boxes. 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

Propeller type exhaust fan shall conform to IS:2312 (latest edition)in all respects. The motor shall be of die-cast 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 arms and a resilient suspension. The motor and blades shall be of mild steel 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 MEDIUM VOLTAGE DISTRIBUTION BOARDS

GENERAL

This section covers specification of DBs.

STANDARDS AND CODES

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 listed below.

Miniature Air Circuit Breakers for AC circuits	IS 8828 : 1978
Degrees of Protection provided by enclosures	IS 2147 : 1962
for low voltage switchgear	
Code of Practice for installation and maintenance	IS 10118 : 1982
of switchgear not exceeding 1000 volts	
General requirements for switchgear and controlgear	IS 4237 : 1982
for voltages not exceeding 1000 volts	

MINIATURE CIRCUIT BREAKERS

- The MCB's shall be of the completely moulded design suitable for operation at 240/415 Volts 50 Hz system.
- The MCB's shall have a rupturing capacity of 10 KA at 0.5 p.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.
- Type test certificates from independent authorities shall be submitted with the tender.

FINAL DISTRIBUTION BOARDS

- 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 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 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.
- 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.

SHEET STEEL TREATMENT AND PAINTING

- 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.

NAME PLATES AND 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.

ROUTINE AND COMPLETION TESTS

INSTALLATION COMPLETION TESTS

At the completion of the work, the entire installation shall be subject to the following tests:

1. Wiring continuity test
2. Insulation resistance test
3. Earth continuity test
4. Earth resistivity test

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.

Wiring Continuity Test

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

Insulation Resistance Test

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 direct or 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.

Testing of Earth Continuity Path

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.

Testing of Polarity of Non-Linked Single Pole Switches

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 switch is fitted to one of the outer or phase conductor of the supply. The entire electrical installation shall be subject to the final acceptance of the Construction Committee as well as the local authorities.

Earth Resistivity Test

Earth resistivity test shall be carried out in accordance with IS Code of Practice for earthing IS 3043.

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.

Tests and Test Reports

The Contractor shall furnish test reports and preliminary drawings for the equipment to the Construction 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 MEDIUM VOLTAGE CABLES

GENERAL

Technical specifications in this section covers supplying and laying of :

- Medium voltage cables.

STANDARDS AND CODES

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	IS 1554 - 1988
Cross link polyethylene insulated PVC	IS 7098 - 1985

(sheathed XLPE cables)

Code of practice for installation and maintenance of power cables	IS 1255 - 1983
Conductors for insulated electrical cables	IS 8130 - 1984
Drums for electrical cable	IS 10418 - 1982
Methods of test for cables	IS 10810 - 1988
Recommended current rating	IS 3961 - 1987
Recommended short circuit rating of high voltage PVC cables	IS 5891 - 1970

CABLES

Medium Voltage Cables

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's name and trade mark at every metre length. Cores shall be provided with following colour scheme of PVC insulation.

1 Core	:	Red/Black/Yellow/Blue
2 Core	:	Red and Black
3 Core	:	Red, Yellow and Blue
3 1/2 /4 Core	:	Red, Yellow, Blue and Black

Current ratings shall be based on the following conditions.

a)	Maximum conductor temperature	70° C
b)	Ambient air temperature	45° C
c)	Ground temperature	30° C
d)	Depth of laying	1000 mm

Short circuit rating of cables shall be as specified in IS 7098.

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, Storage and 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 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 wheels and pulled by ropes or they shall be mounted on trailers etc. drums shall be unloaded preferably by crane otherwise they shall be rolled down carefully on suitable ramps. While transferring cable form 1 drum to another, the barrel of the new drum shall have diameter not less than the original drum. Cables with kinks or similar visible defects like defective armouring etc shall be rejected. Cables shall be supplied at site in cut pieces as per actual requirements.

LAYING OF CABLES

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.

In Masonry Trenches

Wherever so specified, cables shall be laid in indoor/outdoor masonry/RCC trenches to be provided 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**.**

Type of cables	Size	Clamping by	Fixing intervals
MV	Upto and including 25 sq mm	Saddles 1 mm thick	45 cm
MV & HV	35 sq mm to 120 sq mm	Clamps 3 mm thick 25 mm wide	60 cm
MV & HV	150 sq mm and above	Clamps 3 mm thick 40 mm wide	60 cm

Note : The fixing intervals specified apply to straight runs. 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 Construction 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 Construction 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 tiers shown in tray layout drawings. Spacing between horizontal supports arms of vertical tray runs to be 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 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 by red oxide followed by the same finishing paint. Steel sheet covers wherever indicated to be similarly painted. Trays shall be erected 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 run of cable tray shall be completed before laying of cables. Cable trays shall be erected so as to be exposed and accessible.

Buried Directly In Ground

General

Cables shall be so laid that they will not interfere with underground structures. All water pipes, sewage lines or other structures which become exposed by excavation shall be properly supported 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 Construction 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 Construction Committee.

Routing of cables

Before cable laying work is undertaken, the route of the cables shall be decided with the Construction 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 than HV 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.

Width of Trench

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 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.

Depth of Trench

The depth of trench shall be determined on the following basis:

- 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.

Excavation of Trenches

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 Construction Committee. Existing property exposed during trenching shall be temporarily supported or propped adequately as directed by the Construction 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 Construction 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.

Laying of Cable In Trench

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 creeping to one side while rotating. The cable shall be pulled 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 cable shall be lifted slightly over the rollers beginning from one end by helpers standing 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 Construction 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 100 mm (normal size) laid breadth wise for the full length of the cable to the satisfaction of the Construction 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 be rammed and watered in successive layers not exceeding 300 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 berms or lawns have been

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

Laying In Pipes/Closed Ducts

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 under roads, pavements etc. The pipes for road crossings shall preferably be on the skew to reduce the angle of bend as the cable enters and leaves the crossing. Pipes shall be continuous and clear of 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 used for cables passing through RCC Hume pipes or for parts of vertical cables at the lighting poles.

Laying of Cables In 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 Construction Committee shall be obtained and the Contractor shall cut chases, lay the cables and make good the chases to original finish.

Cable Entry Into Buildings

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/JOINTING OF CABLES

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 shrinkable Raychem 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 for 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 Construction Committee.

MEASUREMENT OF CABLE RUNS

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.

CABLE LOOPS

At the time of the installation approximately 3 metres of surplus cable shall be left

- at each end of the cable
- on each side of underground straight through/tee/termination joints.
- at entries to buildings
- and such other places as may be decided by the Construction Committee.

This cable shall be left in the form of a loop.

Wherever long runs of cable length are installed cable loops shall be left at suitable intervals as specified by the Construction Committee.

BONDING OF CABLES.

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 the gland or casting, so that in the event of ground movement no undue stress is placed on to the cable conductors.

TESTING

Tests At Manufacturer'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):

- Routine test on each drum of cables.
- Acceptance tests on drums chosen at random for acceptance of the lot.
- Type test on each type of cables, inclusive of measurement of armour DC resistance of power cables.

Site Testing

- All cables before laying shall be tested with a 500 V megger for 1.1 kV grade or with a 2500/5000 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 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.
- After laying and jointing, the cable shall 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 2500/5000 V megger for cables of higher voltages.

Test Witness

Tests shall be performed in presence of the Construction Committee. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.

MEDIUM VOLTAGE SWITCHGEAR

GENERAL

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

STANDARDS AND CODES

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 listed below.

Low Voltage switchgear & controlgear		IS 13947 : 1993
Part I	:	General rules
Part II	:	Circuit Breakers
Part III	:	Switches, disconnectors, switch disconnectors and fuse combination units
Part IV	:	Contactors and Motor starters
Part V	:	Control circuit devices and switching elements
Marking of Switchgear busbars		IS 11353 : 1985
Degree of Protection of Enclosures for low voltage switchgear.		IS 2147 : 1962
Electrical relays for power system protection		IS 3231 : 1986
Code of Practice for selection, installation and Maintenance of switchgear & controlgear		IS 10118 : 1982
Low voltage switchgear & controlgear assemblies		IS 8623 : 1993

SWITCHGEAR

Medium Voltage Air Circuit Breakers

Technical Parameters

- 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 25 MVA at 415 Volts or as per schedule of quantities.

Constructional Features

- 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.

Operating Mechanism

- 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.
- The operating handle and mechanical trip push button shall be at 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" -- Both main and secondary isolating contacts closed

  "Test" -- Main isolating contacts open and secondary isolating contacts closed

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

  "Maintenance" -- Circuit Breaker fully outside the panel ready for maintenance

Circuit Breaker Interlocking

- Sequence type strain free interlocks shall be provided to ensure the following:
- 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.
- It shall not be possible for the Circuit Breaker to be plugged in unless it is in the OFF position.
- A safety catch shall be provided to ensure that the movement of the Breaker, as it is withdrawn, is checked before it is completely out of the cubicle, thus preventing its accidental fall due its weight.

- Mechanical and electrical antipumping devices shall be incorporated in the ACB's as required.

Circuit Breaker Auxiliary Contacts

The Circuit Breaker shall have minimum 6 N.O. and 6 N.C. auxiliary contacts rated at 16 amps 415 volts 50 Hz. These contacts shall be approachable from the front. They shall close before the main contacts when the Circuit Breaker is plugged in and vice versa when the Circuit Breaker is Drawn Out of the cubicle.

Protective Devices

- The Circuit Breaker shall have protective devices as specified in the drawing and approved by the Construction 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 characteristics and the magnetic 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.
- Over voltage relay.
- Under/no voltage trip coil or Relay as required.
- Over current and earth fault IDMT relays with shunt/series trip coil operation as specified.
- The Circuit Breakers shall be suitable to accommodate one or more types of protection as specified.

Instrument Transformers

The Circuit Breaker shall have the required Current Transformers as specified 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 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 Construction 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.

Indicating Lamps

LED type indicating lamps shall be provided for indication of phases and Breaker position as required.

Control Wiring

All wiring for relays and meters shall be of copper conductor PVC insulated and shall be colour coded and labelled with 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.

Type Test Certificates

The Contractor shall submit type test certificates from a recognised test house for the Circuit Breakers offered.

Switch Fuse Units

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 housing shall be of robust construction designed to with stand 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.

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 not open unless the switch is 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.

Moulded Case Circuit Breakers

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 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 :

- Under voltage trip
- Shunt trip
- Alarm switch
- Auxiliary switch

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

- Handle interlock to prevent unnecessary manipulations of the breaker.
- Door interlock to prevent door being opened when the breaker is in ON position
- De interlocking device to open the door even if the breaker is in ON position.

MCCBs shall have rupturing capacity as specified in drawings.

All MCCB shall be provided with adapter terminal for facilitates higher sizes of cable/ links

Metering, Instrumentation And Protection.

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

Current Transformers

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 primary current, rated burden and class of accuracy as specified drawings. Rated secondary current shall be 5A unless otherwise stated. Minimum acceptable class for measurement shall be class 0.5 to 1 and for protection class 10. 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 :

- Name and make
- Serial number
- Transformation ratio
- Rated burden
- Rated voltage
- Accuracy class

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 in a neat manner.

Potential Transformer

PTs shall confirm to IS 3156 (Part-I, II and III) in all respects.

Measuring Instruments

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°C. Meters shall be flush mounting and shall be enclosed in dust tight housing. The housing shall be of steel or phenolic 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.

Ammeters shall be capable of carrying substantial over loads 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.

Watt meter

Wattmeter shall be of 3 phase Digital type and shall be provided with a maximum demand indicator if required.

Power factor meters

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.

Energy and reactive power meters

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 to

make or break the normal circuit current with which they are associated. 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 Construction Committee for approval.

Over current relays

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 50 to 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.

Earth fault relay

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

Under voltage relay

Under voltage relays shall be of induction type and shall have inverse limit operation characteristics with pickup voltage range of 50 to 90% of the rated voltage.

Power Factor Correction Capacitors

Power factor correction capacitors shall conform to IS 2834 in all respects. Approval of insurance association of India shall be obtain if called for. Capacitors shall be suitable for 3 phase 415 volts 50 Hz supply and shall be available in single and three phase units of 5,10,15,20,25 and 50 kVAR 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 hours cycle.
- Current overloads shall be 15 % for continuous operations and 50% for six hours in a 24 hours cycle.
- Over load of 30% continuously and 45% for six hours in a 24 hours cycle.

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.

MEDIUM VOLTAGE SWITCH BOARDS

General

- All medium voltage switchboards shall be suitable for operation at three phase/three phase 4 wire, 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.

Switch Board Configuration

- The Switch Board shall be configured with Air Circuit Breakers, MCCB's, and other equipment as drawings approved by the Construction Committee.
- The MCCB's shall be arranged in multi-tier formation whereas the Air Circuit Breakers shall be 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.

Equipment Specifications

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.

Constructional Features

- 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 proof to 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.
  Panel mounted lock to be proved on each compartment.

Switchboard Dimensional Limitations

- A base channel 75mm x 40mm x 5mm shall be provided at the bottom.
- 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 2300 mm
- The height of the operating handle, push buttons etc shall be restricted between 300 mm and 2000 mm from finished floor level.

Switch Board Compartmentalisation

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.
- Each circuit breaker, and MCCB shall be housed in separate 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 for accommodating instruments, indicating lamps, control contactors and control fuses etc. These shall 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.
- Adequate and proper support shall be provided in cable compartments to support cables.

Switch Board Bus 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. .
- The bus bars and interconnections shall be insulated with insulation tape/ fibre glass.
- The bus bars shall be extensible on either side of the Switch 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.
- All bus bars shall be colour coded.
- All bus bar connections in Switch 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.

Switch Board Interconnections

- 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 copper conductor wires of adequate size to carry full load current shall be used. The terminations of all such interconnections shall be crimped.

Drawout Features

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 for operation 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.

Instrument Accommodation

- 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.
- For MCCB's instruments and indicating lamps can be provided on the compartment doors.
- 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.

Cable Terminations

- Knockout holes of appropriate size and number shall be provided in the Switch Board in conformity 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.

Space Heaters

The Switch Board shall have in each panel thermostatically controlled space heaters with a controlling 15 amp 230 volt switch socket outlet to eliminate condensation.

Earthing

A main earth bar of G.I./copper as required shall be provided throughout the full length of the Switch Board with a provision to make connections to the sub-station earths on both sides.

Sheet Steel Treatment And Painting

- 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 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 not be less than 50 microns.

Name Plates And 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.

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 in front of and along the full length of the Switch Board. The width of the matting shall be 1000mm. The rubber mat shall withstand 15 KV for 1 minute and leakage current shall not exceed 160 mA/sq. metre.

After installation the Switch Board shall be tested as required prior to commissioning.

Testing & Commissioning at site by third party

a) Alignment of panel, interconnection of Bus bars and tightness of bolts and connection.

b) Inter panel wiring

c) Free movement of ACB/MCCB/SFU

d) Operation of breakers

e) Insulation Tests

f) Primary & secondary injection tests of relays.

g) Interlocking function.

CABLE TRAYS

Cable trays, of sizes as per drawings approved by the Construction 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 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 electrical contractor. Tray mounting structures shall be welded to plate inserts or to structural beams as approved by the Construction 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 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 tiers shown in tray layout drawings. Spacing between horizontal supports arms of vertical tray runs to be 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 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 by red oxide followed by the same finishing paint. Steel sheet covers wherever indicated to be similarly painted. Trays shall be erected 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 run of cable tray shall be completed before laying of cables. Cable trays shall be erected so as to be exposed and accessible.

MEDIUM VOLTAGE DISTRIBUTION BOARDS

GENERAL

This section covers specification of DBs.

STANDARDS AND CODES

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 listed below.

Miniature Air Circuit Breakers for AC circuits	IS 8828 : 1978
Degrees of Protection provided by enclosures	IS 2147 : 1962

for low voltage switchgear

Code of Practice for installation and maintenance IS 10118 : 1982

of switchgear not exceeding 1000 volts

General requirements for switchgear and controlgear IS 4237 : 1982

for voltages not exceeding 1000 volts

MINIATURE CIRCUIT BREAKERS

- The MCB's shall be of the completely moulded design suitable for operation at 240/415 Volts 50 Hz system.
- The MCB's shall have a rupturing capacity of 10 KA at 0.5 p.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.
- Type test certificates from independent authorities shall be submitted with the tender.

FINAL DISTRIBUTION BOARDS

- 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 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 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.
- 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 Owners.
- A sample of the completed board is to be got approved by the Construction Committee before commencement of supply and erection.

SHEET STEEL TREATMENT AND PAINTING

- 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.

NAME PLATES AND 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.

ROUTINE AND COMPLETION TESTS

INSTALLATION COMPLETION TESTS

At the completion of the work, the entire installation shall be subject to the following tests:
Wiring continuity test

1. Insulation resistance test
2. Earth continuity test
3. Earth resistivity test

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.

Drawings and Documentation

The contractor shall submit the following shop drawing before start of execution.

a) List of all types of components and equipments to be used.
b) Descriptive installation, operational, maintenance and trouble shooting write-ups and manuals and design study material.
c) Preparing of shop drawings based on Contractor basic layout drawings co-ordinating with other services such as Civil/Architectural, HVAC, Plumbing, Piping and Plant System Supplier and Electrification Contractors etc. and submit to the Construction Committee for approvals prior to commencing the work.

RISING MAINS

1.0 RISING MAINS BUS TRUNKING SYSTEM

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.
Bus trunking system should conform to IEC-139 Part 1 & 2 and shall be suitable for 45 KA symmetrical fault level 415 volt 3 phase 4 wire 50 Hz supply, insulation voltage 660 volts .

1.1.2 **Busbars**

Busbars shall be made of electrical grade E-9/E aluminum busbars. The rating of busbar shall be as specified in drawing.
Maximum temperature rising of the Rising Mains Bus Trunking System shall be as per IEC standards and temperature rise shall not exceeding 50^{o}C above 40^{o}C ambient.

1.1.3 Bus bars shall be of sufficient cross section so that a current density of 0.8 A/1 A Sq mm is not exceeded at nominal current.

1.1.4 The cross section of the neutral busbar shall be the same as that of the phase busbar for busbars of capacities.

Each busbar shall be individually insulated by means of heat shrinkable PVC sleeves

1.2 BUSBARS SUPPORTS

Busbar supports/insulators shall be made of thermal resistant epoxy resin as insulation material and shall be of suitable size and spacing to withstand dynamic stresses due to short circuit currents in the system.

1.3 MOUNTINGS

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 bus trunking 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 The tap off unit shall be plug in type bolted type as required.

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 by means of a aluminium strip of adequate size bolted to each 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 BUSBARS AND SUPPORTS

1.5.1 Busbars joint shall be thoroughly cleaned and a suitable oxidizing grease shall be applied before making joints.

1.5.2 The rising mains bus trunking shall have four busbar. Busbar shall be supported every 250 mm 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 the joints.

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 Installation of rising mains bus trunking system

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 Construction Committee without any extra payment.

1.6.2 Mountings

The accessories used with the rising mains bus trunking system for tapping and distribution shall be 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 The entire installation including mounting shall be provided in such a manner that there are no chances of entry of insects into the rising mains bus trunking system.

1.6.5 Danger notice board

Danger notice board shall be provided on the rising mains bus trunking system at every floor level.

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 **Test and test reports**

Type test reports for the rising mains shall be furnished alongwith the bid and routine test according to IS-8623 Part-II shall be given with the supply. The routing rest shall comprise of :-

a) Heat run test

b) High voltage test

c) Insulation resistance test using 1.1 kV megger

d) Any other visual test as per the relevant IS at the time of inspection

e) Impedance Test

TECHANICAL SPECIFICATIONS FOR FIRE FIGHTING

The whole fire fighting system is to be designed and carried out as per National building code as amended from time to time till date.

SYSTEM TESTING

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 Construction 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.

COMMISSIONING OF THE SYSTEMS

After completion of the start-up trials, 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.

