



GOVERNMENT OF WEST BENGAL

OFFICE OF THE SUPERINTENDING ENGINEER, SOUTH CIRCLE,
HOUSING DIRECTORATE, P- 7 & 8, C.I.T. ROAD, 1ST FLOOR, KOLKATA-
700014

BID DOCUMENTS FOR

CONSTRUCTION OF OITIKA -OWNERSHIP HOUSING
FOR WBCS(EXE) OFFICERS
AT PRE. NO.-44-0676, PLOT NO.-II-D/37 IN AA-IID,
ACTION AREA -IID, NEW TOWN, KOLKATA.
ON TURNKEY BASIS

**(e-NIQ No. 01 of 2023-24 of Superintending Engineer,
South Circle, Housing Directorate)**

SECTION 1

Notice Inviting e-Quotation (NIQ)

GOVERNMENT OF WEST BENGAL
Office of the Superintending Engineer
South Circle, Housing Directorate
P- 7 & 8, C.I.T. ROAD, 1st Floor, Kolkata – 700 014

Memo No.: 812/1B – 873

Date: 20/07/2023

TENDER REFERENCE NO. WBHOUSING/SE/SC/HD/e-NIQ-01/2023-2024

e-NOTICE INVITING QUOTATION

1. The Housing Directorate, Government of West Bengal has been entrusted to establish and develop OITIKA –Ownership Housing for WBCS(Exe) officers at PRE. NO.-44-0676, Plot NO.-II-D/37 IN AA-IID, Action Area -IID, New Town, Kolkata.
2. In terms thereof, Housing Directorate (Tender Inviting Authority) hereby invites bids through 'e-quotationing' from eligible and qualified Indian bidders for – Construction of OITIKA –Ownership Housing for WBCS(Executive) officers at PRE. NO.-44-0676, Plot NO.-II-D/37 IN AA-IID, Action Area -IID, New Town, Kolkata in the State of West Bengal on turnkey basis in a two bid system as per Schedule of Requirement.

Description of work	Bid Participation Money (Part of EMD)	Cost of Bid Document	Time of Completion
Construction of (G+12) 6 nos. multi-storied frame-structured Buildings alongwith ancillary buildings and allied works complete in all respect as per drawings stipulated in the tender documents at PRE. NO.-44-0676, Plot NO.-II-D/37 IN AA- IID, Action Area -IID, New Town, Kolkata	50 Lakh	The successful bidder shall have to pay Rs. 15,000/- Each for 6 (Six) sets	3 years

3. Any bidder willing to take part in the process of e-tendering will have to be enrolled and registered with the State Government e-Procurement system, on <https://wbtenders.gov.in/>. The bidder is to click on the link for e-tendering site as given on the website and if required, may contact the e-procurement Help Desk at 3A, Commissariat Road, Hastings, Kolkata – 700 022.
4. Intending bidder may download the Bid Documents from the website: <https://wbtenders.gov.in> directly & appropriate Bid Participation Money (Part Of Earnest Money) of an amount as mentioned in Sl. No. 2 hereinabove may be remitted through on-line transfer in favour of Executive Engineer, New Town Construction Division-II, Housing Directorate and also to be documented through e-filing (scan copy is to be submitted). The Successful bidder shall have to deposit the EMD @2% of the bid amount put to quotation - less 50 Lakh (Bid Participation Money) in form of Bank Guarantee. Necessary Earnest Money shall be deposited by Bank Guarantee. Intending Bidder shall get the Beneficiary details from e-Quotation portal with the help of Digital Signature Certificate and may transfer the the Participation Money (part of the EMD) from their respective bank as per the Beneficiary Name & Account No., Amount, Beneficiary Bank name (ICICI Bank) & IFSC Code and e- Procurement Reference no. At the time of uploading the Quotation, the intending Quotationer should upload a scanned copy of such Unique Transaction Receipt (UTR) as Bid Participation Money (Part of Earnest Money Deposit) in favour of Executive Engineer, New Town Construction Division-II along with his quotation.
5. Bid Documents may be downloaded from the website <https://wbtenders.gov.in> and only the Technical Bid duly digitally signed shall have to be submitted online. Bidders, who would come out as successful in Technical Bid Round, shall qualify for participation in the Financial Bid. Only those eligible bidders shall be requested to submit their Financial Bid as per time schedule stated herein under.
6. The documents submitted by the bidders should be properly indexed and digitally signed. Both Technical Bid and Financial Bid / Price Bid in respect of each of the packages are to be submitted in technical (statutory & non- statutory folder) and financial folder concurrently duly digitally signed in the website www.wbtenders.gov.in.
7. The Technical Bid and Financial Bid are to be submitted online on or before the date and time mentioned in Sl. 11 of this e-NIQ.

8. The Financial Bid / Price Bid of the prospective bidder shall be considered only if the Technical Bid (both statutory and non-statutory) of the bidder is found qualified by the Tender Evaluation Committee. The decision of the Tender Evaluation Committee shall be final and absolute in this respect. The list of responsive / technically qualified and nonresponsive Bidders shall be displayed in the website and also in the Notice Board of the office of the Superintending Engineer, South Circle, Housing Directorate, on the scheduled date and time.
9. Eligibility criteria for participation in the process: -
- 9.1. The tender inviting & accepting authority shall determine the eligibility of each bidder. The bidders shall have to meet the following minimum qualifying criteria:
- i. Financial Capacity.
 - ii. Technical Capability comprising of personnel & equipment capability.
 - iii. Experience/Credentials.
- 9.2. The eligibility of a bidder shall be ascertained on the basis of the digitally signed documents in support of the minimum criteria as mentioned in (i), (ii) and (iii) above. If any document submitted by a bidder is either manufactured or false, in such cases the eligibility of the bidder/ tenderer shall be rejected outright at any stage without any prejudice to the rights of the Tender Inviting Authority.
- 9.3. The prospective bidders shall have to meet the following eligibility criteria:
- a) Bona fide & Resourceful Company/ reputed construction company / agency registered under the relevant laws in India / Public Sector Undertaking/ Statutory body/ statutory corporations having credential of similar nature under Central Govt./ any State Govt. / Public Sector Undertaking/Statutory Body/ Statutory Corporations— subject to ITB 4.5.
 - b) The bidders have to meet the following eligibility criteria:
 - (i) Joint venture shall not be allowed to participate in the e-NIQ.
 - (ii) The bidder shall have satisfactorily completed as a contractor: -

At least one multi-storied (G+12 storied, ≥40 m high) housing project of ` 300 Crores on turnkey basis (including production of architectural, structural and related interdisciplinary services shop drawings and as-

built drawings) at any place(s) in India during the last 5 (five) financial years ending on the last day of the month previous to the one in which the tender is invited.