SECTION FOR SUPPLY OF EQUIPMENT

The Contractor shall be required to submit the performance certificate from the manufacturer of the equipment's procured by him. Individual item or batch certificates shall be provided as applicable.

EXTERNAL PIPING

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 shall be flanged jointed in side the trench. Pipe to pipe jointing inside the trench shall 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 at 4.5 kg/sqmts area of 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.

ANNUAL MAINTENANCE CONTRACT

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, Spares and labour required. The maintenance service shall include watch and ward of the 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.

IMPORT OF EQUIPMENT

The Contractor shall make his own arrangement for import of equipment including all certification, payment of foreign exchange etc. The Construction Committee shall not be involved in this process unless a certificate is required from his end.

APPROVAL BY LOCAL FIRE SERVICE AUTHORITY

It shall be the responsibility of the contractor to get the approval in stages 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 Construction 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.

No extra charges shall be paid on account of interaction with the Fire Service.

CIVIL WORKS

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 making good after completion, small size 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**

Pump shall be as per IS: 1520 - 1660, IS: 9070, IS: 325 and shall be the following construction

Pump **Horizontal split casing**

	Description	Double Suction
a.	Casting	Cast Iron / Cast steel
b.	Impeller	Bronze
c.	Shaft	High Tensile steel
d.	Bearings	Heavy duty Ball / Roller Bearings.
e.	Base Plate	Cast Iron / Fabricated M.S
f.	Flanges	Conforming to I.S.S. 1536 / 1960
g.	Packing	Mechanical Seal
h.	Max Speed	2900 RPM
i.	Driver	T.E.F.C
j.	Starter	Direct on line

Pump and driver shall be mounted on a single bed-plate and directly driven through flexible coupling in case of horizontal split casting pumps.

The pumps shall be of the type approved by the Construction Committee and capable of delivering 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 ACCESSORIES AND FITTINGS

The following accessories shall be provided with each pump among other standard accessories required:

a) Coupling guard for horizontal split casting pumps.

b) Lubrication fittings and seal piping.

c) Test and / or air vent cocks

1.2.1 Following fittings shall be provided with each pump among other standard fittings required:

a. Suction and discharge shut off valves (gate type) and discharge check valves and vibration pads as specified under section “PIPING”.

b. Suction and discharge pressure gauges not less than 100 mm dia and of the appropriate rating with gauge valves etc. Suction gauge shall be of compound type.

c. 25mm GI gland drain.

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 preferably be factory aligned, wherever necessary, site alignment shall be done by competent persons. Before the foundation bolts are grouted and the couplings are bolted, the bed plate levels and alignment results shall be submitted to the Construction 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. PIPING SCOPE

The scope of this section comprises the Supply, Laying, Erection, Testing and commissioning of pipes required for this project.

2.1 WATER PIPING

All piping laid shall be as follows:

Pipe Size	Material	Joints & Fittings	Sealing Material
Upto 150mm	M.S tube Medium class I.S.1239 part-II	i) Welded joints & Screwed fittings ii) Unions	i) Non hardening ii) Lubricant
	rubber insertion	iii) Slip on flanges	iii) 3mm, 3 ply

Pipe threads shall be to IS : 554 and flanges to IS : 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 pressure ratings suitable for the piping system. Fittings used on welded piping shall be of the weld-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 All equipment and valve connections shall be through flanges (Welded or screwed for galvanized steel)

2.6 All welded piping is subject to the approval of the Construction Committee and sufficient number of flanges and unions shall be provided.

2.7 Gate valves wafer type Butterfly valves shall be provided as required or as shown in the applicable shop drawings conforming to the following specifications:

Size	Construction	Ends	Type
12mm to 40mm	Gun Metal	Screwed Female	Gate valve
50mm and Over	Body -cast iron		Butterfly valve
Seat -The resilient lining moulded Black nitrile rubber.			
	Disc -SG Iron to IS : 1865		SG 400/12
	& BS : 2789 Gr420/20 Nylon coated.		

Gate valves shall conform to IS : 780 / 1969, flanges to IS : 1536 or as required. 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 gaskets between mating flanges. The valves shall be suitable for flow in either direction and seal in both directions.

2.8 Check valves shall be provided as required or as shown on the drawings and conform to the following specifications

Size	Construction	Ends
12mm to 65mm	Gun Metal	i) Screwed Female
75mm and Over	Gun Metal / 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 PIPING INSTALLATION AND AIR VALVES.

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, locations of isolating drain and air valves etc. They must keep in view the specific openings 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 and finish coated black. Where pipe and clamp are of dissimilar material, a gasket shall be provided in between. Spacing of pipe supports shall not exceed the following:

Pipe Size (mm)	**Spacing (M)**
3 to 12	1.22
19 to 25	1.83
32 to 150	2.44

150 and above	3.05

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 Construction Committee.

d Piping layout shall take due care for expansion and contraction in pipes.

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 ends of 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**
Upto 100mm dia	25mm dia
100mm to 300mm dia	28mm dia

Discharge from the air valves shall be piped through an equal sized G.S pipe to the nearest drain or floor waste or as shown.

g All buried pipes shall be cleaned and coated with zinc chromate primer and bituminous paint, than wrapped with two layers of fiber glass felt each layer laid in bitumen.

h Drain shall be provided at all low points in the piping system and shall be of the following sizes :

Mains	**Drains**
Upto 300mm dia	25mm dia
Over 300mm dia	38mm dia

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 PRESSURE GAUGES

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 Pressure gauge shall be provided at the following locations and as indicated on the drawings :

Suction and discharge of pumps.

Care shall be taken to protect pressure gauges during pressure testing.

2.11 VIBRATION ELIMINATION

Piping installation shall be carried out with vibration elimination fittings wherever required.

2.12 TESTING

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 Construction Committee.

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

c System may be tested in sections and such sections shall be securely capped.

d The Construction 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 Construction 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 over water 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 Construction Committee.

3 VALVES & ACCESSORIES

3.1 VALVES

a 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 spindle shall be removable type, and shall be easily rotated.

3.2 HOSE REEL

a The Hose Reel shall be drum type. The rubber Hose pipe shall be fixed on a drum that shall be 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 means of fasteners. The Hose Reel shall have an ABS Plastic nozzle.

c The Hose Reel shall be connected to the Riser by means of 25 mm dia MS pipe with threaded bends, union etc. A cut off Ball Valves shall also be provided.

3.4 FIRE BRIGADE INLET

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 be complete 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 SYSTEM DRAINAGE

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 PAINTING

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 coats of enamel paint shall be applied. Each coat shall be given minimum 24 hours drying time. 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 Painting shall be expertly applied in two or more coats, the paint shall not over run on surfaces not requiring painting such as walls, surfaces etc. Nuts and bolts shall be painted black, while valves shall be painted blue.

3.7 COUPLINGS

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 BUTTERFLY VALVE

a The Butterfly Valve shall be suitable for waterworks The Valves shall fulfill the requirements of API 609 and MSS-SP-67.

b The body shall be of cast iron to IS:210 in circular shape and of high strength. The disc shall be 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 have complete contact between the seat and the disc throughout the perimeter. The elastomer

rubber shall have a long life and shall not give away on continuous applied water pressure. 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 rubber shall be projected outside such that they are wedged within the pipe flanges to prevent leakage's.

3.9 AIR RELEASE VALVE

Each pump shall be provided with a pressure Relief Valve. The Valve shall be constructed of bronze and provided with an open discharge orifice for releasing the water.

3.10 NON RETURN VALVE

a Non-return valves shall be cast iron spring action swing check type. An arrow mark in the 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 GUN METAL VALVES

a Gun metal Valves shall be used for smaller dia pipes, and for threaded connections. The Valves shall bear certification as per IS:778.

b The body and bonnet shall be of gun metal to IS:318, grade LTB 2. The stem, gland and gland nut shall be of forged brass to IS:319. The hand wheel shall be of cast iron to IS:210, grade FG 200 /260.

c The Hand wheel shall be of high quality finish to avoid hand abrasions. Movement shall also be easy. The spindle shall be non rising type.

4 FIRE EXTINGUISHERS

4.1 5 kg ABC Type Dry Powder Fire Extinguisher

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 with Dry 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. 0S ufficient space for Nitrogen gas shall be provided inside the body, above the powder filling.

4.6 The Neck ring shall be externally threaded the threading portion being 1.6 cm. The filler opening in the neck ring shall not less then 50 mm. Discharge nozzle shall be screwed to the hose. The design of the nozzle shall meet the performance requirement, so as to discharge at least 85 % of contents 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 pressure available inside. The extinguisher shall be treated with anti corrosive paint, and it shall be 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. ELECTRICAL INSTALLATION

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 :

Motor Capacity	**Size & Number of Cables.**
Upto 5 HP	1 X 3 X 2.5 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 X 40mm X 2mm) 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 along with 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:-

	Cross sectional area of current carrying Conductor (Sq. mm)	Size of earth copper conductor SWG
1.	4 / 6 / 10	10
2.	16 / 25 / 35	8
3.	50 / 70 / 95	6
	Where the current of Motor / equipment is more than 150 Amps 25 mm X 3 mm copper strips shall be used.	

All three phase motors / equipment shall be earthed with two independent earth 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 and authorized person. The entire electrical installation shall be got approved by Electrical

Inspector & certificate from Electrical Inspector shall be submitted. All tests shall be carried out in presence of the Construction 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 TESTING AND COMMISSIONING OF SYSTEM

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 Construction Committee

6.2 Soon after the work is completed, the Contractor shall get the complete system including all sub-systems 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 Any defects noticed during these tests shall be promptly rectified by the Contractor.

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 Construction Committee.

7 Samples

The Contractor shall be required to have samples of the following kept at site after approval by the Construction Committee. The Contractor shall use only those items for which samples have been approved.

7.1 Conduit

7.2 Cable

7.3 Pump panel parts.

7.4 Pipes and fittings

7.5 Hose Reel

7.6 Gun Metal Gate Valve

7.7 Pipe supports and clamps

7.8 Fire Extinguishers.

7.9 All other materials as asked for during execution.

FIRE ALARAM SYSTEMS

1.1. DESCRIPTION:

A. This section of the specification includes the providing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm 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 Construction committee and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for Local Protected Premises Signalling Systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.

1. The Secondary Power Source of the fire alarm control panel will be capable of providing at least 24 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. Underwriters Laboratories Inc. (UL) - USA:

No. 38 Manually Actuated Signalling Boxes

No. 50 Cabinets and Boxes

No. 864 Control Units for Fire Protective Signalling Systems

No. 268 Smoke Detectors for Fire Protective Signalling Systems

No. 268A Smoke Detectors for Duct Applications

No. 346 Water flow Indicators for Fire Protective Signalling Systems

No. 464 Audible Signalling Appliances

No. 521 Heat Detectors for Fire Protective Signalling Systems

No. 1971 Visual Notification Appliances

E. The FACP shall meet requirements of UL ANSI 864 Ninth 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 Construction 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. Initiation Device Circuits (IDC) shall be wired Class B (NFPA Style B) as part of an addressable device connected by the SLC Circuit.

3. Notification Appliance Circuits (NAC) shall be wired Class B (NFPA Style Y) as part of an addressable device connected by the SLC Circuit.

4. All circuits shall be power-limited, per UL864 requirements.

5. A single ground fault or open circuit on the system Signalling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

6. Alarm signals arriving at the main FACP shall not be lost following a primary power failure or outage of any kind until the alarm signal is processed and recorded.

C. BASIC SYSTEM FUNCTIONAL OPERATION

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

1. The system alarm LED on the FACP shall flash.

2. A local sounder with the control panel shall sound.

3. A backlit 80-character LCD display on the FACP shall indicate all information associated with the fire 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 dial-up over PSTN or Internet or Intranet via PSDN or virtual private network.

1.3. SUBMITTALS

A. General:

1. Two copies of all submittals shall be submitted to the Construction Committee for review.

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 UL-listed 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. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications provided by contractor and approved by Construction 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. Show annunciator layout, configurations, and terminations.

C. Manuals:

1. Submit simultaneously with the shop drawings, 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 between the 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. Software Modifications

1. Provide the services of a qualified technician to perform all system software 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, zones and 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 free from 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. Each circuit in the fire alarm system shall be tested semi-annually.

3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72 Chapter 10.

B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, 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. POST CONTRACT EXPANSIONS:

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 of intelligent or addressable devices by ten 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. Submittals that do not include this estimate of post contract expansion cost will not be accepted.

1.7. APPLICABLE STANDARDS AND SPECIFICATIONS:

The specifications and standards listed below form a part of this specification. The system shall 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 appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

B. Local and State Building Codes.

C. All requirements of the Authority Having Jurisdiction (AHJ).

1.8. APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

UL Underwriters Laboratories Inc

FM Factory Mutual

PART 2.0 PRODUCTS

2.1. EQUIPMENT AND MATERIAL, GENERAL:

A. All equipment and components shall be new, and the manufacturer's current model. The materials, 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. CONDUIT AND WIRE:

A. Conduit:

1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
2. Where required, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
4. Wiring for 24-volt DC control, alarm notification, emergency communication and similar power-limited 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. Conduit shall be 3/4-inch (19.1 mm) minimum.

B. Wire:

1. All fire alarm system wiring shall be new.
2. 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 wire and cable shall be listed and/or approved by a recognized testing agency for use with a 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. Terminal Boxes, Junction Boxes and Cabinets:

All boxes and cabinets shall be UL listed for their use and 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. MAIN FIRE ALARM CONTROL 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. **Operator Control**

1. Acknowledge Switch:

   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 display to the next alarm or trouble condition.

   b. Depression of the Acknowledge switch shall also silence all remote enunciators piezo sounders.

2. Alarm Silence 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. Alarm Activate (Drill) Switch:

   The Alarm Activate switch shall activate all notification appliance circuits. The drill function

shall latch until the panel is silenced or reset.

4. **System Reset Switch:**

   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. **Lamp Test:**

   The Lamp Test switch shall activate all system LEDs and light each segment of the liquid crystal display.

C. **System Capacity and General Operation**

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 ICs to 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), have complicated programming (such as a diode matrix), are not considered suitable substitutes.
6. **The FACP shall provide the following features:**

   a. Drift compensation to extend detector accuracy over life. Drift compensation shall also 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. The ability to display or print system reports.

   d. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification an excessive number of times.

   e. Positive Alarm Sequence (PAS pre signal), meeting NFPA 72 requirements.

f. Rapid manual station reporting.

g. Non-alarm points for general (non-fire) control.

h. Periodic detector test, conducted automatically by the software.

i. Walk test, 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. Central Microprocessor

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 contain and 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. A special program check function shall be provided to detect common operator errors.
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 program utility shall be available. This program shall be used to off-line program the system with batch 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. Local Keyboard Interface

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 display shall contain an alphanumeric, text-type display and dedicated LEDs for the annunciation of AC POWER, FIRE ALARM, 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 command all 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. Signalling Line Circuits (SLC)

1. The SLC interface shall provide power to and communicate with up to 159 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 as a calibrated sensitivity test instrument.

H. Serial Interfaces

1. The system shall provide a means of interfacing to UL Listed Electronic Data Processing (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. The door shall provide a key lock and shall provide for the viewing of all 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 the panel to the enclosure back box.

J. Power Supply:

1. The main power supply for the fire alarm control panel shall provide 7.0 amps of available 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, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral

battery charger or may be used with an external battery and charger systems. Battery arrangement may be configured in the field.

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. Programmable Electronic Sounders:

1. Electronic sounders shall operate on 24 VDC 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. Shall be flush or surface mounted as show on plans.

L. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:

1. The maximum pulse duration shall be 2/10 of one second.
2. Strobe intensity shall meet the requirements of UL 1971.
3. The flash rate shall meet the requirements of UL 1971.

M. Audible/Visual Combination Devices:

1. Shall meet the applicable requirements of Section A listed above for audibility.
2. Shall meet the requirements of Section B listed above for visibility.

N. Specific System Operations

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. Device status
    b. Device type
    c. Custom device label
    d. Device zone assignements
4. System Status Reports: Upon command from an operator of 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 buffer that will be capable of storing up to 1000 events. Each of these activations will be stored

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. Systems that use volatile memory 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 and may also activate control relays. 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. The Silent Walk Test will not sound NACs but will store the walk test information in History for later viewing.
    b. Alarming an initiating device shall activate programmed outputs, which are selected to participate in Walk Test.
    c. Introducing a trouble into the initiating device shall activate the programmed outputs.
    d. Walk test shall be selectable on a per device/circuit basis. All devices and circuits which 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. All devices tested in walk test shall be recorded in the history buffer.
    f. All devices not tested in walk test shall be recorded in the history buffer.

9. Water flow Operation

    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. Supervisory Operation

    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. Signal Silence 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-Alarm Input Operation

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. SYSTEM COMPONENTS:

A. **Conventional Manual Call Point**

The manual call point should be compatible with Addressable Fire control panels through Module

They are suitable for immediate manual activation of the alarm of extinguishing system in the 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:pt 2.

B. **CONVENTIONAL Photoelectric/ Optical Type Smoke Detector**

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 should have bi-colour LED. In normal 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. Projected Addressable Beam Detector

1. The projected beam type shall be a 4-wire 24 VDC intelligent, addressable projected beam smoke detector device.
2. The detector shall be listed to UL 268 and shall consist of a single transmitter\receiver and corresponding non powered reflector.
3. The detector shall operate in either a short range (16' - 230') or long range (16' - 328') when used with an extender module.
4. The temperature range of the device shall be -22 degrees F to 131 degrees F.
5. The detector shall feature an optical sight and 2-digit signal strength meter to ensure proper alignment of unit without need of special tools.

6. The unit shall be both ceiling and wall mountable.
7. The detector shall have the ability to be tested using calibrated test filters or magnet-activated remote test station.
8 The 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. CONVENTIONAL Rate of Rise Type Heat Detector

It is a combination of rate of rise and fixed temperature principle using thermistor and with automatic compensation for changes of ambient conditions.

The detector should have bi-colour LED. In normal conditions should blink green and in case of fire it should blink Red.

The thermal detectors are tested and approved to EN54 part 5 (2000) Class A1R by LPCB.

F. CONVENTIONAL Hooter/strobe/hooter cum strobe

Horn/Strobe shall be listed to UL 1971 and UL 464 and shall be approved for fire protective service. 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. Addressable Monitor Module for Dry Contact Devices

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. Two-Wire Detector Monitoring/Zone Monitor Module

1. Means shall be provided for the monitoring of 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 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. Addressable Control Relay Module

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. Six Output Addressable Control Relay Module

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. Provision shall be included for disabling a maximum of three unused modules.
4. A single isolated set of dry relay form C contacts shall be provided for each of the 6 module addresses, which shall be capable of being wired for either a normally open or normally closed operation.
5. The module shall allow an addressable control panel to switch these contacts on command.
6. 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. Multiple Two-Wire Detector Monitoring

1. A single multi input 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 from 01 to 150 and the remaining module addresses shall be automatically assigned to the next nine higher addresses.
4. Provision shall be included for disabling a maximum of two unused addresses.
5. The supervised state (normal, open, or short) of the monitored device shall be sent back to the 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 zone may be wired for Style D 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 module is operational and in regular communication with the control panel. LEDs shall latch on when a circuit is in alarm.

L. <u>Isolator Module</u>

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC 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 isolator module 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>Alphanumeric LCD Type Annunciator (Ann-Bus Mode):</u>

1. The alphanumeric display enunciator shall be a supervised, remotely located back-lit eighty (80) characters LCD display for alarm annunciation in clear English text.
2. The LCD enunciators shall display all alarm and trouble conditions in the system.
3. An audible indication of alarm shall be integral to the alphanumeric display.
4. It shall be possible to connect up to 8 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.
5. Up to 8 total devices of any kind, LCD, printer gateway, LED, Relay or I/O module may be installed on the ANN-BUS.

2.5. SYSTEM COMPONENTS – ADDRESSABLE/CONVENTIONAL DEVICES

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 flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED.
4. 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.
5. Detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof 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 an alarm 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. Detectors shall provide address-setting means using decimal switches.

2.6. BATTERIES:

A. Upon loss of Primary (AC) power to the control panel, the batteries shall have sufficient capacity to power the fire alarm system for required standby time (24 or

60 hours) followed by 5 minutes of alarm.

B. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.

C. If necessary to meet standby requirements, external battery/charger systems may be used.

PART 3.0 - 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 may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system

programming and test period. If construction is ongoing during this period, measures shall be taken 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 all of the adjustments and tests for the system. All testing shall be in accordance 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. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

C. Verify activation of all water flow switches.

D. Open initiating device circuits and verify that the trouble signal actuates.

E. Open and short signalling line circuits and verify that the trouble signal actuates.

F. Open and short notification appliance circuits and verify that trouble signal actuates.

G. Ground all circuits and verify response of trouble signals.

H. Check presence and audibility of tone at all alarm notification devices.

I. Check installation, supervision, and operation of all intelligent smoke detectors 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 be consulted 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. FINAL INSPECTION:

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 dealer shall provide a user manual indicating "Sequence of Operation."

SPECIFICATION FOR DIESEL GENERATING SETS

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 SCOPE OF WORK

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 day oil tank. Return fuel line with fuel cooler and piping with accessories upto day service tank etc.

2.3 Lube oil system with piping etc.

2.4 To design the mechanical ventilation system for D.G. enclosure with fans and duct etc. as per 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 Exhaust emission shall meet CPCB & SPCB norms and residential silencer, exhaust piping with mineral wool insulation and aluminium cladding as called for.

2.7 Steel fabricated structure/support/hanger including fixing, grouting and bolting etc.

2.8 Painting of steel work.

2.9 Auxiliary control panel if required.

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 the D.G. supplier will furnish back up combined guarantee for 2 years 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.

Some of the applicable standards are listed below:

IS – 1601	:	Performance and testing of IC engines for general purpose.
BS – 649	:	Performance and testing of IC engines for general purpose.
BS – 4613	:	Electrical performance of rotating electrical machine.
BS – 4999/5000	:	Applicable parts of BS 4999/5000.
IEC – 34-1/	:	Specification for rotating electrical machines.
IS – 4722/		
VDE – 0530		
IS – 4889	:	Method of determination of efficiency of rotating electrical machinery.
IS – 6491	:	Degrees of protection provided by enclosures for rotating Electricity machinery
IS – 4729	:	Measurement and evaluation of vibration of rotating Electrical machines.
AIEE – 606	:	Recommended specification for speed governing (1959) of internal combustion engine generator units.
IS – 2705	:	Current transformers.
IS – 1248	:	Electrical indicating instruments.
BS – 5514 /	:	Reciprocating internal combustion (I.C) engine driven A.C. Generators.
IS – 03046 or		
IS – 08528 Part 2		
IEEE – 115	:	Test procedure for synchronous machine.

- Indian Electricity Act.
- Indian Electricity Rules.
- Factory Act.

IS-7098 Part I & II	:	XLPE insulated PVC sheathed for working voltage 1.1 to 11 KV.
IS-3975	:	Mild steel wire, strips & tapes for armouring cable.
IS-3961	:	Current rating of cables.
IS-694	:	PVC / HRPVC insulated (heavy duty) electric cables for working. voltage upto and including 1100 volts.
IS-424-1475	:	Power cable flexibility test.
(F-3)		
IS-1554 (Part-I)	:	PVC/.HRPVC insulated cables upto 1100 volts.
IS-5083	:	Extruded inner/outer seath.

IS-6121	:	Cable glands.
IS-10418	:	Cable drums.
IS-13947/ IEC 947	:	Air circuit breaker/moulded case circuit breaker.
IS-8623	:	Specifications for factory built assemblies of switch gear and control gear for voltage upto and including 1000vac/1200vdc.
IS 1018	:	Switchgear and control gear selection/installation and maintenance.
IS-13779	:	Digital measuring instruments and testing accessories.
IS-2705	:	Current transformer for metering and protection with classification burden and insulation.
IS -2147 (Part I, II & III)	:	Degree of protection provided by enclosures for low voltage. Switchgear & control gears.
IS-3427	:	Metal enclosed switchgear and control gear.
BS-162	:	Safety clearance.
IS-3202	:	Code of practice for climate proofing of electrical equipment.
IS-375	:	Marking and arrangement for switchgear, busbars, main connections and auxiliary wiring.
IS-722	:	Ac electric meters.
IEC-255	:	Electrolytic copper/aluminium bus bars.
IS-5082	:	Electrolytic copper & aluminium
IS-4201	:	Application guide for Current Transformer.
IS-4146	:	Application guide for Voltage Transformer.
IS-3034	:	Code of practice for fire safety of industrial building-electrical generating and distribution station.
IP-30	:	National electrical code (NEC) BIS publication.
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 Construction Committee. Major activities requiring approval/review shall include but not to be limited to the following:

Bidder shall be responsible for:

- Detailed co-ordination with other services, shop drawings for various electrical layouts such as equipment layout, cabling layouts, earthing layouts, including equipment installation and cable termination details etc. prior to start of work.
- Preparation of bill of materials for cabling, earthing and miscellaneous items etc.
- Cable schedule (as per site requirement).
- Interconnection drawing.
- Protection co-ordination drawings.
- Shop inspection and testing procedures.
- Field testing and commissioning procedures.
- Preparation of as built drawings.
-

6.00 SITE CONDITIONS

i) Design ambient	50 Deg.C. maximum for engine and 40 deg C for alternator
ii) Altitude	300M above sea level
iii) Relative Humidity	98% maximum
iv) Site environment	Normal

7.00 DESIGN CRITERIA

7.01 ELECTRICAL DETAILS OF INCOMING SUPPLY

a)	Supply Voltage	11 KV as per SEB approved.
b)	Fault level (sym.) at supply of point (designed)	350 MVA (to be confirmed from State Electricity Board by Tenderer).
c)	Neutral	As per supply company
d)	Voltage Variation	$\pm$ 5%
e)	Frequency Variation	$\pm$ 3%

7.02 L.T. POWER DISTRIBUTION SYSTEM

a)	Voltage	415 V
b)	Frequency	50 Hz

c)	Neutral	Solidly Grounded
d)	Short Circuit Fault withstand Capacity	10 - 50 KA (1 Sec.)

7.03 CONTROL SUPPLY FOR ELECTRICAL SYSTEM

The various supply voltage to be used in the control panels for main equipments are:

a)	Spring Charge Motor	230 Volt AC
b)	Closing/Trip Coil	24 V DC
c)	Alarm/Indication/Relay	24 V DC
d)	Heaters	230 V AC

7.04	PAINTING OF PANEL	Powder coating of approved shade as per Specification Clause of painting.
7.05	PAINTING OF CABLE TRAY AND STRUCTURE STEEL	Powder coated of approved shade as per Specification Clause of painting.

8.00 CABLE DETAILS

8.01	L.T. CONTROL CABLES	Copper conductor FRLS/PVC insulated 1.1 KV grade.
8.02	POWER CABLES (L.T.)	Aluminium / copper conductor FRLS/PVC / XLPE armoured.
8.03	GROUNDING CONDUCTOR	Copper/G.I. as per BOQ.

9.00 ACCURACY CLASS OF METERS

Revenue Metres	Class 0.5 or as per SEB approved.
Am-meter Voltmeter and Other Instrument	Digital Type.

1.00 DRAWINGS

i) The drawings along with this specification is provided by contractor and approved by Construction committee. These drawings are meant to give general idea regarding the nature of work covered by these specifications.

ii) Any information/data shown/not shown in these drawings shall <u>not relieve the contractor of his responsibility</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) <u>Shop Drawings</u>

The contractor shall prepare detailed coordinated electrical shop drawing. Cable Schedule with other relevant services and submit to the Construction 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 cable details 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 will submit 2 prints for preliminary approval and finally six prints for distribution.

iv) Completion Drawings/As Built Drawings

On completion of the work and before issue of certificate of virtual completion, the contractor shall submit to the Society 6 sets alongwith soft copy of 'As Built' drawings of the work alongwith originals including write up (trouble shooting, installation, operation and maintenance manual with instructions) incorporating all such changes and modifications during engineering and execution.

These drawings must provide:

- Location of all earthing stations, route and size of all earthing conductors.
- Layout and particulars of all cables.
- Location and details of D.G. control panel/aux. panel, and relay panels with description detailed control wiring diagram.
- Layout of cable trays with support and their fixing details.

11.00 MANUFACTURER'S INSTRUCTIONS

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 MATERIALS AND EQUIPMENTS

All the materials and equipments shall be of the approved make and design. Unless otherwise called for any approval by Construction Committee, only the best quality materials and equipment shall be used.

A. VENTILATION OPENING

In order to ensure adequate ventilation, 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. DEGREE OF PROTECTION

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.

- Installed out door : IP-55.
- Installed indoor in air conditioned area : IP-31.
- Installed in covered area : IP-42.
- Installed indoor in non air conditioned area where possibility of entry of water is limited : IP-41.
- For L.T. switchgear (AC and DC distribution boards) : 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. RATING PLATES, NAME PLATES AND LABELS

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's name, year of manufacture, equipment name, type or serial number together with

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. FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, welding/soldering/brazing material for all copper/G.I. earthing and essential chemicals etc, (however diesel shall be provided by Society). which will be required to put the equipment/scheme covered under the scope of the specifications, into successful operation, shall be furnished by the Contractor unless specifically excluded under the exclusions in these specifications and documents.

E. DESIGN IMPROVEMENTS

The bidder shall note that the equipment offered by him in the bid only shall be accepted for supply.

If for any reason, Contractor wishes to deviate from specification, prior permission from Construction 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. QUALITY ASSURANCE PROGRAMME

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:

- His organization structure for the management and implementation of the proposed quality assurance programme.
- Documentation control system.
- Qualification data for bidder's key personnel.
- 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.
- Control of non-conforming items and system for corrective actions.
- Inspection and test procedure both for manufacture and field activities.
- Control of calibration and testing of measuring instruments and field activities.
- System for indication and appraisal of inspection status.
- System for quality audits.
- System for authorizing release of manufactured product to the Purchaser.
- System for maintenance of records.
- System for handling storage and delivery and

- 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 quality surveillance of the system and procedure of the Contractor/his Vendor's quality management and control activities.

G. QUALITY ASSURANCE DOCUMENTS

The Contractor shall be required to submit the following Quality Assurance Documents within three weeks after dispatch of the equipment.

- All Non-Destructive Examination procedures, stress relief and weld repair procedure actually used during fabrication and reports including radiography interpretation reports.
- Welder and welding operator qualification certificates.
- Welder's identification list, listing welder's and welding operator's qualification procedure and welding identification symbols.
- Raw material test reports on components as specified by the specification and/or agreed to in the quality plan.
- Stress relief time temperature charts/oil impregnation time temperature charts.
- 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, STORING AND INSTALLATION

- 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 Construction 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 shall make 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.

- The Contractor shall submit to the Construction Committee every week, a report detailing 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.
- The words 'erection' and 'installation' used in the specification are synonymous.
- 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 PROTECTIVE GUARDS

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 DESIGN CO-ORDINATION

The Contractor shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. 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 DESIGN CO-ORDINATION MEETING

The Contractor will be called upon to attend design co-ordination meetings with the Construction Committee during the period of Contract. The Contractor shall attend such meetings at his own cost at Chandigarh or at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during those discussions.

19.00 DIESEL ENGINE

19.01 Air cooled diesel engine electric starting high speed diesel engine with integrated DG Set Controller conforming to BS:649/1958 with 10% over loading for one hour in any 12 hours duration. The engine will be fitted with the following standard accessories. The supplier can quote for equivalent engine and shall furnish complete details of the same along with tender quotation.

a) Fly wheel to suite flexible coupling.
b) Flexible coupling.
c) Exhaust fan turbo charger with after cooler.
d) Cooling water centrifugal pump.
e) Radiator (engine mounted).
f) Corrosion resistor.
g) Automatic over speed trip protection.
h) Lub. oil pump.
i) Lub. oil priming pump (if Required).
j) Lub. oil filter.
k) By pass filter.
l) Fuel pump.

m) Fuel filter.
n) Air in take manifold.
o) PCC 3.3/EPC/wood ward/Powercom (having SEMs control system).
p) Self starter 24 volts DC including battery and battery charger.
q) Residential silencer.
r) Flexible pipe for silencers.

20.00 GOVERNING SYSTEM

20.01 The Governor shall be electronic fuel control type for coupled Genset.

21.00 EXHAUST SYSTEM

Engine emission exhaust system shall be meet the CPCB/SPCB norms of exhaust emissions for D.G. Sets residential type silencer ducting, bends, hood/canopy, thermally insulated aluminium clad exhaust piping etc. shall be provided alongwith structural support with stays for each engine. 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 Exhaust Pipe Insulation

Exhaust pipe insulation shall be carried out with mineral wool (rigid pipe sections) of 150 Kgs./Cu.m for temperature above 250 deg.C. The material for pipe insulation shall be factory faced 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 ENGINE INDICATORS

a. Digital tachometer with running hour meter
b. Starting attempt counter
c. Lubricating oil pressure low
d. Water temp. high/low.
e. Water pressure low/high.
f. Over speed
g. Engine fail to start
h. KVA
i. Volts R-Y-B / RY-YB-BR.
j. Amps R-Y-B.
k. Fault condition with reset for engine.

23.00 ALTERNATOR (415V– 3 Phase, 4 Wire System)

23.01 The Alternator shall be industrial type screen protected drip proof. IP-23. Class – H insulation with temperature rise limited to Class-'H', self ventilated, air cooled, rotating field, salient pole, 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 ± 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 All external nuts and bolts shall be of high tensile steel only.

23.07 The alternator shall be capable to sustain the unbalanced current between the phases minimum 25% of rated current provide that the KVA rating and maximum current does not exceed of rated current in any phase as per BS-4999 Part-101.

23.08 The alternator shall be dynamically balanced complete with rotor and shaft.

23.09 Damper winding shall be provided in the pole to damp the oscillations and ensure satisfactory performance during parallel operation.

24.00 OUTDOOR TYPE ACOUSTIC ENCLOSURE FOR D.G. SET

a) Silent DG set container is of modular construction with the provision to assemble and dismantle easily as per the site condition.
b) There are no protruding parts.
c) The container is fabricated out of CRCA sheet of 16 SWG.
d) The sheet metal components are hot dip nine tank pre-treated.
e) To have long lift of container it is pure polyester based powder coated (inside as well outside). All nut and bolts/hardware are zinc coated.
f) Fuel tank at the base of silent DG set is having required capacity. It is provided with breather, drain plug.
g) The fuel level can be indicated with the help of fuel gauge meter.
h) There is provision for filling the fuel from outside as in the case of automobiles with locking arrangement.
i) Battery is accommodated in a separate tray in the container.
j) There is a provision for drain plugs for draining mobile oil/diesel.
k) The doors are gasketed with high quality EPDN gaskets to avoid leakage of sound.
l) The door handles are lockable type.
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) The rock wool is further covered with fibre glass cloth and perforated powder coats sheet.
o) A special residential silencer is provided with in the DG to control exhaust noise.
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 on anti-vibration pads.
r) Noise level is 75 dB(A) at 1 meter distance.

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 the Construction Committee with no extra claim to 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. Acceptance Tests on D.G. Set.

One (1) hour at variable load including 10% overload at manufacturer works.

Before each test, the engine shall be brought to a steady state under the conditions of the test.

B. NOTICE PERIOD

Atleast 1 week notice time shall be maintained before the tests mentioned above by manufacturer.

25.02 **Test Certificate**

a. Test Certificate shall be submitted in two (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.

26.00 DEVIATION

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 QUALITY ASSURANCE PROGRAMME

Quality Assurance shall follow the requirements of Construction 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.

Technical literature, testing procedure with acceptable value shall be submitted along with the bid.

Any deviation shall be explained with supporting documents shall also be submitted.

28. SPECIFICATION FOR DG AUTOMATION SYSTEM

Controller Based DG SYNCHRONIZATION SYSTEM

1. CONTROL PHILOSOPHY

Automatic Start & Stop of Engine:

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 from Man machine interface to automatically control the start and stop of the engine, depending on the predefined load setting in the controller. In case engine does not start in the first cranking, two more 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 to engine 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. DG Synchronization Controller

The entire operation of the captive power generation system will be controlled 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

- Tripping of less priority loads in the plant in case of under frequency of bus both in isolation as 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.
- The System supplier will supply built drawing. Along with trouble shooting and operation and maintenance guidelines.

Controller must have these protections for Generator.

Protection	ASNI Code	Protection	ASNI Code
Under/Over Voltage	27P/59P	Reverse Power	32R
Under/Over Frequency	81U/81O	Voltage dependent Over Current	51V
Short Circuit	50P/N	Unbalance Voltage	47
Over Current	51	Unbalance Current	46
df/dt	81R(ROCOF)	Under Excitation	32RV
Vector Surge	78	Over Excitation	32FV
Over Load	32	Over Speed	12

Low Battery Voltage	27 DC	High Battery Voltage	59DC
Phase Sequence Error	47	Hz/V Failure	53
Earth Fault	51N		

3 Communication for SCADA & BMS connectivity

1 CAN Communication J1939 4

2 Modbus(RS-485)

3 Ethernet Communication

Controller Must be 3 Phase Synchronization
3 Phase Generator Voltage
3 Phase Bus Voltage

3.1 Auto Mode

a) System Operation

- While the normal mains supply is healthy, the DG set shall be at rest and the load shall be supplied by mains. 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 up of 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.
- A three attempt starting facility shall be provided with the sequence 6 seconds ON 5 seconds OFF 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 out for start. A master timer shall be provided for the function. An audio visual alarm shall be given.
- Suitable adjustable timers shall be incorporated which shall 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 be reset.
- Once engine has built up voltage, signals shall be provided to operate the alternator, mains and bus coupler circuit breakers as per logic sequence required. The Mains supply circuit breaker shall open before the alternator circuit breaker closes. Before giving close command to alternator breaker, all the bus couplers shall 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 that all the engine auxiliaries like cub oil pump, CT fan, cooling water pump are running and healthy. 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 on the 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/loads on the Main LT panel bus.
- The Automatic Load Management system shall be designed to provide optimum utilization of the DG sets so that operation of the DG sets is need based with higher load factor on each set. The system would therefore transfer loads from one bus to the other on the Main LT panel with Main

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 system shall also 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 number of operating hours of each DG set so that to ensure that all DG sets are operated as equally 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.

- The DG set shall stop after idle running of one minute after restoration of main supply.

- The DG set reverts to standby conditions and is ready to start should the mains supply fail again.

b) Sequence of operation for Auto start, Auto load management & Auto Synchronizing

- One failure of grid supply, DG-1 shall start automatically and close its breaker shall start feeding the load.

- On DG-1 attaining its full rated capacity, DG-2 shall start automatically.

- Voltage and frequency of DG-2 shall be monitored and necessary commands shall adjust the parameters of DG-2 with bus.

- System shall also monitor the slip frequency and the beat voltage of the machine or system.

- The above sequence shall be followed for subsequent DG'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.

- It shall be possible to alter crucial settings / time delays thru. Man Machine Interface.

- Controller, annunciation system, protection system and metering system shall have compatibility for future interface with PC for graphics displays / report generation.
- System shall have total manual override.

Tenderers may note that the controller controls and sequence of operation are indicative of requirements and the controller shall not withstanding the above, be complete in all respects to achieve the control, monitoring and operation of DG sets indicated above.

3.1.2 **Manual Mode**

- Under manual mode it shall be possible for the operator to start up the generator set by pressing the (START) push button.
- Three attempt starting facility shall also be operative for the start up function.
- 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.
- Engine shut down, other than due to faults shall be manual by pressing a 'STOP' button.