OR

Two multi-storied (G+12 storied, ≥40 m high) housing projects worth not less than of ` 500 Crores on turnkey basis (including production of architectural, structural and related interdisciplinary services shop drawings & as-built drawings) at any place(s) in India during the last 5 (five) financial years ending on the last day of the month previous to the one in which the tender is invited

OR

One ongoing multi-storied (G+12 storied, ≥40 m high) housing project which has been partially completed on turnkey basis to the extent of 80% or more and the value of work executed be not less than ` 300 Crores, shall also be considered for determining the eligibility criteria if documentary evidence can be produced showing that the value of the completed portion of the project is ` 300 Crores or more.

N.B. – (1) For eligible government sector projects, completion certificate shall have to be submitted. Completion certificate along with TDS / 26AS certificates evidencing payment of at least 80% of the completed works shall have to be submitted.

(2) For running works, the certificate of progress submitted by the bidder shall also certify that the progress of the works is satisfactory and no penal action has been initiated against the bidder. All Client certificates shall be issued by the Engineer-in-Charge of the works not below the rank of Executive Engineer or equivalent. TDS certificates shall not be considered as an alternative to the Client's certificate.

(3) Certificates of group/associate/ subsidiary/ parent/ holding company shall not be considered as a valid certificate of experience of the bidder, unless the same is supported by such documents that the

group/ associate/subsidiary/ parent/ holding company and the bidder/, have amalgamated/ merged into the same entity.

(4) The eligible projects shall not include any project executed for group/associate/subsidiary/ parent/ holding company.

(5) For determining the value of the eligible projects as specified in ITB 4.1, the tendered amount of the project will be considered for evaluation and not the estimated amount of such project(s).

- c) A bidder must have average annual turnover of at least ` 500 Crores (from construction works only) in every year during the last 5 (five) financial years or a gross turnover of no less than ` 2500 Crores (from construction works only) during the last 5 (five) financial years ending on last day of the month previous to the one in which the tender is invited for meeting the eligibility criteria. as stated in 4.1.3 Section 2 /ITB; The annual turnover is to be certified by a Chartered Accountant.
- d) The bidder shall have an Available Bid Capacity equal to or more than ₹. 300 Crores. The Available Bid Capacity shall be calculated as per formula given 4.1.4 of Section 2 /ITB.
- e) The bidder shall submit a Bank Solvency Certificate of a value of ` 100 Crores or more in the name of the bidder from any scheduled bank. as stated in 4.1.5 of Section 2 /ITB.
- f) Bidder(s) must satisfactorily meet criteria or requirement given below:
 - i. The other eligibility criteria as described in Clause 2 of Section 3 (Evaluation and Qualification Criteria).
 - ii. A bidder must have audited balance sheets & other financial statements for the last 5(five) years.
 - iii. The other eligibility criteria including eligibility criteria for technical personnel and Plant & Equipment are described in Clause 2 of Section 3 – Evaluation and Qualification Criteria.

10. Bids shall remain valid for a period not less than 180 days, after the deadline / last date for Financial Bid submission. Bid with a shorter validity period shall be rejected. If the bidder withdraws the bid within the period of bid validity, the

earnest money as deposited shall be forfeited or invoked, as the case may be, forthwith without assigning any reason thereof.

11. Important Information Date & Time Schedule:

1	Date of uploading of Quotation Documents online) (PublishingDate)	20/07/2023
2	Documents download start date (Online)	20/07/2023 after 6.55 PM
3	Documents download end date (Online)	25/08/2023 upto 1.00 PM
4	Date of Pre Bid Meeting with the intending bidders in the office of the Superintending Engineer, Housing Directorate, P-7&8 C.I.T. Road, Kolkata - 700014	26/07/2023 at 12.00 Noon
5	Bid submission start date (Online)	03/08/2023 from 10.00 am
6	Bid submission closing (Online)	25/08/2023 upto 3.00 PM
7	Bid opening date for Technical Proposals (Online) bidders in the Office of the Superintending Engineer, Housing Directorate, P-7&8 C.I.T. Road, Kolkata - 700014	28/08/2023 at 12.00 Noon
8	Date & Place for opening of Financial Proposal (Online)	To be informed later
9	Date of uploading of list bidders along with the offer rates through (online), Also if necessary for further negotiation through offline for final rate	To be informed later

12. if the Employer declares any date specified above a holiday or on any account the office remain closed, in such event, the time limit for an event on the specified date shall be extended by the Employer to the next working day.

13. All standards, technical specifications and codes of practice referred to shall be latest editions including all applicable official amendments and revisions. The selected bidder shall make available at site all relevant Indian Standard Codes of practice as applicable.

14. Wherever Indian Standards do not cover some particular aspects of design/construction, relevant International Standards shall be referred to. The selected bidder shall make available at site such standard codes of practice.
15. In case of discrepancy among standard codes of practice, technical specifications and provisions in Employer 's Requirements, the order of precedence shall be as below:
- i. Provision in General Requirements of Employer 's Requirements
 - ii. Technical Specifications in Employer 's Requirements
 - iii. Standard codes of practice.
 - iv. In case of discrepancy in reference to standard codes of practice, the order of precedence shall be BIS, IRC, BS, ASTM.
16. The bidder, at its own responsibility and risk is encouraged to visit and examine the site of work and its surroundings and obtain all information that may be necessary for preparing the bid and entering into a contract for the work as mentioned in the Notice Inviting e-Quotation, before submitting. The cost of visiting the site shall be at its own expense. A brief site information has been given in Section 5 (Employer 's Requirements).
17. The existing services and utilities that may need to be diverted, shall be done with proper liaison and upon getting approval of Housing Directorate. The services and utilities which cannot be diverted but will require supporting, proper supporting shall be done so that they are not damaged along their branches. Precautions to be taken while handling the services and utilities are mentioned as under:
- i. No Services and Utilities running through service corridor between feeder roads and the plot boundary shall be damaged. If due to some reason mishap occurs, it shall be rectified immediately by the selected bidder at its own cost under intimation of Housing Directorate.
 - ii. The above instructions are only indicative, other precautions which are specified from time to time by the Housing Directorate shall be followed by the selected bidder at all times.

18. Superintending Engineer, South Circle, Housing Directorate reserves the right to reject any or all applications for participating in bidding process and the right to accept or reject any or all offer without assigning any reason whatsoever and Superintending Engineer, South Circle, Housing Directorate is not liable for any cost that might have incurred by any bidder at the stage of bidding.
19. The Bid Participation Money of unsuccessful bidders shall be refunded post declaration of financial evaluation result in E-Procurement portal. Provision relating to refund of the Bid Participation Money deposited by the unsuccessful bidders shall be according to directives of Finance Department Notification no 3975-F(y) dated 28/07/2016 and Bid Participation Money refund shall be Suo-Moto within the time line provided in the said notification and without seeking for any application from the unsuccessful applicant.
20. Post determination of the award of contract, and acceptance of LOA by the successful bidder, the Bid Participation Money (part of the EMD) of L2 bidder shall be refunded Suo-Moto with in T+2 days of acceptance of LOA, where T means day on which information relating to acceptance of LOA is posted in the E-Procurement portal.
21. Prospective bidders are advised to note carefully the minimum qualification criteria as mentioned in Instructions to Bidders (ITB) and various conditions in –General Conditions of Contract and other bidding documents as per ITB 6.1 before tendering the bids.
22. Conditional/ incomplete bids shall not be accepted.
23. The intending bidders are required to quote their rates online.
24. The bidders shall have to comply with the provisions of the (a) Contract Labour (Regulation & Abolition) Act, 1970 (b) Apprentices Act, 1961 and (c) Minimum Wages Act. 1948 or the notifications thereof or any other laws relating to and the rules made and order issued there under from time to time pursuant to Clause 6 of the –General Conditions of Contract.

25. In case of ascertaining authority of intending bidders at any stage of bidding process or execution of work, necessary irrevocable Power of Attorney is to be produced as and when asked for by the tender inviting and accepting authority / Housing Directorate.
26. During scrutiny, if it comes to the notice of Tender Inviting Authority that any credential or any record furnished is found incorrect/ manufactured/ fabricated, the bidder would not be allowed to participate in the bid and the application shall be rejected outright without any prejudice to the rights of the Superintending Engineer, South Circle, Housing Directorate.
27. The Superintending Engineer, South Circle, Housing Directorate reserves the right to cancel the tender process without assigning any reason, whatsoever, to the bidders and no claim in this respect shall be entertained.
28. Before issuance of the notification of award, the quotation inviting Authority or its authorized representative may verify all credentials and other documents, if found necessary. After verification, if it is found that the documents submitted by the lowest bidder is either manufactured or false in that case work order shall not be issued in favour of the said bidder under any circumstances and the Bid Participation Money deposited by the bidder shall be forfeited or invoked, as the casemay be, by the Tender Inviting Authority without assigning any reason thereof.
29. Where an individual holds a digital certificate in his own name duly issued to him in respect of a bidder company of which he is a director, such individual person shall, while uploading any quotation for and on behalf of such bidder, shall upload a copy of Power of Attorney showing authorization in his favour, while uploading such tender.

Superintending Engineer
South Circle, Housing Directorate
Government of West Bengal

Memo No.: 812/1/1B – 873

Date: 20/07/2023

Copy forwarded to the Assistant Chief Engineer, Nodal Officer, Housing Dte. with the request to kindly arrange for publication of the notice in 5(five) daily newspaper i.e. in Times of India, The Telegraph, Anandabazar Patrika, Bartaman & Sanmargh with an information to this office. He is also requested to note that the matter for publication are stated below :- “For & on behalf of Hon’ble Governor of West Bengal, Superintending Engineer, South Circle, Housing Dte. invite open tender vide e-Notice Quotation No. 01 of 2023-2024 of S.E.S.C., H. Dte. Construction Of Oitika – Ownership Housing For WBCS(Exe) Officers At Pre. No.-44-0676, Plot No.-II-D/37 IN AA-IID, Action Area -IID, New Town, Kolkata. On Turnkey Basis”. Approximate Project Cost – Rs. 150 Crore, Date of submission start date (Online) is 03/08/2023 from 10.00 am, Date of submission closing (online) is 25/08/2023 upto 3.00 pm, Detail information/download/upload will be available in the website <http://wbtenders.gov.in>. Further corrigendum & addendum if required will be published only on website”.

Superintending Engineer
South Circle, Housing Directorate
Government of West Bengal

Memo No.: 812/2(25)/1B – 873

Date: 20/07/2023

Copy forwarded for favour of kind information to the:-

- 1) The Special Secretary, Housing Department for display on the Website of Housing Department.
- 2) The Chief Engineer, Housing Directorate (In duplicate).
- 3) The Superintending Engineer, North Circle, Housing Directorate / West Circle, Housing Directorate / Southern Circle No. I / II, Eastern Circle / Presidency Circle I & II, P.W.D., Superintending Engineer (Elec.), H&P, Works, PWD.
- 4) The Executive Engineer, Housing Directorate, Siliguri Division/Malda Division/Kolkata South-I/ Kolkata South-II/Kolkata North-I/II/Nadia Division/Burdwan Division/Bankura Division/Midnapore Division/ Electrical Division No. I / II
- 5) Federation of Contractors’ Association, West Bengal
- 6) Notice Board
- 7) Estimating Branch of this office for information.

Superintending Engineer
South Circle, Housing Directorate
Government of West Bengal

Memo No.: 812/3(9)/1B – 873

Date: 20/07/2023

Copy forwarded for information & wide circulation to the :-

1. Vice-Chairman, HRBC, St. Georges Gate Road, Kolkata.
2. Chief Engineer,(HQ),PWD,WB, Nabanna, 8th Floor, Howrah.
3. Chief Engineer, E.Z-I, CPWD, Nizam Palace, Kolkata.
4. Chief Engineer-I, WB HIDCO, New Town, Rajarhat.
5. Commissioner, Housing Board, 105, S. N. Banerjee Road, Kolkata.
6. Director General (Operation), KMDA, Unnayan Bhawan Salt Lake.
7. Chief Municipal Engineer, Development & Planning Department, KMC, S.N. Banerjee Road, Kolkata.
8. Chief Executive Officer, NKDA.
9. Chairman, Project Implementation Committee of Oitika Project for WBCS(Exe) Officers.

Superintending Engineer
South Circle, Housing Directorate
Government of West Bengal



GOVERNMENT OF WEST BENGAL
OFFICE OF THE SUPERINTENDING ENGINEER, SOUTH CIRCLE,
HOUSING DIRECTORATE, P- 7 & 8, C.I.T. ROAD, 1ST FLOOR, KOLKATA-
700014

BID DOCUMENTS FOR
CONSTRUCTION OF OITIKA -OWNERSHIP HOUSING
FOR WBCS(EXE) OFFICERS
AT PRE. NO.-44-0676, PLOT NO.-II-D/37 IN AA-IID,
ACTION AREA -IID, NEW TOWN, KOLKATA.
ON TURNKEY BASIS

SECTION 2
Instructions to Bidders (ITB)

This Section specifies the procedures to be followed by bidders in the presentation and submission of their bids. Information is also provided on the submission, opening, and evaluation of bids and on the award of contract.