3.1.3 **Test Mode**

- 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.
- Engine shall build up voltage but 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 TEST run the power supply has failed, the load shall automatically get transferred to alternator.
- Bringing the mode selector to auto position shall shut down the sets.

TECHNICAL SPECIFICATIONS FOR EXTERNAL ELECTRICAL WORKS

STANDARDS

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.

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.

Some of the relevant Indian and British Standards are listed below:

IS 13947	:	A.C. Circuit Breakers (Relevant Parts/SCC).
IS 3427	:	Metal enclosed Switchgear & Control Gear.
BS 162	:	Safety Clearances.
IS 2705	:	Current Transformers (Parts 1 to 4).
IS 3156	:	Voltage Transformers (Parts 1 to 4).
IS 3202	:	Code of Practice for climate proofing of electrical equipment.
IS 375	:	Marking & Arrangement for Switchgear Bus Bars, main connections and auxiliary wiring.
IS 722	:	A.C. Electric Meters.
IS 1248	:	Direct acting Electrical Indicating Instruments.
IS 3231	:	Electrical Relays for Power System Protection.
IS 2544	:	Epoxy Cast Resin Insulators.
IS 5082	:	Electrolytic Copper and Aluminium.
IS 5792	:	High Voltage HRC fuses.

11 KV AND MEDIUM VOLTAGE CABLES

1. GENERAL

Technical specifications in this section covers supplying and laying of :

- 11 kV cables
- Medium voltage cables.

2. STANDARDS AND CODES

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	IS 1554 - 1988
Cross link polyethylene insulated PVC (sheathed XLPE cables)	IS 7098 - 1985
Code of practice for installation and maintenance of power cables	IS 1255 - 1983
Conductors for insulated electrical cables	IS 8130 - 1984
Drums for electrical cable	IS 10418 - 1982
Methods of test for cables	IS 10810 - 1988
Recommended current rating	IS 3961 - 1987
Recommended short circuit rating of high voltage PVC cables	IS 5891 - 1970

3. CABLES

3.1 11 KV Cables

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 be provided with extruded PVC sheathing. Galvanized steel wire of strip armouring shall then be

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. Medium Voltage Cables

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's name and trade mark at every meter length. Cores shall be provided with following colour scheme of XLPE insulation.

1 Core	:	Red/Black/Yellow/Blue
2 Core	:	Red and Black
3 Core	:	Red, Yellow and Blue
3 1/2 /4 Core	:	Red, Yellow, Blue and Black

Current ratings shall be based on the following conditions.

a) Maximum conductor temperature 90^0 C

b) Ambient air temperature 45^0 C

c) Ground temperature 30^0 C

d) Depth of laying 1000 mm

Short circuit rating of cables shall be as specified in IS 7098 Part-I.

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.

4. DELIVERY, STORAGE AND 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 90^0C 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 wheels and pulled by ropes or they shall be mounted on trailers etc. drums shall be unloaded preferably by crane otherwise they shall be rolled down carefully on suitable ramps. While transferring cable form 1 drum to another, the barrel of the new drum shall have diameter not less

than the original drum. Cables with kinks or similar visible defects like defective armouring etc shall be rejected. Cables shall be supplied at site in cut pieces as per actual requirements.

5. LAYING OF CABLES

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 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.

5.1 In Masonry Trenches

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 / 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 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.

Type of cables	Size	Clamping by	Fixing intervals
MV	Upto and including 25 sq mm	Saddles 1 mm thick	45 cm
MV & HV	35 sq mm to 120 sq mm	Clamps 3 mm thick 25 mm wide	60 cm
MV & HV	150 sq mm and above	Clamps 3 mm thick 40 mm wide	60 cm

Note : The fixing intervals specified apply to straight runs. In the case of bends, additional clamping 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.

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 Construction 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 tiers shown in tray layout drawings. Spacing between horizontal supports arms of vertical tray runs to be 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 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 by red oxide followed by the same finishing paint. Steel sheet covers wherever indicated to be similarly painted. Trays shall be erected 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 run of cable tray shall be completed before laying of cables. Cable trays shall be erected so as to be exposed and accessible.

5.3 Buried Directly In Ground

5.3.1 General

Cables shall be so laid that they will not interfere with underground structures. All water pipes, sewage lines or other structures which become exposed by excavation shall be properly supported 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 Construction 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 Construction Committee.

5.3.2 Routing of cables

Before cable laying work is undertaken, the route of the cables shall be decided with the Construction 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 than HV 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.

5.3.3 Width Of Trench

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 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.

5.3.4 Depth Of Trench

The depth of trench shall be determined on the following basis:

- 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.

5.3.5 Excavation Of Trenches

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 Construction Committee. Existing property exposed during trenching shall be temporarily supported or propped adequately as directed by the Construction 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 Construction 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 m in depth.

5.3.6 Laying Of Cable In Trench

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 creeping to one side while rotating. The cable shall be pulled 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 cable shall be lifted slightly over the rollers beginning from one end by helpers standing 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 Construction 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 100 mm (normal size) laid breadth wise for the full length of the cable to the satisfaction of the Construction 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 be rammed and watered in successive layers not exceeding 300 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 berms or lawns have been cut or kerb stones displaced the same shall be repaired and made good to the satisfaction of the Construction Committee and all surplus earth and rocks removed to places as specified.

5.3.7 Laying In Pipes/Closed Ducts

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 under roads, pavements etc. The pipes for road crossings shall preferably be on the skew to reduce the angle of bend as the cable enters and leaves the crossing. Pipes shall be continuous and clear of 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 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 pipe as itemized in bill of quantities.

5.3.8 Laying Of Cables In 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 Construction Committee shall be obtained and the Contractor shall cut chases, lay the cables and make good the chases to original finish.

5.3.9 Cable Entry into Buildings

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/JOINTING OF CABLES

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 shrinkable Raychem 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 for 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 Construction Committee.

7. MEASUREMENT OF CABLE RUNS

The cable runs shall be measured upto the outer end of the boxes without any allowances for over lap 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.

8. CABLE LOOPS

At the time of the installation approximately 3 meters of surplus cable shall be left

- at each end of the cable.
- on each side of underground straight through/tee/termination joints.
- at entries to buildings.
- and such other places as may be decided by the Construction Committee.

This cable shall be left in the form of a loop.

Wherever long runs of cable length are installed cable loops shall be left at suitable intervals as specified by the Construction Committee.

9. BONDING OF CABLES.

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 the gland or casting, so that in the event of ground movement no undue stress is placed on to the cable conductors.

10. TESTING

10.1 Tests at Manufacturer'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) :

- Routine test on each drum of cables.
- Acceptance tests on drums chosen at random for acceptance of the lot.
- Type test on each type of cables, inclusive of measurement of armour DC resistance of power cables.

10.2 Site Testing

- 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 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.
- After laying and jointing, the cable shall 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 Test Witness

Tests shall be performed in presence of representative of the Construction Committee. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.

<u>MEDIUM VOLTAGE SWITCHGEAR</u>

1. GENERAL

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

2 STANDARDS AND CODES

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 listed below.

Low Voltage switchgear & controlgear IS 13947 : 1993

Part I : General rules

Part II : Circuit Breakers

Part III : Switches, dis-connectors, switch dis-connectors and fuse combination units
Part IV : Contactors and Motor starters

Part V : Control circuit devices and switching elements

Marking of Switchgear busbars IS 11353 : 1985

Degree of Protection of Enclosures for low voltage switchgear. IS 2147 : 1962

Electrical relays for power system protection IS 3231 : 1986

Code of Practice for selection, installation and Maintenance of switchgear & controlgear IS 10118 : 1982
Low voltage switchgear & controlgear assemblies IS 8623 : 1993

3. SWITCHGEAR

4.

3.1 Medium Voltage Air Circuit Breakers

3.1.1 Technical Parameters

- 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 Constructional Features

- 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 Operating Mechanism

- 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.
- The operating handle and mechanical trip push button shall be at 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" -- Both main and secondary isolating contacts closed

  "Test" -- Main isolating contacts open and secondary isolating contacts closed

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

  "Maintenance" -- Circuit Breaker fully outside the panel ready for maintenance

3.1.4 Circuit Breaker Interlocking

- Sequence type strain free interlocks shall be provided to ensure the following:
- 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.
- It shall not be possible for the Circuit Breaker to be plugged in unless it is in the OFF position.
- A safety catch shall be provided to ensure that the movement of the Breaker, as it is withdrawn, is checked before it is completely out of the cubicle, thus preventing its accidental fall due its weight.
- Mechanical and electrical anti-pumping devices shall be incorporated in the ACB's as required.

3.1.5 Circuit Breaker Auxiliary Contacts

The Circuit Breaker shall have minimum 6 N.O. and 6 N.C. auxiliary contacts rated at 16 amps 415 volts 50 Hz. These contacts shall be approachable from the front. They shall close before the main contacts when the Circuit Breaker is plugged in and vice versa when the Circuit Breaker is Drawn Out of the cubicle.

3. 1.6 Protective Devices

- The Circuit Breaker shall have protective devices as required and approved by the Construction 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 characteristics and the magnetic 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.
- Over voltage relay.
- Under/no voltage trip coil or Relay as required.
- Over current and earth fault IDMT relays with shunt/series trip coil operation as specified.
- The Circuit Breakers shall be suitable to accommodate one or more types of protection as specified.

3. 1.7 Instrument Transformers

The Circuit Breaker shall have the required Current Transformers as specified 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 and the Class of Accuracy required for metering and protection. Separate sets of Current transformers shall be provided.

3. 1.8 Metering

The metering required to be provided for each Circuit Breaker shall be as approved by Construction 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.

3. 1.9 Indicating Lamps

LED type indicating lamps shall be provided for indication of phases and Breaker position as required.

3. 1.10 Control Wiring

All wiring for relays and meters shall be of copper conductor PVC insulated and shall be colour coded and labelled with 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.

3. 1.11 Earthing

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

3. 1.12 Type Test Certificates

The Contractor shall submit type test certificates from a recognised test house for the Circuit Breakers offered.

3.2. Switch Fuse Units

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 housing shall be of robust 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.

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 not open unless the switch is 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. Moulded Case Circuit Breakers

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.

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:

- Under voltage trip
- Shunt trip
- Alarm switch
- Auxiliary switch

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

- Handle interlock to prevent unnecessary manipulations of the breaker.
- Door interlock to prevent door being opened when the breaker is in ON position
- De-interlocking device to open the door even if the breaker is in ON position.

MCCBs shall have rupturing capacity as specified in drawings and approved by Construction Committee.

3.4. Metering, Instrumentation And Protection.

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

Current Transformers

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 primary current, rated burden and class of accuracy as specified in drawings. Rated secondary current shall be 5A unless otherwise stated. Minimum acceptable class for measurement shall be class 0.5 to 1 and for protection class 10. 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:

- Name and make
- Serial number
- Transformation ratio
- Rated burden
- Rated voltage
- Accuracy class

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 in a neat manner.

Potential Transformer

PTs shall confirm to IS 3156 (Part-I,II and III) in all respects.

Measuring Instruments

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 -10^0 C and + 50^0 C. Meters shall be flush mounting and shall be enclosed in dust tight housing. The housing shall be of steel or phenolic 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.

Ammeters shall be capable of carrying substantial over loads 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.

Watt meter

Wattmeter shall be of 3 phase digital type and shall be provided with a maximum demand indicator if required.

Power factor meters

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.

Energy and reactive power meters

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 to make or break the normal circuit current with which they are associated. 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 Construction Committee for approval.

Over current relays

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 50 to 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.

Earth fault relay

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

Under voltage relay

Under voltage relays shall be of induction type and shall have inverse limit operation characteristics with pickup voltage range of 50 to 90% of the rated voltage.

3.5. Power Factor Correction Capacitors

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 415 volts 50 HZ supply and shall be available in single and three phase units of 5, 10, 15, 20, 25 kVAR 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 hours cycle.
- Current overloads shall be 15 % for continuous operations and 50% for six hours in a 24 hours cycle.
- Over load of 30% 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. MEDIUM VOLTAGE SWITCH BOARDS

4.1 General

Main LT Panel shall be supplied as per BOQ, specifications & drawings (SLD). Main LT Panel shall be 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 auto load management/ auto load sharing as required Hardware & Software (as per the BOQ) to achieve the auto start/ stop of DG Sets, auto changeover, bus coupler switching & interlocking of incomer & bus coupler breakers of Main LT Panel**.**

- All medium voltage switchboards shall be suitable for operation at three phase/three phase 4 wire, 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 Switch Board Configuration

- The Switch Board shall be configured with Air Circuit Breakers, MCCB's, and other equipment as required and approved by Construction Committee.
- The MCCB's shall be arranged in multi-tier formation whereas the Air Circuit Breakers shall be 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 Equipment Specifications

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 Constructional Features

- 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 proof to 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 Switchboard Dimensional Limitations

- A base channel 75 mm x 5 mm thick shall be provided at the bottom.
- 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
- The height of the operating handle, push buttons etc shall be restricted between 300 mm and 1800 mm from finished floor level.

4.6 Switch Board Compartmentalization

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.
- Each circuit breaker and MCCB shall be housed in separate 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 for accommodating instruments, indicating lamps, control contactors and control fuses etc. These shall 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.
- Adequate and proper support shall be provided in cable compartments to support cables.

4.7 Switch Board Bus 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 copper shall be 1.25 amps per sq. mm. and for Aluminium shall be .8 amp per Sq. mm. and suitable to withstand the stresses of a 31 MVA fault level or at 415 volts for 1 second or as per schedule of quantities. .
- The bus bars and interconnections shall be insulated with insulation tape/ fiber glass.
- The bus bars shall be extensible on either side of the Switch 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.
- All bus bars shall be colour coded.
- All bus bar connections in Switch 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 Switch Board Interconnections

- 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 copper conductor wires of adequate size to carry full load current shall be used. The terminations of all such interconnections shall be crimped.

4.9 Drawout Features

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 for operation 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 Instrument Accommodation

- 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.
- For MCCB's instruments and indicating lamps can be provided on the compartment doors.
- 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 Cable Terminations

- Knockout holes of appropriate size and number shall be provided in the Switch Board in conformity 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 Space Heaters

The Switch Board shall have in each panel thermostatically controlled space heaters with a controlling 15 amp 230 volt switch socket outlet to eliminate condensation.

4.14 Earthing

A main earth bar of G.I./copper as required shall be provided throughout the full length of the Switch Board with a provision to make connections to the sub-station earths on both sides.

4.15 Sheet Steel Treatment And Painting

- 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 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 not be less than 50 microns.

4.16 Name Plates And 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.

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 entry of 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 in front of and along the full length of the Switch Board. The width of the matting shall be 1000 mm. The rubber mat shall withstand 15 KV for 1 minute and leakage current shall not exceed 160 mA/sq. metre.

After installation the Switch Board shall be tested as required prior to commissioning.

4.18 <u>Testing & Commissioning at site by third party</u>

a) Alignment of panel, interconnection of Bus bars and tightness of bolts and connection.

b) Inter panel wiring

c) Free movement of ACB/MCCB/SFU

d) Operation of breakers

e) Insulation Tests

f) Primary & secondary injection tests of relays.

g) Interlocking function.

BUS DUCT

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 Construction 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 SYSTEM PARAMETERS

Bus ducts shall be suitable for following system parameters:

Bus bars	:	0.8 /1 A
Nominal voltage	:	415 Volts
Number of conductors	:	3 Phase 4 wire
Maximum system voltage	:	500 Volts
Power frequency withstand	:	2500 Volts
Temperature rise	:	35^0 C above 45^0 C ambient (bus temperature 80^0 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 without deformation. Bus bars shall be of electrical wrought aluminium of cross section calculated to allow temperature rise as specified above taking all de-rating factors into consideration. Maximum bus bar temperature shall not exceed 120^OC during system short circuits for more than 3 seconds and less than 5 seconds. Bus bars shall be held as close as possible to minimize reactance. Insulation shall be capable for withstanding 130^0C without deterioration. Design shall

allow for expansion of adjacent bus bars and enclosure. Design shall permit a misalignment of 12 mm at 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 suitably rust 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 regular intervals. 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 KV SWITCHBOARDS

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. STANDARDS AND CODES

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.

11000 volt Circuit Breaker IS 13118; 1991

Metal Enclosed Switchgear and Control gear for voltages above 1000 volts IS 3427 : 1969

Electrical Relays for Power System Protection IS 3231 : 1986

Voltage Transformers IS 3156 : 1978

Current Transformers IS 2705 : 1981

Rubber Mats for Electrical Works IS 5424 : 1983

Danger Notice Plate IS 2551 : 1982

3. 11000 VOLT CIRCUIT BREAKERS

3.1 Technical Parameters

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 symmetrical breaking capacity of 350 MVA at 11000 volts or as stipulated in schedule of quantities.

3.2 Technical Specifications

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.

The Circuits Breaker shall be suitable for switching duty of Transformers

4. CIRCUIT BREAKER CONSTRUCTIONAL FEATURES

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.

Each withdrawable truck shall have its own Circuit Breaker.

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 withdrawal and 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

Sheet steel barriers shall be provided between

- Instrument Panel and Potential Transformer
- Instrument Panel and Current Transformers
- Busbar chamber and Circuit Breaker compartments

5. CIRCUIT BREAKER OPERATING MECHANISM

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.

Mechanical ON/OFF position indication shall be provided on the front of the circuit breaker.

The operating mechanism shall be mounted on the front panel of the truck.

The operating handle and the mechanical trip push button shall 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. CIRCUIT BREAKER INTERLOCKING

Each Circuit Breaker shall be provided with the following mechanical safety interlocks to ensure protection to the equipment and the operator.

The Circuit Breaker cannot be closed unless it is in the 'PLUGGED IN' position.

The Circuit Breaker cannot be withdrawn from or pushed into the housing unless the main contacts are open.

The Circuit Breaker cannot be put into service without making the secondary connections between the truck and housing.

The cover of the drawout voltage transformer cannot be opened unless the transformer is isolated.

7. CIRCUIT BREAKER AUXILIARY CONTACTS

The Circuit Breaker shall have a minimum of 6 N.O. and 6 N.C. auxiliary contacts rated at 5 amps. These contacts shall close before the main contacts when the Circuit Breaker is plugged in and vice versa when the Circuit Breaker is lowered.

8. PROTECTIVE RELAYS

The Circuit Breaker shall have over current, earth fault protection and auxiliary relay devices as required and approved by Construction Committee. These relays shall be mounted flush on a separate compartment with access from the rear for wiring and maintenance.

9. POTENTIAL AND INSTRUMENT TRANSFORMERS

A drawout type cast resin voltage 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 Construction 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 Construction Committee 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.

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.

LED type indicating lamps shall be provided for phase and other operational indications.

11. TYPE TEST CERTIFICATES

The Contractor shall submit type test certificates of the Circuit Breakers complying to the relevant Indian Standards from a recognised Test House.

12. 11 KV SWITCHGEAR PANEL

12.1 General

The switchgear panels shall be suitable for operation at 11000 volt 3 phase 50 Hz supply system with a short circuit withstand 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 Switchgear Configuration

The panel shall be configured with 11,000 volt Circuit Breakers, associated metering and protective devices and other equipment and approved by Construction Committee.

Each 11,000 volt Circuit Breaker shall be housed in an individual panel in single tier formation.

12.3 Equipment Specifications

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 Constructional Features

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 and vermin proof. All doors and covers shall also be fully gasketed with synthetic rubber 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 Switchgear Panel Limitations

A base channel of 75 mm x 5 mm thick shall be provided at the bottom.

The Switchgear Panel height shall normally be restricted to a maximum of 2300 mm.

12.6 Switchgear Panel Compartmentalisation

The Switchgear 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.

Each Circuit Breaker shall be housed 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 Switchgear Panel Busbars

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.

All busbars and interconnections shall be colour coded.

The main horizontal busbars shall run through the entire length of the Switchgear Panels.

12.8 Switchgear Panel Interconnections

All interconnections shall be with solid electrolytic copper of adequate size to carry the full rated current and fibre glass insulated.