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General Instructions to Bidders

1. Scope of Bid

- 1.1. In connection with the Expression of Interest (EOI) for construction of OITIKA – Ownership Housing Project for WBCS(Exe) officers at Premises No.-44-0676, Plot II-D/37 in Action Area -IID, New Town, Kolkata, on Turnkey Basis, Office of the Superintending Engineer, South Circle, Housing Directorate, P - 7 & 8, C.I.T. Road, 1st Floor, Kolkata-700014 (hereinafter referred to as “the Employer”), issues this Bid Document for the procurement of Works as specified in Section 5 (Employer's Requirements). The name, identification, and number of contacts of the National Competitive Bidding (NCB) are given below: -

E-tendering

The tender is invited online and submission of tender will also be online as detailed in the EOI.

- 1.2. Throughout the Bid Documents:

Definitions

- 1.2.1. the term "**in writing**" means communicated in written form and delivered against receipt;
- 1.2.2. the terms '**bid** ', '**quotation** 'and '**tender** 'and their derivatives (**bidder/quotationer/tender, bid/quotation/tender, bidding/quotationing/tendering, etc.**) are synonymous.
- 1.2.3. except where the context requires otherwise, words indicating the singular also include the plural and words indicating the plural also include the singular; and
- 1.2.4. 'day' means calendar day.
- 1.2.5. words indicating one gender include all genders.

2. General guidance for e-tendering

- 2.1. Any bidder willing to take part in the process of e-tendering will have to be enrolled and registered with the State Government e-Procurement system, on <https://wbtenders.gov.in>. The bidder is to click on the link for e-tendering site as given on the website and if required, may contact the e-procurement Help Desk at 3A, Commissariat Road, Hastings, Kolkata – 700 022.

Registration
of Bidder

Digital Signature Certificate (DSC)

2.2. Each bidder is required to obtain a Digital Signature Certificate (DSC) for submission of tenders, from the approved service provider of the National Informatics Centre (NIC). Details are available on the website www.wbtenders.gov.in. DSC is given as a USB e token.

The bidder can search and download EOI and the Bid Documents electronically once it logs on to the website mentioned in Sl. No. 4 of the EOI. This is the only mode of collection of Bid Documents. The bidders are also advised to upload relevant documents such as certificates, purchase order details etc. well in advance under the “My Documents” Tab at www.wbtenders.gov.in so that those can later be selected and attached during bid submission. This is likely to ensure hassle free upload of Bid Documents.

There is no upper limit on the size of the file to be uploaded. However, the speed of upload is dependent on the memory available in the Client system as well as the network bandwidth used. In order to reduce the file size, bidders are advised to scan the documents in 75-100 DPI so that the optimal clarity is maintained.

The Employer will not be responsible for any delay or the difficulties faced during the submission of bids online by the bidders due to local connectivity or other issues.

3. Corrupt Practices

3.1. The Employer requires that bidders, suppliers, contractors under contracts with the Employer, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, the Employer: -

(a) defines for the purposes of this provision, the terms set forth below as follows:

i. "corrupt practice"/ "bribery" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party or influencing the process procuring goods or services or executing contracts;

ii. "fraudulent practice"/ "fraud" means any act or omission, including a misrepresentation of information or facts, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation or to influence the process procuring goods or services or executing contracts, to the detriment of the Employer or other participants;

- iii. **"coercive practice"** means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
 - iv. **"collusive practice"** means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party or designed to result in bids at artificial prices that are not competitive;
 - v. **"restrictive practice"** means forming a cartel or arriving at any understanding or arrangement among bidders with the objective of restricting or manipulating a full and fair competition in the bidding process.
- (b) will reject a proposal to award a contract if it determines that the bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or restrictive practices in competing for the Contract in question; and
 - (c) will sanction a party or its successor, including declaring ineligible, either indefinitely or for a stated period of time, to participate in any tender/bidding process of the Employer if it at any time determines that the firm has, directly or through an agent, engaged in corrupt, fraudulent, collusive, or coercive practices in competing for, or in executing, a contract of the Employer.
 - (d) will cancel or terminate a contract if it determines that a bidder /party has, directly or through an agent, engaged in corrupt, fraudulent, collusive coercive or restrictive practices in competing for, or in executing, a contract with the Employer.
 - (e) will normally require a Contractor of the Employer to allow the Employer or any person that the Employer may designate, to inspect or carry out audits of the Contractor 's accounting records and financial statements in connection with the Contract.

4. Eligible Bidders

4.1. The bidders have to meet the following eligibility criteria:

4.1.1. Shall either be a company within the meaning of the Companies Act, 2013/ statutory corporation / Public Sector Undertaking, subject to ITB 4.4 and 4.5 below, with a permanent office at Kolkata.

4.1.2. The bidder shall have satisfactorily completed as a contractor, at least one multi-storied (G+12 storied, ≥40 m high) housing project of ₹ 300 Crores on turnkey basis (including production of architectural, structural and related interdisciplinary services shop drawings and as-

Eligibility
criteria

built drawings) at any place(s) in India during the last 5 (five) financial years ending on the last day of the month previous to the one in which the tender is invited.

OR

Eligibility
criteria

Two multi-storied (G+12 storied, ≥40 m high) housing projects worth not less than of ₹ 500 Crores on turnkey basis (including production of architectural, structural and related interdisciplinary services shop drawings & as-built drawings) at any place(s) in India during the last 5 (five) financial years ending on the last day of the month previous to the one in which the tender is invited.

OR

One ongoing multi-storied (G+12 storied, ≥40 m high) housing project which has been partially completed on turnkey basis to the extent of 80% or more and the value of work executed be not less than ₹ 300 Crores, shall also be considered for determining the eligibility criteria if documentary evidence can be produced showing that the value of the completed portion of the project is ₹ 300 Crores or more.

N.B. –

(1) For eligible government sector projects, completion certificate shall have to be submitted. Completion certificate along with TDS / 26AS certificates evidencing payment of at least 80% of the completed works shall have to be submitted.

(2) For running works, the certificate of progress submitted by the bidder shall also certify that the progress of the works is satisfactory and no penal action has been initiated against the bidder. All Client certificates shall be issued by the Engineer-in-Charge of the works not below the rank of Executive Engineer or equivalent. TDS certificates shall not be considered as an alternative to the Client's certificate.

(3) Certificates of group/associate/ subsidiary/ parent/ holding company shall not be considered as a valid certificate of experience of the bidder, unless the same is supported by such documents that the group/ associate/subsidiary/ parent/ holding company and the bidder/, have amalgamated/ merged into the same entity.