12.9 Drawout Features

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 safety and compliance to the relevant Standards.

12.10 Switchgear Panel Interlocks

Each group of busbars and feeder connections shall be fitted with automatically operated safety shutters 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.

Padlocking provision of the shutter in the closed position shall be included for maintenance purposes.

12.11 Instruments And Protection Relays

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.

LED type indicating lamps shall be provided for phase and other operational indications.

The current transformers for metering and protection shall be mounted on the solid copper busbars with proper supports.

12.12 Switchgear Panel Internal Wiring

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 Cable Terminations

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 Space Heaters

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 Designation Labels

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 Sheet Steel Treatment And Painting

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) Auxiliary switch with 5NO + 5NC contacts.
ii) Mechanical operation counter
iii) Spring charging handle
iv) Recharging in/out handle
v) Foundation bolts
vi) Maintenance manual
vii) Instruction manual

12.19 Auxiliary supply

a) The tipping shall be at 24 V DC through a battery bank unit

b) Space heater, Indication and other auxiliary supply shall be through to 230 V AC

12.20 Site Test by third party

a) Alignment panel, interconnection of bus bar and tightness of bolts and connection

b) Inter panel wiring

c) Free movement of circuit breaker trolley

d) Manual/electrical operation of the breaker

e) Megger test

f) CT/PT ratio/Polarity primary injection test.

g) Secondary injection test on relays

UNITIZED COMPACT SUB-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. Specific requirements shall be in accordance with single line diagram/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 latest revision of the following Indian and British standards:

IEC 60694:	Common clause for High Voltage switchgear and low voltage switchgear.
IS 13118/IEC 62271-100	High Voltage alternating current circuit breakers.
IS 12729/IEC 62271-200	AC metal enclosed switchgear and control gear for rated voltages above 1kV and upto and including 52kV.
IEC 62271-202	High-Voltage/Low-Voltage prefabricated substation.
IS 9921/IEC 60129	AC switches and earthing switches.
IS 9920/IEC 60265	Switches and disconnectors.
IEC 60420	Combined switch/disconnectors.
IEC 60420	High voltage fuses.
IS 2705/IEC 60185	Current Transformers.
IEC 60060	High voltage test procedures.
IEC 60529	Classification of degrees of protection for enclosures.

D. In case of imported equipment standards of the country of origin shall 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 statutory regulations currently in force in the country.
F. BS/IEC or IS not mentioned above but are applicable to this installation shall also apply.

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. Factory and site testing procedures and report formats shall also be included.
E. Preparation of bill of materials for Different Items.
F. Interconnection drawing.
G. Protection co-ordination drawings/tables for complete power system.

H. Shop inspection and testing procedures.
I. Field-testing and commissioning procedures.
J. Preparation of as built drawings for the services the contractor is rendering.

Any other work/activity, which is not listed above; however is necessary for completeness of electrical system.

PART 2 – PRODUCTS

2.1.0 COMPACT VCB

2.1.01 DESIGN CRITERIA

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 11KV distribution 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 SPECIFIC REQUIREMENT

The Non-Extensible ring main unit suitable for Indoor/Outdoor installation requirement of 11KV, 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 stored energy mechanism for operation. It shall have arrangement for terminating up to 300 mm^2 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 mm^2 11KV, 3C PILC/XLPE cables.
c) Providing right angled reusable boot for terminations (3x3 nos.)

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 per statutory limits governed by Indian Electricity Rules 1956 with latest amendments in force.

2.1.04 GENERAL FINISH

The equipment should be totally enclosed, metal clad, vermin and dust proof suitable for tropical climate use as detailed above. The body of the RMU Unit should be of metalised cast resin tank /stainless steel and should be rust free.

2.1.05 PAINTING

The surface of all metallic parts shall be thoroughly cleaned, scrapped and degreased preferably by 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 grey enamel paint or RAL 9002. The paint shall withstand 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 rating of 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 BREAKING AND MAKING CAPACITY

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 full load current and shall have fault making capacity of 52.5 KA peak. In case of asymmetrical breaking capacity, DC component shall be indicated by bidder in the offer.

2.1.08 TYPE OF EQUIPMENT

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. All medium voltage parts should 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 / Breaker ON-OFF, Earth, & 'SF6 gas pressure low' indication etc. shall be provided.
D. Handle operated 'spring assisted' or 'spring charged' mechanical operation shall be provided.
E. SF6 Insulation: Switchgear housing shall be completely gas tight.
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. The RMU Unit should be SCADA compatible for our future use.

2.1.09 BUSBARS

The busbar shall be SF6 insulated type. The cross sectional area of the copper busbar and jointing 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. Each load break switch shall be of the triple pole, simultaneously operated, non- automatic type with 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 pad locking 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 during its lifetime.
G. The switches should be designed such that they can be operated remotely if required by providing motor drives in future.
H. The technical particulars of switch are:
I.

a)	Construction per phase	SF6-Single Break
b)	Current Capacity	630A
c)	Making Capacity	52.5 KA(peak)
d)	Breaking capacity normal load current	630A (0.7 pf)
e)	Short time rating	21 KA for 3 second
f)	Short circuit current making capacity (KAP)	52.5KA
g)	Impulse withstand voltage to earth between poles.	75 kV
h)	Power frequency withstand voltage to earth and between poles	28kV RMS

2.1.11 SF6/VACUUM CIRCUIT BREAKER

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 pad locking 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 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. Breaker shall be provided with a shunt trip coil suitable for 230VAC supply.
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 a fuse 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. The technical particulars of the Circuit Breaker shall be as followed:

a)	Construction	SF6/Vacuum Single Break
b)	Current capacity	630A
c)	Making capacity	52.5 kA
d)	Short time rating	21kA for 3 Sec.
e)	Impulse flashover withstand voltage	75kV peak
f)	Power frequency withstand voltage	28kV (rms)
g)	Current Transformer	11kV tape wound
	a) CT ratio	250 / 1A
	b) Over current factor	To correspond to breaking capacity
	c) Class of accuracy	Class X suitable for self powered relay
	d) Impulse flash over withstand voltage	75kV (peak)
	e) Power frequency withstand 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 protecting transformers of rated power from 160 KVA.
i)	The circuit breakers shall be provided with interlocked earth switch	
j)	Three Nos. CT.s on the bushings in case of cable mounted ring CT's adequate insulation shall be provided to the full rated voltage of the RMU, including impulse withstand voltage.	

2.1.12 FAULT PASSAGE INDICATORS (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 OPERATIONS AND INTERLOCKING

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. Operation handle shall be considered as part of the unit and should be provided with each RMU.
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. All mechanical interlock shall be robust so as not to give any way during normal operation.
G. Thetripping of breaker unit should be provided with push button.

2.1.14 EARTHING ARRANGEMENT

A. It shall be easily possible to test cables of Isolators without opening cable compartment covers & without disconnecting cables.
B. Equipment earthing of copper strips of adequate size shall be provided.

2.1.15 CABLE BOXES

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 mm^2 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/push on type/cold shrinkable type termination's can be adopted.
C. Earthing: All ring main units shall have a special earth bar with a sectional area of not less than 100 mm^2 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 mm^2 section.
D. The manufacturer shall supply all foundation bolts, nuts and washers necessary for installation.
E. Removable eyebolts shall be provided to facilitate the handling of the RMU/tee-off unit/ SF6 isolators.
F. Labels: All RMUs shall be clearly labelled as required indicating where necessary their purpose and "ON" and "OFF" lettered on brass, ivory, enamel iron 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 as per the relevant standards and during manufacture and on completion.

Routine Test

The tests shall be carried out in accordance with IEC 62271-200 include but not necessarily limited to the following:

i. Withstand voltage at Power Frequency for all current carrying parts including wiring
ii. Measurement of resistance of the main circuit
iii. Gas Leakage test
iv. Withstand voltage on auxiliary circuits
v. Operation of functional locks, interlocks, signalling devices and auxiliary devices
vi. Suitability and correct operation of protections, Control instruments and electrical connections of the circuit breaker operating mechanism.
vii. Verification of wiring
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.

Type Test

The following type test should have been conducted on Ring Main Unit inline with IEC 62271-200.

i. Short time current test on main circuits
ii. Short time current test on earthing circuit
iii. No load operation and mechanical endurance test
iv. Impulse withstand test 75kV rms (1 min.)
v. Temp rise test

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 11/0.415 OIL TYPE DISTRIBUTION TRANSFORMER

2.2.01 GENERAL

1

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 CODE AND STANDARDS

The transformer shall comply with the latest edition of the following and other relevant Indian Standards / Manual:

IS 335;	Insulating oil
IS 1271:	Thermal evaluation and classification of electrical insulation
IS 2026:	Power Transformers
IS 2099:	Bushing for alternative voltages above 1000V
IS 2705:	Current transformer
IS 3347:	Dimension for porcelain transformer bushings.
IS 3637:	Gas operated relays
IS 3639:	Fitting and accessories for power transformers
IS 4201:	Application guide for CTs
IS 6600:	Guide for loading of oil immersed transformer
IS 8478:	Application guide for ON load tap changers
IS 8468:	On load tap changers
IS 10028:	Code practice for selection, installation and Maintenance of transformer
IS 13947:	LV Switchgear and Control gear-Part-I General rules CBIP Manual on transformers
IS 2074:	Ready mixed paint, air drying red oxide, zinc chrome priming
IS 5:	Color of ready mix paint
IEC 76:	Power transformer
IEC 76.2 or IEC	Temperature limits
IEC-76-1 or IEC 726 or IS: 2026	All Parts
IEC-298, or IEC 466	High voltage Switch gear and Control gear
IEC-947-1, IEC-439-1	Low voltage Switch gear and Control gear
IS:1180 IS:2026	For distribution transformers
IEC-550 (151): 1978, IS: 1885	SEV Chapter 151 Electro magnitude devices.
IEC-60-1: 1989	High voltage test Technique Part-I.
IS: 2017 Part I	General definition and test requirements.
IEC-68-2-62: 1991	Environmental testing – part 2, tests impact amendment I (1993)

IEC-71-2: 1976, IS: 3716	Insulation co-ordination Part 2 Application guide
IEC: 76-1:1993, IS: 2026 (Part I)	Power transformer Part I general
IEC 76-2:1993	Power transformer Part 2 temperature rise.
IEC 76-5, 1976	Power transformer Part 5 ability to withstand short circuit test
IEC: 243-1,1988:	Methods of tests for Electric strength of solid insulating
IS: 258-1	Material Part – I tests and power frequencies.
IEC: 354:1991: IS: 6600	Loading guide for oil immersed power transformer.
IEC: 551:1987: IS: 13964	Determination of transformer and reactor sound level.
IS: 2932:	Enamel synthetic, exterior a) under coating b) Finishing
IS: 3347:	Dimension of porcelain transformer bushing for use in very heavily polluted atmosphere

Transformer shall also conform to the provisions of the latest revisions of the Indian Electricity rules and any other statutory

TRANSFORMER

Outdoor transformer shall be step down transformer from 11 KV to 0.415 KV three phase 50 cycles copper wound. Transformer shall be having high efficiency, low magnetic field and impedance shall be as per IS & transformer shall conform to IS 1180 of level II in 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 and star on secondary side having automatic on load tap changing device high tension side for tapping +5% and -15% at step of 2.5% (Eight tappings, 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 regulating relay.

b) OLTC conservator with drainage valve, filling hole with cover and silicagel breather and oil level indicator.

c) Oil conservator with sump and drain valve with cover plate.

d) Dehydrating breather with silica gel and oil seal.

e) Oil filling valve 32mm with cover plate.

f) Thermometer pockets.

g) Diagram, rating plate, terminal marking plate.

h) Two earthing terminals.

i) Lifting lugs for active part only.

j) Four bi-directional plain rollers.

k) First filling of oil.

l) Double diaphragm explosion vent with sight glass.

m) 150mm dial type winding temperature indicator with maximum reading pointer and alarm and trip contacts.

Pocket for above item.

n) Plain oil level gauge with minimum level marking.

o) Air release plug on tank cover.

p) .P. thermo junction box.

q) Detachable radiator with top and bottom stop valves and drain and air release plugs.

r) 150mm dia type oil temperature indicator with maximum reading pointer and alarm and trip contact.

s) 150mm dia magnetic oil level indicator with low level alarm and trip contacts and minimum filling and maximum level markings.

t) Jacking pads with haulage holes.

u) Base channel with viewing holes.

v) Drain cum bottom filter valve 32mm with cover plate.

w) 11 KV cable end box available for 1 No. 3 core x 240 Sq.mm XLPE cable in H.T. side.

x) Provision for 3200Amp 10nos 3.5x300sqmm XLPE –Al armoured cable.

y) 100VA, 440/110 V Transformer for RTCC.

z) Extra neutral bushing for solid earthing.

aa) Neutral CT in separate box with terminal brought in for connection.

ab) Pressure equaliser pipe.

The transformer be rated for a maximum temperature rise of 50 Deg. C for oil and 55 Deg. C for winding over 45 Deg. C ambient temperatures.

The transformer shall conform to the IS: 335 and 1180,of 2018

TRANSFORMER LOSSES:

12.1 The no load losses in kilowatt at rated voltage and frequency and the load losses in kilowatt at rated full load current and frequency at 75 Deg. C shall be guaranteed to **5.05 kW at 50% Load and 15 kW at 100% load** respectively respectively with tolerance as per IS-1180 of level -II

12.2 In case during testing the actual losses are found within guaranteed figure the transformers shall be accepted without any advantage to contractor for lower loss.

12.3 Where actual losses during testing are found in excess of maximum guaranteed figures, 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 in tender documents.

Measurement of losses shall form part of type test/routine/ acceptance test. The losses of first and 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.

The supplier shall supply two copies of the type test/routine test certificate to each consignee with each transformer on receipt of dispatch instructions.

WINDINGS

Windings shall be subjected to shrinking and seasoning 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.

Windings and connections shall be braced to withstand shocks during transport or short circuits.

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 inside oil shall be made of oil resistance material which 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) Full vacuum of 760mm of Hg. for filling with oil by vacuum.

b) Internal gas pressure of 0.35 Kg/cm2 (5 lbs/sq.in) with oil at operating level.

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.

Adequate 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.

Tank shall be provided with valves etc. 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. Explosion vent shall be equipped with remote monitoring/alarm contracts with oil indicator.

The transformer be rated for a maximum temperature rise of 50 Deg. C by thermometer in oil 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.

ON LOAD TAP CHANGING (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 OLTC oil chamber shall have oil filling and drain plug, relief vent 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) Manual Control

The cranking device for manual operation of OLTC gear shall be removable and suitable for operation by a man standing on ground level. The mechanism shall be complete with the following:

a) Mechanical tap position indicator which shall be clearly visible from near the transformer.

b) Mechanical operation counter.

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) Electrical Control

The includes the following:

a) Electrical local control from transformer marshal box.

b) Electrical remote control from remote control (RTCC Panel).

c) The control scheme shall have the following features:

i) An interlock to cut off electrical control automatically upon recourse being taken to manual control.

ii) Selection of point of control local or remote, it shall not be possible for any two electrical controls to be in operation at same time.

d) Reinforcement of the initiating impulse for a tap change, ensuring a positive completion once initiated.

e) Step by step operation, ensuring only one tap change for each tap changing command.

f) An interlock to cut off the electrical control when it tends to operate the gear beyond 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 it shall 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 mechanism box or in Transformers marshalling 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.

Tap position indicator shall be supplied loose for mounting on the RTCC.

On the RTCC there shall be following components also:

i) Raise/Lower switch for manual operation.

ii) Lamp indicating ON LOAD TAP CHANGE in 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.

OLTC shall have individually separate breather.

The external surface of transformer shall be painted with epoxy paint shade of IS: 631.

The installation, testing and commissioning shall conform to IS Code of Practice 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 transformer shall be lifted by lugs or shackles or by any other suitable means (such as 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 be choked 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 the oil, 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 results shall 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 a sample from individual transformer and till the result is not found to satisfaction of Engineer, oil conditioning shall have to be carried out.

d) Jack for the above transformers shall have to be provided by the Contractor.

e) If vacuum oil filling in transformer is envisaged the Contractor shall arrange the necessary equipment.

f) All the cable terminations and control wiring is to be carried out by Contractor.

<u>CONTROL WIRING</u>

The Contractor shall supply and install, test and commission all control/instruments wiring as found necessary. The job is turnkey and shall remain the responsibility of Contractor to ensure its functioning in useful and defined manner.

All the indoor control wiring shall have copper conductor and 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.

VECTOR GROUP

Transformer shall have vector group of Dyn 11

TESTS:

Transformers shall be subjected to routine & type tests as specified in IS 1180, IS 11171 iec – 726 & given below:

Routine tests:

a) Turns ratio measurement at various taps
b) HV and LV winding resistance
c) Checking of vector group
d) Insulation Resistance Test
e) No Load Loss & No Load current measurement.
f) Measurement of Load losses at 25%, 50%, 75%, 100% & 110%.
g) Impedance voltage and impedance.
h) Separate source voltage withstand test
i) Induced over voltage withstand test.
j) Partial discharges 25 PC upto 1.2 times of the rated voltage.
k) Heat Run Test

Type tests:

a) Impulse voltage withstand test.
b) Short circuit test.
c) Measurement of acoustic noise level.
d) Leakage Test (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 are conducted and approval of local authorities is obtained.

Tenderer may submit type test certificates conducted on similar rated transformers for bid validation.

TESTING AND INSPECTION

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 Construction Committee.

b) Contractor shall ensure that type tested equipment is only offered and routine test shall be conducted as per relevant standards in presence of the Construction Committee.

DRAWING AND INFORMATION

The vendor shall furnish following drawings/documents in accordance with enclosed requirement.

a) General arrangement of transformer.

b) General arrangement of HV cable box with connection diagram.
c) General arrangement of LV bus-duct and connection arrangement.
d) General arrangement of marshelling box and wiring diagram.
e) Rating and diagram plate indicating % impedence etc.
f) Type test and guaranteed technical parameters.
g) Reactance, resistance and capacitance.
h) The initial charging current (in rush current).
i) Calculation for transformer such as core sizing, flux density, turn ratio & sizing of transformer.

QUALITY ASSURANCE

Quality Assurance shall follow the requirements of Society as applicable. Quality assurance involvement will commence at enquiry and follow through to completion and acceptance thus total 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 ENCLOSURE FOR PACKAGE SUBSTATION

The package substation shall have the following features.

A. Enclosure for the package substation shall be made of galvanized iron type, 2mm thick minimum.
B. Separate compartment for 11 kV compact VCB, Distribution Transformer & LT Switchgear
C. Door of the HT and LT compartment shall be designed such as complete door is divided into minimum two fold / parts vertically for minimum space requirement while opening.
D. Metal base of 4mm hot dip galvanized or CRCA steel shall be provided.
E. The colour of enclosure shall be cream (RAL 1001).
F. Structure of the substation shall be able to withstand the gross weight of all equipment.
G. The roof of the substation shall be designed to support loads up to 250kg/m^2.
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. Protection degree of the enclosure for MV & LV compartments shall be IP54.
J. Protection degree of the enclosure for Transformer compartment shall be IP24D.
K. Louvers shall be designed for natural ventilation and thermal Class K10.
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. LV interconnection should be by means of Aluminium busbars.
N. Internal earthing circuit shall be provided by means of Al. (50x6mm) busbars.
O. Internal lighting shall be provided for MV & LV compartments.
P. Design of Transformer Compartment shall be such to accommodate oil type transformers.
Q. Non-metallic barrier shall be provided between MCCB.
R. Non-metallic phase separator shall be provided between the three phases connected to MCCB.
S. Suitable cut out shall be provided on LT compartment for installing meters etc.
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 compact to meet the traffic and road requirements.
U The bidder has to specify the total weight of the Packaged Substation.

2.3.0 RELAY CO-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. Routine Test

The tests shall be carried out in accordance with IEC 62271-202 include but not necessarily limited to the following:

i. Dielectric test on the HV interconnection.
ii. Test on auxiliary and control circuits.
iii. Functional tests.
iv. Verification of correct wiring.
v. Test after assembly on site.

B. Type Test

The tests shall be carried out in accordance with IEC 62271-202 include but not necessarily limited to the following:

i. Tests to verify the insulation level of the prefabricated substation.
ii. Tests to prove the temperature rise of the main components contained in a prefabricated substation.
iii. Tests to prove capability of the main and earthing circuits to be subjected to the rated peak and rated short-time withstand currents.
iv. Functional tests to prove satisfactory operation of the assembly.
v. Tests to verify the degree of protection.
vi. Test's to verify the withstand of the enclosure of the prefabricated substation against mechanical stress.
vii. Internal arc test.
viii. EMC compatibility tests.
IX. Type test certificate of PSS, if so desired by the customer, shall be furnished.

C. Test Witness

All tests shall be performed in presence of Construction 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. Test Certificates

Certified reports of all the tests carried out at the works shall be furnished in three (3) copies for approval of the Construction Committee.
The equipment shall be dispatched from works only after receipt of Construction Committee written approval of the test 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 REJECTION OF EQUIPMENT

A. Deviation from specification must be stated in writing at the quotation stage.
B. In absence of such statement, it will be assumed that the requirements of the specifications are met 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 Construction Committee may reject the item or defective component thereof, whichever is considered necessary, and after adjustment or modification as directed by the Construction 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 Construction Committee. Delivery of panel boards on site without significant cable connection (Say 80%) shall not entitle progress payment certified for material delivery on site.

TECHNICAL SPECIFICATIONS FOR CABLE TRAYS

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 Construction 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 tiers shown in tray layout drawings. Spacing between horizontal supports arms of vertical tray runs to be 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 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 by red oxide followed by the same finishing paint. Steel sheet covers wherever indicated to be similarly painted. Trays shall be erected 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

run of cable tray shall be completed before laying of cables. Cable trays shall be erected so as to be exposed and accessible.

TECHNICAL SPECIFICATIONS FOR EARTHING

1. GENERAL

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.

The Earthing System shall in totally comprise the following:-

a) Earth Electrodes

b) Earthing Leads

c) Earth Conductors

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.

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. EARTHING MATERIAL

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 solid or stranded copper wire is used it shall be of the grade ordinarily required for commercial electrical work generally designated as being of 98% conductivity when annealed, conforming to Indian standard specifications.
- Galvanised Steel - Galvanised steel used shall be thoroughly protected against corrosion by hot dipped Zinc coating. The material coating shall withstand the test specified in IS 2309:1969.

- The strips to be used shall be in maximum lengths available as manufactured normally avoiding unnecessary joints.

4 EARTH ELECTRODES

- **Plate Earth Electrode**

The plate electrodes shall be of copper/ GI as as per drawing approved by the Construction 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.

- **Earth Electrode Pit**

Method of Installing Watering Arrangement

In the case of plate earth electrode, a watering pipe of 20 mm dia of medium class G.I. Pipe shall be provided and attached to the electrode. A funnel with mesh shall be provided at the top of this pipe for watering the earth. The watering funnel attachment shall be housed in masonry enclosure of not less than 300 x 300 x 300 mm. A RCC frame base with removable RCC cover slab M-25- 4nos- 10mm dia -M.S. reinforcements bar at top & bottom both way shall be suitably embedded in the masonry enclosure

Location of Earth Electrode

The following guidelines shall be followed for locating the earth electrodes

An earth electrode shall not be situated less than 5 metres from any building.

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.

The location of the earth electrode shall be such where the soil has reasonable chance of remaining moist, as far as possible.

Entrances, pavements and road ways shall not be used for locating the earth electrode.

Number of Earth Electrodes

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. EARTHING LEADS

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.

- **Earthing Lead Sizes**

  Strip earthing leads shall be of copper/GI and as per specifications.

- **Earthing Lead Installation**

  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.

- **Method of Connecting Earthing Lead To Earth Electrode**

  In the case of plate earth electrode the earthing lead shall be securely bolted to the plate with 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 in case of GI Pipe and GI plate earth electrodes or tinned brass in case of Copper plate electrode.

- **Protection of Earthing 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 to 60 cm in case of road crossing or pavements). The portion within the building shall be recessed in walls and floors to adequate depth.

6. EARTHING CONDUCTORS

Earthing conductors shall form the earthing network throughout the installation for earthing of all non- carrying metal parts.

Connection of Earthing Conductors

- Main earthing conductors shall be taken from the earth connections at the main switch 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 earth leakage circuit breaker.
- Metal conduits, cable sheathing and armouring shall be earthed at the ends 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.

- **Earthing Conductor Installation**

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.

Joints shall be riveted and brazed in approved manner.

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.

- **Sizing of Earthing Conductors**

All fixtures, outlet boxes and junction boxes shall be earthed with Bare copper 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 rating 200 amps and above shall be earthed with a minimum of 2 Nos. separate and independent 25 mm x 3 mm copper/25mm x 6 mm GI tape.

7. PROHIBITED CONNECTIONS

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. RESISTANCE TO EARTH

No earth electrode shall have a greater ohmic resistance than 1 ohms 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.

ROUTINE AND COMPLETION TESTS

1. INSTALLATION COMPLETION TESTS

At the completion of the work, the entire installation shall be subject to the following tests:

1. Wiring continuity test
2. Insulation resistance test
3. Earth continuity test
4. Earth resistivity test

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.

2. WIRING CONTINUITY TEST

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

3. INSULATION RESISTANCE TEST

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 direct or 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. TESTING OF EARTH CONTINUITY PATH

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 along with 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. TESTING OF POLARITY OF NON-LINKED SINGLE POLE SWITCHES

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 switch is fitted to one of the outer or phase conductor of the supply. The entire electrical installation shall be subject to the final acceptance of the Construction Committee as well as the local authorities.

6. EARTH RESISTIVITY TEST

Earth resistivity test shall be carried out in accordance with IS Code of Practice for earthing IS 3043.

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 above tests are to be carried out by the contractor without any extra charge.

8. TESTS AND TEST REPORTS

The Contractor shall furnish test reports and preliminary drawings for the equipment to the Construction 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.

TECHNICAL SPECIFICATION FOR LIGHTNING PROTECTION WORKS

1. LIGHTENING PROTECTION SYSTEM ESE ION STREAMER Advanced Lighting Protection System (Based on French Standards)

1.1 SCOPE OF WORK

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 system should complies in accordance with NFC 17-102 standard and shall be installed strictly to the manufacturer's instructions.

The advanced lighting protection system shall include components as follow:

ESE ION Streamer Air terminal

Mechanical supports

Down-conductors

Performance counting Equipment (Electro-mechanical counter)

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 ION STREAMER AIR TEMINAL

The air terminal shall be of the type that responds dynamically to the appearance of a lightning 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.

Arcing is not to be continuous and shall only 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.

The materials of the air termination shall be non-corroding in normal atmosphere.

The ION STREAMER air termination shall not be dependent upon batteries or external power supplies for any part 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 DOWN CONDUCTOR

The down conductor should be used 25 x 3 mm copper strip or min. 50 Sq. mm multi Strain flexible copper wire. Two down conductors shall be used in case of the structure height is 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 termination through 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 LIGTHING FLASH COUNTER

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 in a readily 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 GROUNDING SYSTEM

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 by copper bonded steel core ground rods of min. 17 mm dia., 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 steel of 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.

SURGE PROTECTION DEVICE

Class B surge arrester (BDL/B/65/) for three phase two wire system with discharge impulse current (Iimp as per IEC61643-1 65KA (for 10/350μs) between phase to neutral & 100KA (for 10/350μs) 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.

Earth Enhancement material

Earth enhancement material is a superior conductive material that improves earthing effectiveness, especially in areas of poor conductivity (rocky ground, areas of moisture variation, sandy soils etc.). It improves conductivity of the earth electrode and ground contact area. It shall have following characteristics-

shall mainly consist of Graphite and Portland cement. Bentonite content shall be negligible.

shall have high conductivity, improves earth's absorbing power and humidity retention capability.

shall be non-corrosive in nature having low water solubility but highly hygroscopic.

shall have resistivity of less than 0.2 ohms-meter. Resistivity shall be tested by making a 20cm. cube of the material and checking resistance of the cube at the ends. The supplier shall arrange for such testing at the time of supply, if so desired. Necessary certificate from National / International lab for the resistivity shall also be submitted.

shall be suitable for installation in dry form or in a slurry form.

shall not depend on the continuous presence of water to maintain its conductivity.

shall be permanent & maintenance free and in its "set form", maintains constant earth resistance with time. shall be thermally stable between -10^0 C to $+60^0$ 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 for landfill.

shall not be explosive.

shall not cause burns, irritation to eye, skin etc.

Marking: The Earth enhancement material shall be supplied in sealed, moisture proof bags. These bags shall be marked with Manufacturer's name or trade name, quantity etc.

Backfill material

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 ash shall not be used because of its acidic and corrosive nature.

DOUBLE WALLED CORRUGATED HDPE DUCTS

0.1 This specification is issued under the fixed serial number followed by the year of adoption as standard or in case of revision, the year of latest revision.

0.2 This specification requires reference to the following specifications.

(i)	IS:14930 Pt.-I	:	General requirements of Conduit system for Electrical and Communication installation
(ii)	IS:14930 Pt.-II	:	Particular requirements of Conduit system for Electrical and Communication installation
(iii)	IS:2530	:	Method for test for Polyethylene moulding materials and polyethylene compounds.
(iv)	IS:7328	:	HDPE materials for moulding and extrusion
(v)	IS:12063	:	Classification of degrees of protection provided by enclosures of electrical equipment
(vi)	IS:11000(Pt-2/Sec1)		Glow-Wire Test and Guidance, Test Methods for Fire Hazard Testing
(vii)	ASTM D 1693	:	Test method for environmental stress - cracking of ethylene plastics
(viii)	ASTM D 638	:	Standard test method for tensile properties of plastic
(ix)	ASTM D 790	:	Test method for flexural properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
(x)	ASTM D 2240	:	Standard Test method for Rubber property.
(xi)	ASTM D 648	:	Standard Test method for deflection temperature of plastic under flexure load in the Edgewise Position.

0.3 Whenever reference to any specification appears in this document, it shall be taken as a reference to the latest version of that specification unless the year of issue of the specification is specifically stated.

1.0 SCOPE

This document specifies the requirement and testing for Double Walled Corrugated (DWC) HDPE Ducts buried underground including ducts & duct fittings for protection wherever required for all types of Signalling Cables.

2.0 TERMINOLOGY

Terminology as defined in IS: 14930 shall be followed.

3.0 ABBREVIATIONS

- ASTM : American Society for Testing & Materials.
- CC : Cubic Centimetre.
- DSC : Differential Scanning Calorimeter
- DTA : Differential Thermal Analyzer
- DWC : Double Walled Corrugated
- ESCR : Environmental Stress Crack Resistance
- FTIR : Fourier Transform Infrared Spectroscopy
- g : Gram
- HDPE : High Density Polyethylene.
- Hr : Hour
- IS : Indian Standard.
- Kg : Kilograms
- MFI : Melt Flow Index.
- mm : Millimetre
- OIT : Oxidation Induction Test
- SPN : Specification Provisional Number.
- UV : Ultra Violet.

4.0 GENERAL REQUIRMENTS

4.1 The DWC Duct shall consist of two layers, the outer layer will be corrugated and the inner layer shall be 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 shall provide mechanical protection to Signalling Cables contained therein.

4.4 Within the conduit system there shall be no sharp edge, burrs or surface projections which are likely to damage insulated conductors or cables or inflict impurity to the installer or user.

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, the manufacturer shall indicate whether the system can be disassembled and if, so, how this can be achieved.

5.0 REQUIREMENTS OF RAW MATERIALS USED FOR THE DWC HDPE DUCTS

5.1 The base HDPE resin used for the outer and inner layer of the DWC HDPE Duct shall conform to any designation of IS:7328 or to any equivalent standard meeting the requirements given in Table 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 The anti-oxidants used shall be physiologically harmless.

5.3 None of the additives shall be used separately or together in quantities as to impair long term hysical and chemical properties of the duct.

5.4 Single pass rework material of the same composition produced from the manufacturer's own production may be used and it shall not exceed 10% in any case.

5.5 The raw material used for extrusion shall be dried to bring the moisture content to less than 0.1%.

5.6 Suitable UV stabilizers shall be used only for manufacture of the non black coloured HDPE duct to protect against UV degradation, when stored in open for minimum 8 months period. 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 REQUIREMENT OF DWC HDPE DUCTS

6.1 Visual Requirement: The ducts shall be checked visually for ensuring good workmanship that the ducts shall be free from holes, breaks and other defects. The ends shall be cleanly cut and shall be square with axis 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 supplied in standard length of 6 mtr. ± 1%

6.5 Compression Strength: The conduit system shall have adequate mechanical strength. Conduits when bent or compressed 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. Compliance may be checked with the application of force 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 exposed to impact 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. 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 Bending Strength: The conduit system shall have adequate mechanical strength. 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 checked by passing a ball having a diameter equal to 95% minimum inner diameter of the sample declared by the manufacturer, through the sample whilst it is bent around the test apparatus. Test shall be conducted in accordance to the method given in **Annexure- 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 conducted in accordance to the method given in Annexure- F Combustion shall stop within 30 Seconds.

6.10 Anti Rodent Properties: Safety of ducts from the direct attack of subterranean organism anti 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 method given in Annexure- G

6.11 Resistance to External Influences on DWC HDPE Duct Accessories: 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 1m but not longer than 3m using indelible ink with following.

- Manufacturers name
- Specification No.
- Name of the duct with size
- Lot No. of the Product
- Date of manufacture
- Product Length
- Purchaser's Name/ symbol

7.0 DWC DUCT ACCESSORIES

7.1 The following accessories are required for jointing the ducts and shall be supplied along with the ducts against specific orders. The manufacturers shall provide complete procedure and method for installation of the accessories. The required quantities of accessories are to be mentioned by

the purchasing authority in the purchase order.

7.1.1 Plastic Coupler: 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 without any step formation in the inner surface. The coupler may be straight, bands, T-joints type as per requirements of purchaser.

7.1.2 End Cap: This cap made of suitable plastic material shall be fitted on the both ends of duct, coil after 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 PACKING REQUIREMENT

Stores shall be supplied in standard size for delivery and shall be so packed as to permit convenient handling and to protect against loss or damage during transit and storage.

9.0 TYPE TESTS

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)	Visual Requirement	(Cl. No. 6.1)
b)	Color	(Cl. No. 6.2)
c)	Dimension	(Cl. No. 6.3)
d)	Standards length	(Cl. No. 6.4)
e)	Compression Strength	(Cl. No. 6.5)
f)	Impact Strength	(Cl. No. 6.6)
g)	Bending Strength	(Cl. No. 6.7)
h)	Oxidation Induction Test	(Cl. No. 6.8)
i)	Resistance to Flame Propagation	(Cl. No. 6.9)
j)	Anti rodent	(Cl. No. 6.10)
k)	Resistance to External Influences on DWC HDPE Duct accessories	(Cl. No. 6.11)

9.2 The Oxidation Induction Test, Resistance to Flame Propagating Test, Anti Rodent Test on the DWC duct and Resistance to External Influences on DWC HDPE Duct accessories given in Cl. No. 6.8, 6.9, 6.10 & 6.11 respectively may be conducted at the manufacturer's laboratory by inspecting authority or at any recognized laboratory.

9.3 The raw material tests of the DWC duct given in Cl. No. 5.0 Table-1 for each grade of raw material shall be conducted. Test may be conducted at the manufacturer's laboratory by inspecting

authority or at any recognized laboratory.

9.4 Unless otherwise specified each tests shall be made on three new samples.

10.0 ACCEPTANCE TESTS

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) Visual Requirement (Cl. No. 6.1)

b) Color (Cl. No. 6.2)

c) Dimension (Cl. No. 6.3)

d) Standards length (Cl. No. 6.4)

e) Compression test (Cl. No. 6.5)

f) Impact test (Cl. No. 6.6)

g) Bending test (Cl. No. 6.7)

h) Resistance to Flame Propagation (Cl. No. 6.9)

10.2 The Resistance to Flame Propagating Test on DWC HDPE Duct given in Cl. No. 6.9 may be conducted at the manufacturer's laboratory by inspecting authority or at any recognized laboratory.

10.3 Unless otherwise specified each tests shall be made on three new samples.

11.0 ROUTINE TESTS

11.1 The following tests be carried out by the manufacturer after 240 hrs of manufacture:-

a) Visual Requirement (Cl. No. 6.1)

b) Color (Cl. No. 6.2)

c) Dimension (Cl. No. 6.3)

d) Standards length (Cl. No. 6.4)

e) Compression test (Cl. No. 6.5)

f) Impact test (Cl. No. 6.6)

g) Bending test (Cl. No. 6.7)

h) Resistance to Flame Propagation (Cl. No. 6.9)

11.2 The Resistance to Flame Propagating Test on DWC HDPE Duct given in Cl. No. 6.9 may be conducted at the manufacturer's laboratory by inspecting authority or at any recognized laboratory.

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 inspection and proof to this office shall be produced.

12.2 Inspection and testing shall be carried out by the Construction Committee to ensure that all the requirements of this specification are complied with for the acceptance of the materials offered by the supplier for inspection.

12.3 The Construction Committee shall have free access to the works of the manufacturer and to be present at all reasonable times and shall be given facilities by the manufacturer to inspect the manufacturing of the duct at any stage of manufacture. He shall have the right to reject whole or part 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 at his own premises in accordance with this specification. Failing the existence of facilities at his own premises for the prescribed tests, the manufacturer shall bear the cost of carrying out the tests in an approved laboratory, workshop or test house.

13.0 SAMPLING

13.1 All the length of same nominal size, similar construction and class manufactured from the same material under essentially similar conditions of production shall be grouped together to constitute a lot.

13.2 For judging the conformity of a lot to the requirements of the acceptance tests, sampling shall be done for each lot separately. For this purpose, the number of lengths to be selected 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, sample of duct shall 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

The manufacturer shall warrant the material covered by this specification to be free from defects in design, material and workmanship 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 comply with the requirement of the specification, the whole consignment shall be rejected subject to the discretion of the Construction Committee.

16.0 INFORMATION TO BE SUPPLIED BY THE PURCHASER

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 requirements etc. In such cases necessary tolerance shall also be specified by the Construction Committee.

16.2 Adequate quantity & type of duct accessories shall be supplied along with each lot. The Construction Committee may specify additional requirement.

16.3 Inspecting agency for acceptance of material.

16.4 Colour of the Duct.

ANNEXURE - A

DIMENSION OF THE DWC DUCT

1.0 Compliance of the outside diameter shall be checked using a ring gauge or verniercaliper or any suitable method.

1.1 Compliance of the minimum inside diameter shall be checked by measurement according to two perpendicular diameters on the same section and calculating the average value.

1.2 Outside diameter specified are nominal dimensions.

1.3 Outside diameter maximum is nominal outside diameter + (0.018 x nominal outside diameter values) rounded off to + 0.1 mm.

1.4 Minimum inside diameter is nominal outside diameter divided by 1.33

ANNEXURE - B

COMPRESSION TEST

1.0 Conduits are subjected to a compression test as per IS: 14930 (Pt-II). The tests for conduits shall not be started until 240 hrs after manufacture.

1.1 Samples shall be 200 ± 5 mm long.

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 compressed at a rate of 15 ± 0.5 mm/min and the load recorded at the vertical deflection equivalent to 5% of the average value of the original inside diameter of the sample.

1.4 When reaching the deflection of 5%, the applied force shall be at least 450 N

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. In case of doubt, it will be necessary to measure the inner diameter.

ANNEXURE - C

IMPACT TEST

1.0 Twelve samples of the duct each 200 ± 5 mm in length or fittings are subjected to an impact test as per IS: 14930 (Pt-II) by means of the apparatus shown Figure-1.