(4) The eligible projects shall not include any project executed for group/associate/subsidiary/ parent/ holding company.

(5) For determining the value of the eligible projects as specified in ITB 4.1 above, the tendered amount of the project will be considered for evaluation and not the estimated amount of such project(s).

4.1.3. A bidder must have average annual turnover of at least ` 500 Crores in every year during the last 5 (five) financial years (from construction works only) or a gross turnover of no less

Eligibility
criteria

than ₹ 2500 Crores during the last 5 (five) financial years (from construction works only) ending on the last day of the month previous to the one in which the tender is invited for meeting the eligibility criteria. The annual turnover is to be certified by a Chartered Accountant.

4.1.4. The bidder shall have an Available Bid Capacity equal to or more than ₹ 300 Crores. The Available Bid Capacity will be calculated as per formula given below:

Available Bid Capacity = $(A \times N \times 2.0 - B)$ Where,

N = Number of years prescribed for completion of work for which bid is invited.

A = Maximum value of engineering works in respect to Projects (turnkey projects/ item rate projects/ construction works) updated to the price level of the year indicated in table below under note.

B = Value (updated to the price level of the year indicated in table below under note) of existing commitments, works for which Commencement Date has been declared or ongoing works to be completed during the period of completion of the works for which bid is invited. For sake of clarification, it is mentioned that the works for which Letter of Intent/ Work Order/ Award of Contract has been issued but Commencement Date not declared as on the last date of submission of bids shall not be considered while calculating value of B. The factor for the year for updation to the price level is indicated as under:

4.1.5. The bidder shall	The updation factors to update Turnover and/or “A” value for Bid Capacity					
	Year T	Year-1 (2022-23)	Year-2 (2021-22)	Year-3 (2020-21)	Year-4 (2019-20)	Year-5 (2018-19)
	Updation Factor	1.00	1.05	1.10	1.15	1.20

submit a Bank Solvency Certificate of a value of ₹ 100 Crores or more in the name of the bidder from any scheduled bank.

4.1.6. It may be noted that participation in the form of joint venture/consortium / special purpose vehicle will not be allowed in the above EOI.

4.1.7. The other eligibility criteria are described in Clause 2 of Section 3 (Evaluation and Qualification Criteria).

4.2. A bidder shall have to furnish the following documents:

- (a) Current Trade licence, Valid electrical Licence, Professional Tax (P.T.) Clearance Certificate, P.T. (Deposit Challan), GST Registration Certificate along with Income Tax Return Acknowledgement Receipt for current Assessment Year.

Bidder's
document

Bidder's
document

(b) EPF & ESI certificate with current challan, Tax Audit Report in Form 3CB/ Form 3CD along with Balance Sheet & Profit and Loss A/c. for the last 5 (five) years (year just preceding the current financial year will be considered as year-1).

(c) Financial Statement in Form 17, FIN - I of Section 4 (Bidding Forms) digitally signed by the bidder.

(d) Declaration in Form - 2 of Section 4 (Bidding Forms) regarding structure and organization duly digitally signed by the bidder.

N.B. The above-mentioned financial documents such as certificates, Tax Audit Report in Form 3CB, Form 3CD etc. must be system generated. All certificates shall have UDI number in it.

4.3.

Conflict
of
Interest

The Employer considers a conflict of interest to be a situation in which a party has an interest that could improperly influence that party's performance of official duties or responsibilities, contractual obligations, or compliance with applicable laws and regulations, and that such conflict of interest may contribute to or constitutes a prohibited practice by the Employer which requires that bidders, suppliers, and contractors under contracts with the Employer, observe the highest standard of ethics and will take appropriate actions if it determines that a conflict of interest has flawed the integrity of any procurement process. Consequently, all bidders found to have a conflict of interest shall be disqualified. A bidder may be considered to be in a conflict of interest with one or more parties in this bidding process if, including but not limited to:

4.3.1. they have controlling shareholders in common; or

4.3.2. they receive or have received any direct or indirect subsidy from any of them; or

4.3.3. they have the same legal representative for purposes of this bid; or

4.3.4. they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the bid of another bidder, or influence the decisions of the Employer regarding this bidding process; or

4.3.5. participation by a bidder in more than one bid will result in the disqualification of all bids in which the party is involved.

4.4.

Disqualification
if under a
declaration of
ineligibility

A bidder is under a declaration of ineligibility by the Employer in accordance with ITB 3 or by any Department of Government of India or any State Government, at the date of the

deadline for bid submission or thereafter during process of evaluation, shall be disqualified.

- 4.5. Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer, as the Employer shall reasonably request.
- Evidence of continued eligibility

5. Eligible Personnel, Materials, Equipment and Services

- 5.1. The bidder must have the requisite numbers of Technical Personnel, Plants and Equipment as enumerated in Forms 4, 9 and 10 of Section 4 (Bidding Forms). The materials, equipment and services to be supplied under the Contract may have their origin in any country except prohibited by any statute.
- Technical Personnel, Plants and Equipment

- 5.2. For purposes of ITB 5.1 above, "origin" means the place where the materials and equipment are mined, grown, produced or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that differs substantially in its basic characteristics or in purpose or utility from its components.
- "Origin" of products

- 5.3. The bidders are cautioned to read the specifications carefully, as there may be special requirements. The technical specifications presented herein may not be construed as defining a particular manufacturer's product. The bidders are encouraged to advise the Employer, if they disagree. The specifications are the minimum requirements for the products. The products offered must meet or exceed requirements mentioned in the technical specifications. The products shall conform in strength, quality and workmanship to the accepted standards of the relevant industry. Modifications of or additions to basic standard products of less size or capability to meet these requirements will not be acceptable.
- Technical specifications

6. Sections of Bid Document

6.1. Bid Documents	<p>The Bid Document consists of Parts 1, 2, and 3, which include all the Sections indicated below, and should be read in conjunction with any Addenda/Corrigenda issued in accordance with ITB 8.</p> <p>A. PART I Bidding Procedures</p> <p>I. Section 1 – Expression of Interest (EOI)</p> <p>II. Section 2 - Instructions to Bidders (ITB)</p> <p>III. Section 3 - Evaluation and Qualification Criteria (EQC)</p> <p>IV. Section 4 - Bidding Forms (BDF)</p> <p>B. PART II Requirements</p> <p>V. Section 5 - Employer's Requirements (ERQ)</p> <p>C. PART III Conditions of Contract and Contract, Forms</p> <p>VI. Section 6 - General Conditions of Contract (GCC)</p> <p>VII. Section 7 - Particular Conditions of Contract (PCC) [NOT USED]</p> <p>VIII. Section 8 - Contract Forms (COF)</p>
6.2. Completeness of Document	<p>The Employer is not responsible for the completeness of the Bid Document and their Addenda/ Corrigenda, if they were not obtained directly from the source stated by the Employer in the EOI.</p>
6.3. Checking by Bidder	<p>The bidder is expected to examine all instructions, forms, terms, and specifications in the Bid Document. Failure to furnish all information or documentation required by the Bid Document may result in the rejection of the bid.</p>
6.4. Arrangement of Sections and bid documents	<p>All the Sections forming part of the Bid Document are to be taken as mutually explanatory of one another. For the purposes of interpretation, the priority of the documents shall be in accordance to Clause 1.5 of the GCC.</p>
7.	<p>Clarification of Bid Document, Site Visit, Pre-Bid Meeting</p>
f Site visit	<p>7.1. A prospective bidder requiring any clarification of the Bid Document shall contact the Employer in writing by sending an e-mail to the Employer's e-mail address or raise his queries during the pre-bid meeting if provided for in accordance with ITB 7.4 and 7.5. The Employer shall upload in the website hosting the Bid Document, its responses to bidders' queries. Should the Employer deem it necessary to amend the Bid Document as a result of a</p>

request for clarification, it shall do so following the procedure under ITB 8.

7.2. The bidder is advised to visit and examine the Site of Works and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the bidder's own expense.

Permission by the Employer	7.3. The bidder and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the bidder, its personnel, and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.
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Pre-bid meeting	7.4. The bidder's designated representative is invited to attend a pre-bid meeting, the date, time and location of which shall be notified at a subsequent date. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
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Bidder's queries	7.5. The bidder is requested, as far as possible, to submit any questions in writing, to reach the Employer not later than one week before the meeting.
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Minutes of the pre-bid meeting	7.6. Minutes of the pre-bid meeting, including the text of the questions raised, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be uploaded in the e-tender portal i.e. www.wbtenders.gov.in within 7 (seven) days from the date of pre-bid meeting. Any modification to the Bid Document that may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an addendum pursuant to ITB 8 and not through the minutes of the pre-bid meeting.
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7.7. Non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder.

8. Amendment of Bid Document/ Extension of deadlines

8.1. Addenda/ Cor- rigenda	At any time prior to the deadline for submission of bids and in case of the extension of deadline for the submission of bids up to bid opening, the Employer may amend the Bid Document by issuing addenda/ corrigenda.
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8.2. Any addendum/ corrigendum issued shall be part of the Bid Document and shall be uploaded in the e-tender portal i.e. www.wbtenders.gov.in.

8.3 Extension of time by Employer To give prospective bidders reasonable time in which to take an addendum/ corrigendum into account in preparing their bids or for other causes and consideration, the Employer may, at its discretion, extend the deadline for the submission of bids.

9. Costs of Bidding

Bidder's cost The bidder shall bear all costs associated with the preparation and submission of its bid, and the Employer shall not be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

10. Language of Bid

Written in English The bid, as well as all correspondence and documents relating to the bid exchanged by the bidder and the Employer, shall be written in English only. Supporting documents and printed literature that are part of the bid may be in another language provided they are accompanied by an accurate translation of the relevant passages in English, in which case, for purposes of interpretation of the bid, such translation shall govern.

11. Documents comprising the Bid

11.1. Online submission Bids are to be submitted online following the process mentioned in Sl. Nos. 3 and 4 of EOI. All bidders shall initially submit the Technical Proposal / Technical Bid and all documents to be submitted along with the Technical Bid before the prescribed date and time duly signed with a valid Digital Signature Certificate (DSC). The documents are to be uploaded scanned for viruses and duly digitally signed so that the documents will get encrypted (transformed into non readable formats). The documents forming the Technical Bid must be identifiable in respect of each of the sections/categories for which the bidder is submitting a bid. Bidders should especially take note of all the addenda and corrigenda related to the Bid Document and upload all of these documents also as a part of their bid.

The bidders shall carefully go through all the documents and prepare to upload the scanned documents in Portable Document Format (PDF) in the designated link in the web portal as their Technical Bid. Once the bidder is shortlisted, the bidder is required to fill up the BOQ as per the format provided and upload the same again in the designated link in the portal as their Financial Bid, with all documents to be submitted along with the Financial Bid.

- 11.2. The Technical Bid shall comprise of the scanned copies of the following documents in one folder:

Statutory cover of Technical Bid containing:

The
Technical Bid

To be filled in FORM folder:

- (i) Letter of Technical Bid in form of Affidavit as given in Form – 1 of Section – 4 (Bidding Forms)
- (ii) Declaration cum Experience profile of the bidder, as per format given in Section - 4 (Bidding Forms)
- (iii) Power of Attorney in favour of signatory of the bid, as per format given in Section - 4 (Bidding Forms)
- (iv) Qualification Information (duly filled in by the bidder), as per format given in Section - 4 (Bidding Forms)
- (v) Letter of Financial Bid, as per format given in Section - 4 (Bidding Forms)

To be filled in e-NIT folder:

- (i) Notice Inviting e-Tender (Section - 1) and Instructions to Bidders (Section - 2) (uploaded with digital signature).
- (ii) General Conditions of Contract (Section - 6) (uploaded with digital signature).
- (iii) Employer's Requirements (Section - 5) (uploaded with digital signature).

Non-statutory (My Documents) cover containing

To be filled in CERTIFICATE folder:

- (i) Copy of Certificate of Incorporation and Memorandum and Articles of Association
- (ii) Copy of GST Registration Certificate/ letter recording GST identification number along with latest payment challans
- (iii) Copy of Professional Tax Registration Certificate along with latest payment challans
- (iv) Copy of document showing proof of permanent office in Kolkata
- (v) Copy of EPF Certificate in the name of the bidder along with latest payment challans
- (vi) Copy of ESI Certificate in the name of the bidder along with latest payment challans
- (vii) Copy of Bank Solvency Certificate of a value of Rs. 100 Crores or more in the name of the bidder, as per format given in Section - 4 (Bidding Forms)
- (viii) Current Trade licence, Valid electrical Licence.