1.1 The test apparatus shall be placed on a firm flat surface. The samples shall be conditioned in a 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 chamber and completion of impact shall not exceed 10 seconds. The impact height and mass shall be as follows.

Nominal Size of Conduit	Mass of Striker (+1% /-0%) kg	Fall Height (+0% /-1%) (mm)	Energy Joules
Up to 60 mm	5	300	15
61 to 90 mm	5	400	20
91 to 140 mm	5	570	28
Above 140 mm	5	800	40

1.3 The test sample shall be made on the weakest part of the Duct fittings except that it shall not be applied within 5 mm of any sample entry. Samples of ducts are tested on the centre of their length.

1.4 After the test, at least in nine of the samples, there shall be no crack allowing the ingress of light or water between the inside and the outside.

ANNEXURE - D

BENDING TEST

1.0 This test shall be carried out on pliable conduits.

2.0 The test is made on six samples having an appropriate length as per IS: 14930 (Pt-II). Three samples shall be tested at room temperature; the other three shall be tested at-5 ±1°C. For the test at -5°C, the sample shall be conditioned in a cold chamber for 2 hours. The test apparatus as shown in Figure-2 shall allow to bend the duct with a bending radius equal to the minimum bending radius values specified by the manufacturer. One of the ends of the samples shall be fixed on the test apparatus by means of an appropriate device. The sample is then bent to approximately 90 degree (right angle) and hold.

2.1 During the test, the sample shall not flatten. Compliance shall be checked by passing a ball having a diameter equal to 95% minimum inner diameter of the sample declared by the manufacturer, through the sample whilst it is bent around the test apparatus.

ANNEXURE - E

OXIDATION INDUCTION TEST PROCEDURE

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 then be allowed to cool at room temperature for at least 16 hrs. The samples shall be clean and dry. The sample shall then be tested by means of a Differential Scanning Calorimeter (DSC) or by Differential Thermal Analyzer (DTA).

2.0 Instrument Test Procedure:

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 Temperature Calibration: This has to be done according to the instrument manual.

The temperature scale should be adjusted until the determined melting point of pure Indium metal is 156.6 °C at a heat rate of 5°C per minute or any other heat rate as indicated in the manual of the 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 5 mg 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 Oxidation Test: Rapidly increase the temperature of the sample (20 °C/min or greater) 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 shall be sufficient to provide a clearly discernible slope 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 tangent of the exothermic sloped line with the extended base line will be drawn. 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 TO FLAME PROPAGATION TEST PROCEDURE

1.0 Samples of DWC HDPE Ducts shall be checked by applying a 1KW flame.

1.1 A sample of length 675 + 10 mm is mounted vertically in a rectangular metal enclosure with 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.

A steel rod of 16 + 0.1mm is passed through the sample. It is rigidly and independently mounted and clamped at upper end to maintain the sample in a straight and vertical position. The means of mounting is such as not to obstruct drops from falling onto the tissue paper.

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 The burner is supported so that its axis is 45 + 2^0 to the vertical. The flame is applied to the sample so that the distance from the top of the burner tube to the sample measured along the axis 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 axis of the flame intersects with the axis of the sample.

1.3 The test is carried out on three samples. The flame is applied to the sample for the period specified in Table - 4 and is then removed. During the application of the flame, it shall not be moved except to remove it at the conclusion of the period of the test. After the conclusion of the test and after any burning of the sample has ceased, the surface of the sample is wiped 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 same below the burner, the presence of molten material on the internal or external surfaces shall not entail failure if the sample itself is not burned or charred.

2.0 Compliance of DWC HDPE Duct fittings is checked by using the glow wire test IS:11000 (Part 2/Sec 1). The glow wire shall be applied once to each sample in the most unfavourable position of its intended use, with the surface tested in vertical position, at a temperature of 750^{o}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

ANTI RODENT TEST PROCEDURE:

The test against rodent may be conducted as per following procedures:

The ducts are to be laid underground in fields and also near urban or rural settlements. Therefore they should be exposed to 3-4 most predominant rodent species inhabiting these locations. The test rodent species may include the lesser bandicoot rat, Bandicota bengalensis, The Indian gerbils, tatera indica, the soft furred 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 to be 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 uniform body weight are to be used for the trial. Two different types of testes may be undertaken for all the ducts.

Choice Tests: In this trial the ducts of 15-30 cm length (one sample each of treated and untreated /control sample) are exposed to the test rodents along with food, thus the rodent had a choice between the food and the test duct. This test may be run for longer periods (30-45 days). Tap water should be provided ad libitum to the rodents.

NO Choice Test: The rodents are exposed to the test ducts only and no food is given to the rodents during the period of trial. The test ducts (one sample each of treated and untreated /control sample) are to the exposed to the test rodents. This trail may be run for 5-7 days depending upon the health status of starved test rodents. Tap water should be provided ad libitum to the rodents.

Observation on tooth marks, 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 these animals. Number of cases and the extent of rodent bites / scratch marks in control and

anti rodent treated ducts may indicate the relative deterrent/repellent properties of the test ducts.

ANNEXURE - H

EXTERNAL INFLUENCES TEST PROCEDURE

1.0 The accessories in Clause 7.0 shall be tested for external influences as per IS-12063 for ingress of 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 declared by the manufacturer with a requirement of IP 67.

2.0 Degree of Protection - Ingress of Foreign Solid Objects.

2.1 An assembly is made of DWC Pipes fittings with a short length of DWC Pipes assembled in each entry. Where necessary, the open ends of the assembly are plugged or are not part of the test.

2.2 The assembly shall be tested in accordance with the appropriate test of IS 12063.

2.3 The assembly tested for numeral 6, shall be deemed to have passed the test if there is no ingress of dust visible to normal or corrected vision without magnification.

3.0 Degree of Protection - Ingress of Water.

3.1 An assembly is made of a DWC Pipe fittings with a short length of DWC Pipes assembled in each conduit entry. Where necessary, the open end of the DWC Pipe is plugged, or is not part of the test.

3.2 The assembly shall be tested in accordance with the appropriate test of IS 12063.

3.3 The assembly tested for numeral 7 shall be deemed to have passed the test, if there is not sufficient ingress of water to form a drop visible to normal or corrected vision without magnification.

Table-1

RAW MATERIAL REQUIRMENT

(Cl. 5.0)

S. No.	Parameter	Specified Limit	Test Method
1	Density	0.940 to 0.958 g/cc at 27ºC	IS:2530 or IS:7328
2	Melt Flow Index	0.2 to 1.1 g/10 min at 190ºC, 5 kg load	IS:2530
3	Tensile Strength a Yield	20 N/mm^2 Minimum	ASTM D 638-IV
4	Elongation at Break	600 % Minimum	ASTM D 638-IV
5	Hardness Shore D	Between 60 and 65 units	ASTM D 2240
6	Environmental Stress Crack Resistance	No cracking after 96 hrs.	ASTM D 1693
7	Flexural modulus at 1 % strain	690 N/mm^2 minimum	ASTM D 790
8	Heat Deflection Temperature at 45 g/mm^2	65^0C minimum	ASTM D 648
9	OIT (in Aluminum Pan)	30 minutes minimum	As per Annexure-E

Table-2

DIMENSIONS

(Cl. 6.3)

Nominal Size (mm)	Outside Diameter (mm)	Outside Diameter Tolerance (mm)	Minimum Inside 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

Table-3

SCALE OF SAMPLING

(Clause-13.0)

Lot Size	For dimensional requirements		Other
	Sample size of Defectives	Permissible Number	Acceptance tests
(1)	(2)	(3)	(4)
Up to 300	13	0	2
301 to 500	20	0	3
501 to 1000	32	1	4
1001 to 3000	50	2	5
3001 and above	80	3	7

Table-4

TIME OF EXPOSURE OF THE SAMPLE TO THE FLAME

(Clause-6.9)

Material	**Thickness (MM)**	**Flame Application (Tolerances +1 sec.)**
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

(SECTION –8)

BRIEF SPECIFICATIONS AND

LIST

OF

APPROVED MAKES

BRIEF SPECIFICATION OF BUILDING WORKS

Sr.	Requirements	
A	**Civil Works**	
1	Floor to Floor Height	Maximum 3.05 Mtrs. at all levels except at ground floor which shall be 3.35 measured once and basements as specified in drawings.
2	RCC	As per Structural Design (design mix from approved laboratory) and specifications by Structural Consultant. All RCC works shall be conforming to IS Standards.
3	Reinforcement	As per requirement of design, approx. 6 kg/sq. ft. of built up area. The actual reinforcement consumption shall be as per the structural drawing / BBS.
4	Brick work with Coarse Sand	As per specified in Drawings (approved AAC blocks.) cement mortar or as recommended by Structural Consultant.
5	Plaster with Coarse Sand	Internal Plaster (12-15 mm thickness for wall) - Cement Mortar 1:6 (1 Cement : 4 Fine Sand of 0.8 fm or more: 2 coarse sand) Ceiling Plaster (6mm thick) - Cement Mortar 1:3 (1 Cement : 3 Fine Sand of 0.8 fm or more External plaster is not required for aluminium shuttering. If the quality of R.C.C. is not up to the mark & plaster is needed then it will be contractor's scope at no extra cost. Contractor will do external plaster wherever conventional shuttering will be used but the quality will be same as of aluminium 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 of approved make (Type). **For lift lobbies –** On all Floors – Baroda Green with combination of Tiles, stones (Flooring and Dado & Lift facia) as approved by owner. **Main Staircase & Fire Escape Staircase –**Kota Stone on all floors (treads & risers (in single stone), landings and skirting). Staircase railing will be of MS. Weight of railing approx. 10 kg. per RM. **For Foyer / Entrance Area –** Kota Stone with combination of Tiles, stones (this may include Italian stone, Granite, Imported vitrified Tiles.) Glazing, paneling, False ceiling as per drawing/approval of consultant/owner.
7	Dado / Wall Tiles	Ceramic Tiles of approved make (up to door height) and matching floor tiles in toilets and up to 2' above kitchen platform and below sink area.

8	Kitchen platform & Kitchen sink	As per design platform of Granite top with moulding and SS sink (as approved by owner), required plumbing with CP sink cock as per approved sample fit to place modular kitchen underneath it.
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 in same colour), 4 nos. of 5" SS hinges (as approved make), 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"x2 ½" size and **Internal Door frame** shall be of single patam having 4"x2 ½" size of Red Marandi wood including wooden 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. For toilet - Louvered windows of UPVC with float glass.
11	Painting – External	Weather shield Paint with Smooth or Textured finish of approved make as per drawing with 2 coat of putty & primer having rates as Rs. 16/- per SQ.FT. exclusive of Taxes.
12	Painting – Internal	Oil Bound distemper of approved make for walls and ceilings after POP Punning on the walls
13	Balcony Railing	Complete MS Railing with emulsion painted as per drawing. Weight of railing approx. 10kg per sq.mt.
14	Stilt Parking Area	Final finish as per approved Design. Walls and ceiling finish – Smooth or Textured as per architect design.
15	Basement Area	With Tremix Flooring as average 100mm thick as per approved Design with Checkered Tiles on the ramp. Walls and ceiling – White washed.
B	**Electrical**	
1	Switches	Legrand Mosiac or approved equivalent (ISI Marked)
2	Wires	RR cable, Finolex, Polycab, Hawells make (all copper wires and smoke free)
3	Fixtures (Common Area)	LED Fixtures as per approved make for common areas only (Basement, Stilt, Lift lobbies, staircase etc.).
4	Number of Points	As per electrical drawings for Flats and common areas.
5	Telephone & Cable TV Networking	RR cable / Finolex / Indo Asian / Polycab–(Only conduiting will be in scope of contractor, rest will be in the scope of owner.)
6	Switch Fuse Unit	L&T / English Electric
7	MCB / ELCB	Legrand / Standard / Indo Asian / Anchor / ABB.
8	Aviation Lighting	Cable shall be laid of aviation light and to be connected with common area lighting.
9	Lightening Arrestor	Laying of GI strip of 50x6 mm size fixed by vertical and horizontal Arrestor up to earth pit.
10	Lights/Fan Fixture	One Tube light in all rooms & Toilet. Also one CFL light in each balcony (to be compared with surrounding sites).

C	**Plumbing**	
1	Water tanks- OH	RCC water tank at terrace as per plan and design
2	Sanitary ware	As approved by owner.
a)	WC	Wall Mounted EWC of approved make including accessories as per Client.
b)	Wash Basin	With Pedestal or Counter Top as per approved make & Model Complete bathroom set with conventional fittings of make. (Counter Top in Master Bathroom & as per drawing in other toilets.)
c)	CP Fittings	Jaquar / Plumber or equivalent (excluding accessories towel rod/rack/mirror) .
4	Water supply	With CPC as per approved make, concealed for internal & including terrace looping and delivery line from ground floor to OH tank of GI B-Class as per drawings.
5	Drainage	With UPVC pipes for internal piping including suspended line in ceiling covered with false ceiling and shaft piping of CI.
6	External Plumbing	Up to first chamber of required depth on each line of toilet / kitchen using SW pipes.
D	**General**	
1	Anti-termite treatment	To be provided as per normal practice with 10 yrs. Guarantee.
2	Damp proof Course (DPC)	As per recommendation by Structural Consultant.
3	Water proofing	Brick bat coba for Terrace and balconies. Chemical waterproofing with polymer modified membrane for toilets. For basement as mentioned in drawings. 10 years Guarantee shall be provided for each location as recommended by Architect consultants.

BASIC RATES OF MATERIALS

Sr.	Type of Material	Measurement Unit	Basic Rate
1	Granite Stone (South)	SQ.FT.	Rs. 150/- excluding vat & cst
2	Baroda Green	SQ.FT.	Rs. 50/- excluding vat & cst
3	Kota Stone / Tile	SQ.FT.	Rs. 35/- excluding vat & cst
4	Vitrified Tiles	SQ.FT.	Rs. 50/- excluding vat & cst
5	Laminated Wooden Flooring	SQ.FT.	Rs. 60/- excluding vat & cst
6	Anti-Skid Ceramic Tiles	SQ.FT.	Rs. 40/- excluding vat & cst
7	Ceramic Glazed Tiles	SQ.FT.	Rs. 50/- excluding vat & cst
8	UPVC Doors	SQ. FT.	Rs. 500/- excluding vat & cst
9	UPVC Windows	SQ. FT	Rs. 450/- excluding vat & cst

LIST OF APPROVED MAKES

CIVIL WORKS

S. No.	DESCRIPTION	SPECIFICATION	MAKES
1	Structure	RCC structure with MIVAN Shuttering ,Zone-4	As per CPWD Specifications
2	Basement floor	VDS flooring (Trimax Concrete) M-35	Do
3	Drawing/dining floor	Cement Flooring	Do
4	Kitchen floor	Double charged Vitrified tile (800X800)	RAK, Nitco , Kajaria, Somany
5	All bed rooms & toilets floor	Cement Flooring	As per CPWD Specifications
6	Room Floor and other internal flooring	Tiles	RAK, Nitco , Kajaria, Somany
7	Toilet floor	Antiskid ceramic tile (300X300)	RAK, Nitco , Kajaria, Somany
8	Balcony, Servant room, Store	Cement floor)	
9	Toilet wall tile	Glazed wall tile (300X600)	RAK, Nitco , Kajaria, Somany
10	Above Kitchen counter wall tile	Glazed wall tile (300X600)	RAK, Nitco, Kajaria, Somany
11	Entrance lobby, corridor, staircase	Prepolished Granite Stone	As approved sample
12	Lift Facia	Prepolished Granite Stone	As approved sample
13	Stilt/Podium floor used for parking	VDS flooring (Trimax Concrete) M-35	As per CPWD Specifications
14	Front/Internal door frame	Saal, Teak wood (Ivory coast)	As approved sample
15	External door & window	UPVC section with three track with 6 mm plain toughened glass (with wire mesh shutter)	Finista, glass of Modiguard make, Saint Gobbin
16	Door shutter	BWP flush door with teak veneer on both faces as per approved design	Duro, Merino, Century
17	Mortise lock & door , windows hardware accessories	SS finished (White metal)	Godrej, Doorset, Harrison
18	Staircase Railing	M.S. railing with enamel paint	Jindal (Hissar)
19	Balcony railing	M.S. railing with enamel paint as per approved drawing.	Jindal (Hissar)
20	All Internal wall & ceiling finished wherever required	Plastic Emulsion with POP Puning	Asian from Rohtak, Berger
21	All External walls finished	Texture paint	Asian , Unitile, Berger
22	Basement wall ,Ceiling & shafts	Apex Asian paint-2 coats	As per CPWD Specifications
23	Lift	SS hairline finish with SS handrail	Mitsubhisi/Schindler/Otis/Kone

24	waterproofing compound		Dr. Fixit/SIKA/FOSROC/ Pidilite
25	Upvc pipes for sanitary		Supreme, polypack, Finolex
26	GI pipe		Tata, Jindal (Hisar)
27	Cpvc pipe for water supply		Prince, Supreme, Asteral
28	chinaware		Hindware, Parryware,cera,Jaquar
29	Concealed cistern		Gebrit
30	CP fittings		Jaquar opel single lever
31	Modular switch & socket		Legrand, Schneider,Crabtree
32	Electric wire		L&T, Finolex, Delton, KEI
33	Water sealing floor trap to trap cockroaches		Chilly
34	Cement	OPC	J.K. Ambuja, Ultra tech, Lafarge
35	Structure steel	fe - 500 TMT	SAIL /RINL/TATA/Jindal/TISCO
36	Reinforcement Steel		SAIL /RINL/TATA/TISCO,
37	Concrete Admixture		Dr. Fixit/SIKA/FOSROC/ Pidilite
38	Water Proofing cement paint	-	Super snowcem paints
39	White Cement, putty		J.K., Birla, Asian
40	Sink	Stainless Steel	Jayana, Neelkanth, Nirali
41	Antitermite		Chlorpyrophose 20% EC
42	Clear/Float/Frosted Glass		Modi/Saint Gobain (SG)
43	Mosaic Tiles		RAK, Nitco , Kajaria, Somany
44	Tile Grout, Silicone, Sealant, Silicon Spray, Ploysulphinde Sealant		Pidilight/Fosroc
45	Laminate		Merino, Duro, Century
46	Patch Lock, plate Articuture Bolt, Top, Bottom Patch		Godrej, Doorset, Harrison
47	False Ceiling/Gypsum Board		Lafarge/USG Borale
48	Toughened Glass		Saint Gobain /Modiguard
49.	Fire Rated Door		Navair/Sukriti/Shakti

NOTE*:-Basement ramps shall be of 60 mm thick M-35 grade interlocking pavers of Reputed make over RCC inclined slab as per choice of Construction Committee.*