To be filled in FINANCIAL INFO folder:

- (i) Copy of Income Tax Returns for the financial years 2018-2019, 2019-2020, 2020-2021, 2021-2022 and 2022-2023 i.e. assessment years 2019-2020, 2020-2021, 2021-2022, 2022-2023 and 2023-2024
- (ii) Copy of latest Professional Tax Deposit Challan
- (iii) Form FIN – 1 of Form- 17 (Financial Situation)
- (iv) Form FIN – 2 of Form- 17 (Average Annual Turnover for Civil Contractual Work)
- (v) Form FIN-3 of Form –17 (Financial Resources)
- (vi) Form FIN-4 of Form - 17 (Current Contract Commitments/Works in Progress)
- (vii) Form FIN-5 of Form -17 (Bid Capacity)

To be filled in P/L AND BALANCE SHEET 2018-2019 folder:

Profit & Loss Account and Balance Sheet for financial year 2018-2019 along with system generated Tax Audit Return in Form 3CB/ 3CD

To be filled in P/L AND BALANCE SHEET 2019-2020 folder:

Profit & Loss Account and Balance Sheet for financial year 2019-2020 along with system generated Tax Audit Return in Form 3CB/ 3CD

To be filled in P/L AND BALANCE SHEET 2020-2021 folder:

Profit & Loss Account and Balance Sheet for financial year 2020-2021 along with system generated Tax Audit Form in Form 3CB/ 3CD

To be filled in P/L AND BALANCE SHEET 2021-2022 folder:

Profit & Loss Account and Balance Sheet for financial year 2021-2022 along with system generated Tax Audit Form in Form 3CB/ 3CD

To be filled in P/L AND BALANCE SHEET 2022-2023 folder:

Profit & Loss Account and Balance Sheet for financial year 2022-2023 along with system generated Tax Audit Form in Form 3CB/ 3CD

To be filled in CREDENTIAL 1 folder:

- (i) Value of construction works of civil nature of work (excluding road works) completed as per format in Form - 18 in Section – 4 (Bidding Forms) during the last 5 financial years supported by certificate by the Client
- (ii) Form – 11 (Site Organisation)
- (iii) Form – 12 (Method Statement)
- (iv) Form – 13 (Mobilisation Schedule)
- (v) Form – 14 (Construction Schedule)

To be filled in MANPOWER folder:

- (i) Details of personnel in the payrolls of the bidder, as required in Section – 3 (Evaluation and Qualification Criteria)

11.3. The Shortlisted Bidder will submit the Financial Bid which shall comprise of :

Financial Bid

- (i) Bill of Quantities (BOQ) for each section(s), in the specified format; inclusive of all taxes and charges.
- (ii) Cost of individual finished items as specified in the format being Form 15 of Section - 4 (Bidding Forms) as may be applicable.

N.B. – (1) The Shortlisted Bidder is required to compulsorily quote the upper rate for each finished item. However, such rates will not be considered for evaluation of Financial Bid.

- (2) Only downloaded copies of the above documents are to be uploaded, virus scanned and digitally signed by the Shortlisted Bidder.

12. Letters of Bid, and Schedules

Letters

12.1. The letters of Technical Bid shall be prepared using the relevant forms furnished in Section 4 (Bidding Forms). The forms must be completed without any alterations to the text, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested.

13. Bid Prices

Bid Price

13.1. The prices quoted by the Shortlisted Bidder in the Bill of Quantities (BOQ) shall conform to the requirements specified below.

13.2. The price to be quoted in the BOQ, shall be the total price of the bid.

13.3. The price quoted by the Shortlisted Bidder will not be subject to any discount or adjustment.

13.4. All duties, taxes, and other levies payable by the Selected Bidder under the Contract, or for any, other cause, shall be considered to be included in the prices and the total Bid Price submitted by the Shortlisted Bidder. The Bid Price quoted by the Shortlisted Bidder shall be final and shall not be adjusted and/or increased for change in any duty / tax / other levies or outgoings. In other words, the Selected Bidder will not be paid anything more than the Bid Price, which is all inclusive.

However, the Employer will assist (on a no recourse basis and in good faith, based on the selected bidder's representations and in good faith thereof) the Selected Bidder / Contractor to obtain any lawful exemptions from payments of Duties or Taxes on Plant and Materials which are to be incorporated as a part of the Permanent Works by issue of an appropriate certificate in the requisite format certifying the estimated quantities of Plant / Materials that are to be incorporated into the Works. The responsibility for obtaining any such exemptions from the competent authority will remain with the Selected Bidder and the Employer shall in no way be responsible for admissibility of the claims or eligibility of the Selected Bidder.

14. Currencies of Bid and Payment

14.1. The unit rates and the prices shall be quoted by the Shortlisted Bidder entirely in [] Indi-

Indian
Currency

an National Rupees ['] only. The Employer shall be entitled to reject any bid, if the same has been submitted in any other currency.

15. Documents Comprising the Technical Proposal

15.1. The bidder shall furnish, as part of the Technical Bid, a Technical Proposal including a statement of work methods, equipment, personnel, schedule and any other information as stipulated in Section 4 (Bidding Forms), in sufficient detail to demonstrate the adequacy of the bidders' proposal to meet the work requirements and the completion time.

Work meth-
ods, Equip-
ment,
Completion
time

15.2. The bidder will have to present before the Tender Evaluation Committee (TEC, which is an expert technical body), conceptual drawings, work programme, modalities of execution in terms of modern mechanical construction equipment with image display conforming to technical specification and Employer's Requirements. The TEC will take into consideration various factors, collectively and holistically, especially factors having a direct bearing on time-bound completion nature of the Works. If the TEC in their subjective assessment finds any discrepancy in bidder 's capability to render the work satisfactorily based on their presentation and other factors which are corroborative of their stated credentials such as financial strength, experience in similar work, personnel & establishment, plant & equipment or other factors which have a bearing on the bidder's capability to perform the contract, if awarded, the overall evaluation weightage will be calibrated for such bidder accordingly.

Presentation
before the
Tender
Evaluation
Committee

15.3. To establish the conformity of the goods and related services to the Bid Documents, the bidder shall furnish as part of its bid, the documentary evidence that the goods and related services conform to the technical specifications and standard specified in Section 5 (Employer 's Requirements).

Conformity of
goods and
services

16. Documents Establishing the Qualifications of the Bidder

16.1. To establish its qualifications to perform the Contract in accordance with Section 3 (Evaluation and Qualification Criteria) the bidder shall provide the information requested in the corresponding information sheets included in Section 4 (Bidding Forms).

Qualifica-
tions to per-
form the
Contract

17. Bid validity period

17.1. Bids shall remain valid for a period of 180 days after the bid submission deadline date prescribed by the Employer. A bid valid for a shorter period shall be rejected by the Employer as non-responsive.

Bid validity

17.2. In exceptional circumstances, prior to the expiration of the bid validity period, the Employer may request bidders to extend the period of validity of their bids. The request and the responses shall be made in writing. If Participation Money is requested to be extended in accordance with ITB 18, it shall also be extended 28 (twenty-eight) days beyond the deadline of the extended validity period. A bidder may refuse the request without forfeiting its Participation Money. A bidder granting the request shall not be required or permitted to modify its bid.