LIST OF APPROVED MAKES

PUBLIC HEALTH WORKS

S.No	Item	Make
1	PVC WATER STORAGE TANK	SINTEX / FRONTIER
2	GUN METAL VALVES (C.I)	ZOLOTO/KIRLOSKAR/L&T,
3	BRASS GATE VALVE	ZOLOTO/KIRLOSKAR/L&T,
4	S.W. PIPE	PERFECT, ISI MARKED A-CLASS
5	GULLY TRAPS / INSPECTION CHAMBER COVER	RIF / SKF / NECO / NIF
6	WATER CLOSET (ORISSA) INCLUDING PVC CISTERN	HINDWARE, PARRYWARE, CERA, JAQUAR
7	C.P BRASS TAP/PILLAR TAP	CERA, PARRYWARE JAQUAR OPEL SINGLE LEVER
8	C.P BRASS BRASS SHOWER ROSE	CERA, PARRYWARE JAQUAR OPEL
9	C.P BRASS BRASS BIB COCK	CERA /PARRYWARE**,** JAQUAR OPEL SINGLE LEVER
10	C.P BRASS BRASS LONG BODY BIB COCK	CERA /PARRYWARE**,** JAQUAR OPEL SINGLE LEVER
11	C.P BRASS BRASS CONCEALED STOP COCK	CERA /PARRYWARE**,** JAQUAR OPEL SINGLE LEVER
12	C.P BRASS BRASS ANGEL VALVE	CERA /PARRYWARE**,** JAQUAR OPEL
13	TOWEL RAIL/TOILET PAPER HOLDER/SOAP CONTAINER	CERA /PARRYWARE**,** JAQUAR OPEL
14	BALL VALVES	ZOLOTO/KIRLOSKAR/L&T,
15	(A). E.W.C. WALL MOUNTED VITREOUS CHINA (B). E.W.C. FLOOR MOUNTED VITREOUS CHINA	HINDWARE, PARRYWARE, CERA, JAQUAR HINDWARE, PARRYWARE, CERA, JAQUAR
16	PVC FLUSHING CISTERN	PARRYWARE/SUPREME/JAQUAR
17	STROM WATER DRAINAGE PIPE (R.C.C. NP2)	PRAGATI CONCRETE UDVOG/JK SPUN, ISI APPROVED
18	SFRC COVER AND FRAME	SKF, KK MANHOLE ISI MARKED

19	HORIZONTAL SOIL, WASTE HANGING SUPPORTS	CHILLY / LOVELY
20	VITREOUS CHINA WASH BASIN	HINDWARE, PARRYWARE, CERA, JAQUAR
21	STAINLESS STEEL KITCHEN SINK AS PER IS:13983	JAYANA, NEELKANTH, NIRALI
22	MIRROR GLASS	ATUL/MODI GUARD
23	SOIL WASTE PIPE CENTRIFUGGALY CAST IRON S&S IS 3989	HEPCO
24	CENTRIFUGGALY CAST IRON FITTING IS 3989	HEPCO
25	MS/GI PIPES	JINDAL/SURYA
26	MS/GI FITTING	“R” BRAND/ZOLOTO ‘M’ /UNIK
27	FLOOR GRATINGS/COCKROACH CONTROLLAR	CHILLEY
28	WATER SUPPY PUMP	KIRLOSKAR, MATHERPLATT
29	UPVC PIPES FOR SANITARY	SUPREME, PRINCE, POLYPACK, FINOLEX
30	CPVC PIPES FOR WATER SUPPLY	SUPREME, PRINCE, SUPREME, ASTERAL
31	HDPE PIPE	PRINCE, SUPREME, ASTERAL

LIST OF APPROVED MAKES

FIRE FIGHTING WORKS

S.NO	ITEM	MAKE
1	GI/MS Pipes	Jindal (Hissar) / Tata
2	Malleable GI fittings	Zoloto/Unik
3	Butterfly/Check Valve	Audco/ S.K.S
4	GUN METAL VALVES (C.I)	SANT / ZOLOTO / LEADER
5	Sluice, Butterfly and Non Return Valves/Air Release Valve/Ball Valve	Zoloto/Kartar /Leader
6	Single headed Fire Hydrant Valve, Three way Fire Brigade inlet, Shut off Nozzle	SKG**,** Minimax
7	RRL Hose	AN Exflame, Minimax
8	Branch Pipe	SKG**,** Minimax
9	GM Coupling	Minimax
10	Fire Extinguishers	AN Exflame/ Geetach/Safegard
11	Rubber Tube for Hose reel	SKG/ Jyoti/Maruti
12	Enamel Paint for pipes	Asian/ J&N/ Nerolak
13	Welding rods	Victor/Maruti
14	Fasteners(Galvanised)	Fischer/ GKW/Canon
15	Dash fastners/clamps	Cannon/Chilly
16	Hose Box/Hose reel drum	SKG/ Newage/Minimax
17	Anti vibration pads	Kanwal/Dunlop
18	Pressure Gauge	H.Guru/Fiebig
19	Pressure switch	Guru **/** Indfoss
20	Cables/wire	Skyton/National
21	PVC conduit	AKG/BEC
21	Manual Call point/Hooter/Sounder /Response Indicator/Fault Isolators with Base	Cooper/Honeywell/ Agni
22	Control panel(FIRE)/Repeater Panel	Cooper/Honeywell/ Agni
23	Telephone Handset/Receiver	Cooper/Honeywell**/** Agni
24	Microphone/speaker	Cooper/Honeywell/ Agni/Philips

25	Amplifier	Philips
26	Mechanical Seal	As per OEM Cert./Duramat
27	Pumps	Kirloskar
28	Motor	ABB/Crompton
29	Engine	Kirloskar/Koel
30	Installation Control Valve	Safeguard/SKG
31	Pipe Supports (Band Hanger)	Chilly
32	Flow switch	Safex/System Sensor
33	Pipe Fittings	“R” BRAND/ZOLOTO ‘M’ /UNIK
34	Sprinklers	HD

LIST OF APPROVED MAKES

INTERNAL ELECTRICAL WORKS

Sr.No.	Details of equipment/ Material	Manufacturers Name
1	MS black enamelled/galvanized ERW conduits	BEC, Steel- Craft,
2	GI pipes	Jindal (Hissar), Tata,
3	PVC Conduit (ISI Marked), PVC Trunking & Cable Management System	Havells, BEC, Precision , PolyPack, Polycab
4	PVC Conduit Accessories	AKG, Polypack, BEC, ,
5	MS Conduit accessories	Sharma, Rama, Noble
6	FRLS copper conductor wires	KEI, Finolex, Havells, R& R cable, Polycab
7	Modular switches, socket outlets and wiring accessories with moulded cover plate, Call Bell Push Button, Telephone/TV Sockets, Metallic Box	**Havells,** Legrand(Myrius),Schneider(ZENcelo), Crabtree(Murano),MK(Blenze) , Polycab
8	Industrial Sockets & Plugs	Havells**,**Legrand,Siemens,Hager,Schneider, Polycab
9	Lighting Fixtures	Bajaj/Havells/ Philips
10	Heavy duty metal clad socket outlets with MCB in MS housing	Legrand,Siemens,Hager,Schneider, Polycab
11	Weather proof socket outlets	Legrand, Neptune, Siemens, L&T Hager
12	Miniature Circuit Breaker/RCCB	Legrand(DX3),Hager, Schneider(Acti9),Siemens Beta Guard 10KA,
13	Earth Leakage Circuit Breaker	Havells, L&T , Legrand(DX3),Hager, Schneider(Acti9),Siemens Beta Guard 10KA ,
14	Timers	L&T, Legrand(DX3),Hager, Schneider(Acti9), Siemens Beta Guard 10KA
15	Tag Block	Krone
16	MCB Distribution Boards in sheet steel housing (double door)	Schneider, L&T, Legrand(DX3),Hager, Schneider(Acti9),Siemens Beta Guard 10KA, 17Optipro(Indo Asian, Polycab
17	Single phase preventer (current base)	L&T, Minilec
18	Telephone wires / Co-Axial T.V. Cable	Delton, Finolex, Polycab, R& R cable , Havells

19	Telephone Tag Blocks	Krone, Pouyet, TVS, Hensel
20	Tap off / Splitter	Cat vision, Shyam
21	Cable TV wire	Cat vision, Bhansali, Skyline, Finolex Comm-scope, Delton, Rallison
22	Moulded Case Circuit Breakers (with rotary handle) (variable settings)	L&T (d –sine), Siemens-3VA, ABB (T-Max), Schneider (CVS) , Legrand-DPX,/ C & S
23	Air Circuit Breaker (ACB)	L&T-U Power, SIEMENS-3WL, SCHEINDER- MVS, ABB (E-MAX)) C&S
24	Switch fuse units (FN type)	Larsen Toubro, Siemens, Schneider (MG), GE, ABB
25	HRC fuses	Siemens, L&T – HN type, GE
26	Protective Relays (Microprocessor)	ABB, L&T, Larsen Toubro, Alstom, Siemens
27	MV Switchboards /Rising mains (powder coated)	Ambit Switchgear PVT Ltd/Milestones Switchears PVt./ Advance panels & switchgears/ Electro system devices /Adlec systems private ltd/Shivalic power control pvt ltd /Conquerent Control System Pvt ltd (Madhu Group) Indo Asian /S.B .Electricals
28	MV Contactors, Timers (Solid stat)	CTX^3 ,Schneider (Tesys K, D, F),L&T- MNX ABB AF
29	1100 volts grade XLPE cables	Universal (Unistar), Skytone, Havells, Polycab, R & R kable,
30	1100 volts grade PVC control cables	Universal (Unistar),Havells, Skytone, Polycab, R & R kable,
31	Cable lugs/Thimbles	Dowells/Comet
32	Cable Double Compression Glands with earthing links	Peeco, Comet
33	Power Contractors/Capacitor Duty Contractor/Capacitor Bank/Active Filters/Hybrid Filters	L&T, ABB**,** Legrand,Ducati,Epcos,Vishay. Schneider
34	Cast resin Current Transformers	L&T, Automatic Electric, Kappa, Gilbert Maxwell,
35	Measuring Meters (Digital)	L&T Rishab, Automatic Electric, Siemens, Enercon, Caddle
36	Selector Switches	Kaycee, L&T Salzer, Siemens
37	Indication lamps (LED type) and Push Buttons & Pilot Lamps	L&T, Siemens, Vaishno
38	Cable tray	Pilco, Ricco, Slotco, MM Enterprises, Bharti, BEC,

		OBO-bettermann,Legrand Cablofil
39	Energy analyzer meter	Secure, Enercon, L&T,
40	KWH Energy Meter/Metering Instrument	ABB, Rishab, L&T, Crystal , HPL,Genus, Elmeasure
41	Ceiling Fans/Wall Fans/Exhaust Fan/Air Circulator	Crompton Greaves/Usha/Havells/Bajaj
42	Control Cables	KEI/Polycab
43	Terminal Blocks and Connectors	Wago/Connect Well
44	Indoor/Outdoor End Termination Straight through Joints	Dowel/Action/Comet/3M
45	LT Electrical panels/Meter Board Panels/Feeder Pillars	Vidut Control/SPC Electrotech/Dynamic Power projects/Deltech Engineers/Precision
46	Street Lights & Horticulture Lights	Wipro/ Bajaj/Havells
47	Street Octagonal/Decorative Poles	Bajaj/Surya/Philips
48	Lifts/Elevators, SS hairline finish with 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.

LIST OF APPROVED MAKES

EXTERNAL ELECTRICAL WORKS

Sr.No.	Details of Equipment/Material	Manufacturers Name
1	Moulded Case Circuit Breakers	L&T (d–sine), Siemens-3VA, ABB (T-Max), Schneider (CVS) , Legrand-DPX, C& S
2	Switch fuse units (FN type)	Larsen Toubro, Siemens, Schneider (MG), ABB
3	HRC fuses	Siemens, L&T – HN type
4	415 volt Air Circuit Breakers. - Incomer & Bus Coupler	L&T-U Power, SIEMENS-3WL, SCHEINDER- MVS, ABB (E-MAX) , C& S
5	- Outgoings	L&T-C Power, SIEMENS-3WL, SCHEINDER MVS, ABB, C& S
6	Protective Relays (Microprocessor) for L.T. Panel	Larsen & Toubro, Alstom, Siemens, ABB,Schneider
7	APFC Relay (Microprocessor)	L&T, Neptune-Ducati, Siemens (EPCOS), ABB,Schneider
8	MV Switchboards (powder coated)	Ambit Switchgear PVT Ltd/Milestones Switchears PVt./ Advance panels & switchgears/ Electro system devices /Adlec systems private Ltd/Sudhir Switch Gear Ltd/S.B .Electricals / Conquerent Control System Pvt
9	1100 volts grade PVCA/XLPE cables	Havels/KEI/Polycab, Universal (Unistar), Skytone, Polycab, kei, Havells
10	1100 volts grade PVC control cables	Universal (Unistar), Skytone, Polycab, Havells,kei
11	1100 volts grade PVCA/XLPE cables	Universal (Unistar), Skytone, Polycab, Havells,
12	Cable lugs	Comet , Dowells
13	Cable compression glands	Peeco, Comet
14	11kV XLPE cables	Universal (Unistar), Skytone, Polycab ,kei, Havells
15	11 kV Vacuum Circuit breakers/RMU	Siemens, ABB , Scheinder,
16	11 kV Cable joints (Heat shrinkable)	Denson, Raychem, Mahindra. Birla-3M
17	Protection Relay for 11 KV VCB Panel	Siemens, ABB, Alsthom,Schnieder
18	11 kV Potential Transformers	Pragati, ECS, Nortex, Savior, Vishal
19	Package sub-Station with (Oil type) Transformers 11 kv	Ambit Switchgear PVT Ltd/ABB/ Sudhir Switch Gear Ltd/ Schneider/ Conquerent Control System Pvt & transformer- Voltamp transformer Ltd. /Sudhir Power/Cromption/Kiloskar/Cotson/Infraviduit/ Muskain's

20	Capacitors	Ducati,Legrand,Epcos,Vishay , Schneider
21	Cast resin Current Transformers	Rishbah/L&T/Kappa**/** Pragati/ECS/Savior/ Nortex/Avcon

	Details of Equipment/Material	**Manufacturers Name**
22	Measuring Meters (Digital)	L&T Rishab, Automatic Electric, Siemens, Enercon, Schneider
23	Trivector meter	Secure/ Enercon/,Schneider
24	Gas Insulated VCB	ABB / Siemens/Schneider
25	DB/MCB	Legrand(DX3),Hager, Schneider(Acti9)
26	Selector Switches	Kaycee, L&T Salzer, Siemens,Schneider
27	Indication lamps (LED type) and Push Buttons	L.T/Siemens/ Vaishno,Schneider
28	Cable tray	Ricco, Indiana, Pilco, Slotco, M.M. Enterprises, BEC, OBO Beterman,Legrand
29	11KV HT metering panel	Approved as per the local electricity supply

NOTE: All makes shall confirm to standard specifications of each items as enclosed with the tender documents.

LIST OF APPROVED MAKES

FOR D.G. SET

1.	DIESEL GENERATOR (OEMS)	SUDHIR/KIRLOSKAR OR EQUIVALENT
2.	DIESEL ENGINE	CUMMINS/PERKINS/KIRLOSKAR**/**CATERPILLAR
3.	ALTERNATOR	KIRLOSKAR/STAMFORD/CROMPTON GREAVES
4.	AMF PANEL	SIEMENS/L&T/ABB/SCHNEIDER/GE
5.	BATTERIES	Exide,
6.	PUMPS WITH ELECTRIC MOTOR	KIRLOSKAR/KSB/GRUNDFOS
7.	MINERAL WOOL (COMPRESSED TYPE)	LLOYD/MINWOOL/ROCK WOOL
8.	BUTTERFLY VALVES	AUDCO/ADVANCE/ZOLOTO
9.	GATE VALVES/BALL VALVES	R-B/ZOLOTO/CIM-BERIOI
10.	AUXILIARY RELAYS (COMPATIBLE WITH PLC ETC.)	SIEMENS/L&T
11.	POT STRAINER	SANT IND/JAYPEE/EMERALD
12.	ALUMINIUM SHEET	INDALCO/HINDALCO
13.	FUEL LINE (ERW AS PER IS:1239)	JINDAL-HISSAR UPTO 150mm dia & JINDAL – GBD ABOVE 150mm dia/BST
14.	MS PIPE (ERW AS PER IS:1239)	JINDAL-HISSAR/BST
15.	MS STEEL (ANGLE, CHANNEL, STRIP SHEET)	TATA/SAIL/JINDAL-HISSAR
16.	BALANCING VALVE	AUDCO/ADVANCE
17.	NON-RETURN VALVE (WATER TYPE)	AUDCO/KIRLOSKAR
18.	ANTI-VIBRATION PADS	GERB/DUNLOP/ CUMMINS
19.	PRESSURE GAUGES	FEBIG/H.GURU/BICOL
20.	MAGNETIC LEVEL CONTROLLER (FLOAT TYPE)	NAND SHYAM/V-AUTOMAT
21.	DIESEL FLOW METER	KENT/AQUA METRO (SANSAG)
22.	FLAME PROOF MOTORS	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.	MEASURING INSTRUMENTS (DIGITAL TYPE)	MECO/ENERCON/L&T/AEI
26.	CONTROL MCB'S	SIEMENS/HAGER/LEGRAND (MDS)
27.	CT'S (CAST RESIN)	AEI/KAPPA/GILBERT

28.	BRASS COMPRESSION GLAND (HEAVY DUTY)	COMMEX/GRIPWELL
29.	SELECTOR SWITCH	SALZER/SIEMENS/BCH
30.	MCB (10 KA)	SIEMENS/L&T/ABB/GE
31.	CRIMPLING LUGS/THIMBLES	DOWEL/GRIPWELL
32.	TERMINAL STRIP	CONNECT WELL/ELMEX
33.	CONTRACTORS	SIEMENS/L&T
34.	GI/CU STRIP & EARTHING MATERIAL	BHARATI/INDIANA/SLOTCO
35.	BATTERY CHARGER	CHHABI/AMARAJA/BCH/UPTRON/JAKSON
36.	LEAD ACID AUTOMOTIVE TYPE	AMCO/FURUKAWA/HITACHI/GLOBAL/ YUASA/EXCIDE
37.	COPPER CONTROL CABLE	SKYTONE/NATIONAL/RALLISON
38.	POWER CABLES	CCI/NICC/UNISTAR/RALLISON/POLYCAB/KEI
39.	ALUMINIUM GRILLS	GARRY AIRE/RUVI STAR
40.	D.G. SET ENCLOSURE	JAKSON, SUDHIR, CONSTORIUM ACOUSTIC SYSTEMS
41.	G.I. SHEET	JINDAL(HISSAR)/TATA/SAIL/NIPPON/ BHUSAN STEELS

Note:

2. The DG set shall be designed for 50 Deg C ambient temperature & minimum of 1000 metres above sea level and the bidder to give the DG set sizing calculations with deration calculations.
3. The offered DG set shall be suitable for prime power continous rating duty applications.
4. The DG sets offered by the bidders shall be emission compliant as per CPCB norms prevailing in India as on date. The DG set shall also comply to CPCB noise norms prevailing in India as on date.
5. The Engine shall have the capacity to run on 10 % overloading for one hour in every twelve hour duration.
6. The offered engine shall be necessarily be provided with electronic governor/AVR suitable for paralleling/synchronizing.
7. The Alternator winding shall have 2-3 pole pitch winding to take care of heating due to harmonics.
8. The offered Alternator shall be suitable for synchronizing/paralleling if any.
9. The Contractor shall produce samples before procurement of the materials for approval of the Owner/Architect. The material of the makes out of the above as approved by the Owner/Architect shall be used on the work.
10. In respect of materials for which approved makes are not specified above, those will be of makes to be decided by the Owner/Architect and as per sample got approved.
11. The Contractor shall submit samples of all materials before three month of procurement for approval and shall procure directly from the manufacturer/ authorized dealers only.

QUALITY CONTROL

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. **Identify defects:** The Construction 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 Construction Committee may instruct the contractor to search for defects and to uncover and test any work that the Construction Committee considers may have defect.

ii) **Correction of defects:-** The Construction 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 detail given in scope of work. 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 contract shall correct the notified defects within the limit of time specified by the Construction Committee or his authorized representative notice. If the contractor has not corrected a defect within the time specified in Construction Committee notice, the Construction Committee will 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 Construction Committee and 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 become the property of Society. The contractor will bear all the running expenses for conducting such tests. All the tests will be carried in the presence of Construction Committee. All the entries are to be signed by the contractor or his authorized representative and Construction Committee. In case of tests for which there is no arrangement at 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 Construction 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 tests will also be borne by contractor only.***

6. Various quality control operations will be maintained as per clauses of concrete code Specification with latest revision amendments.

7. Contractor shall provide suitable measuring arrangement and leveling instruments of latest quality approved by the Construction Committee at the site of work.

8. No extra payment on account of quality control measures shall be paid to the contractor.