Extended validity period

18. Participation Money

18.1. The bidder shall upload along with scanned copy of its bid in the e-tender website i.e. www.wbtenders.gov.in in the appropriate folders, as part of its bid, shall make payment of the Participation Money of ` 50,00,000/- (Rupees Fifty Lakhs only) to be paid through the ICICI Bank payment gateway through its net-banking enabled bank account, to the designated bank account as mentioned in the website <https://wbtenders.gov.in>. Upon being awarded the Contract, such Participation Money shall be retained by the Employer during the term of the Contract and shall be converted as part of the Earnest Money Deposit (EMD) to be paid by the Selected Bidder. Balance EMD shall be deposited in the form of Bank draft from any scheduled bank in favour of Executive Engineer, New town Construction Division –II, Housing Directorate payable at Kolkata.

Participation Money

18.2. The Participation Money of unsuccessful bidders will be refunded without any interest through an automated process as referred in Memo No. 3975-F(Y) dated 28th July, 2016 of the Finance Department, Government of West Bengal, within 15 days of issue of Notification of Award and submission of Performance Security by the Selected Bidder.

Refund

18.3.	The Participation Money may be forfeited:
Forfeiture of Participation Money	<p>(a) If a bidder withdraws its bid during the period of bid validity specified by the bidder, except as provided in ITB 17.2;</p> <p>(b) If a bidder engages in a corrupt practice, fraudulent practice, coercive practice, collusive practice or restrictive practice as specified in ITB 3.1;</p> <p>(c) If the bidder is declared disqualified in terms of ITB 4.3;</p> <p>(d) If the Selected Bidder fails to:</p> <p>(I) sign the Contract in accordance with ITB 33</p> <p>(II) furnish a Performance Security in accordance with ITB 34; or</p> <p>(e) If the bidder is otherwise in breach of the terms of the Bid Document.</p>

19. Format and Signing of Bid

19.1.	The bid shall be digitally signed by a person or persons duly authorized to sign on behalf of the bidder as stated in Sl. 3 of the EOI.
Signed Bid	

20. Submission of Technical Bid

20.1.	Technical Bid is to be submitted online as stated in Sl. Nos. 3, 4 and 5 of the EOI in the respective folders as provided in ITB 11.1& 11.2 before the prescribed date and time with Digital Signature Certificate (DSC). The documents are to be uploaded scanned for viruses and duly signed, digitally so that the documents will get encrypted (transformed into non readable formats).
Online submission	

21. Deadline for Submission of Technical Bids

Deadline & extension of time	<p>21.1. Complete Technical Bids must be uploaded in the e-tender portal i.e. www.wbtenders.gov.in not later than the date as mentioned in the EOI under Sl. 11</p> <p>21.2. The Employer may, at its discretion, extend the deadline for the submission of bids by amending the Bid Document in accordance with ITB 8, in which case all rights</p>
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and obligations of the Employer and bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.

22. Bid Opening

- Notification of
online
bid opening
- 22.1. The Technical Bid will be opened online by the authority receiving tenders or by its authorized representative at time, date and the place specified in the EOI under Sl. 11 in the manner specified in the EOI. The authority receiving tenders or its authorized representative, shall decrypt all Technical Bids submitted by the bidders and copy it in any storage device such as a compact-disc, pen drive or hard drive. The authority receiving tenders or its authorized representative shall then take print outs of all technical bids and upload each Technical Bid on the website www.wbtenders.gov.in. The date and time for online opening of Financial Bid will be announced at the time of uploading of Technical Evaluation Sheet/Report. The manner of online opening of Financial Bid will be same as Technical Bid opening.
- Completeness
of Bid
- 22.2. All folders containing the Technical Bids shall be opened one at a time, and the following recorded:
(a) the name of the bidder;
(b) any other details as the Employer may consider appropriate.
Only Technical Bids recorded at bid opening shall be considered for evaluation.
- Record of
Technical Bid
- 22.3. The Employer shall prepare a record of the opening of Technical Bids. A copy of the record shall be uploaded to the website www.wbtenders.gov.in.
- Shortlisted
bidders
- 22.4. At the end of the evaluation of the Technical Bids, the Employer will upload in the website www.wbtenders.gov.in, the name of the bidders who have submitted substantially responsive Technical Bids and who have been determined as being shortlisted for submission of Financial Bids. The date and time for submission of shortlisted Financial Bids will also be uploaded in the website www.wbtenders.gov.in.

Completeness of Financial Bid	<p>22.5. The Employer shall conduct the opening of the Financial Bid of all the shortlisted bidders, who have submitted the Financial Bids. All folders containing Financial Bids shall be opened one at a time and the following recorded:</p> <p>(a) the name of the bidder;</p> <p>(b) the Bid Prices; and</p> <p>(c) any other details as the Employer may consider appropriate.</p> <p>Only Financial Bids recorded during the opening of Financial Bids shall be considered for evaluation. No bid shall be rejected at the opening of Financial Bids except when the Financial Bid is not in accordance with the Bid Document.</p>
22.6 Record of Financial Bid	<p>The Employer shall prepare a record of the opening of Financial Bids that shall include, the name of the shortlisted bidder and the price quoted by the shortlisted bidder. A copy of the record shall be uploaded on the web portal www.wbtenders.gov.in.</p>
Confidentiality	<p>23. Confidentiality</p>
	<p>23.1. Information relating to the examination, evaluation, comparison, and post qualification of bids and recommendation of award of Contract, shall not be disclosed to bidders or any other persons not officially concerned with such process until information on award of Contract is communicated to all bidders.</p>
	<p>23.2. Any attempt by a bidder to influence the Employer in the evaluation of the bids or Contract award decisions may result in the rejection of its bid.</p>
24.	<p>Clarification of Bids</p>
24.1. Clarification by Bidder	<p>To assist in the examination, evaluation and comparison of the Technical and Financial Bids, the Employer may, at its discretion, ask any bidder for a clarification of its bid. Any clarification submitted by a bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change in the substance of the Technical Bid or, prices in the Financial Bid shall be sought, offered, or permitted.</p>

- 24.2. If a bidder does not provide clarifications of its bid by the date and time set in the Employer's request for clarification, its bid may be rejected.

25. Deviation, Reservations, and Omissions

25.1. During the evaluation of bids, the following definitions apply:

Deviation,
Reservations,
Omissions

25.1.1. "Deviation" is a departure from the requirements specified in the Bid Document;

25.1.2. "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bid Document; and

25.1.3. "Omission" is the failure to submit part or all of the information or documentation required in the Bid Document.

26. Preliminary Examination of Technical Bids

- 26.1. The Employer shall examine the Technical Bid to confirm that all documents and technical documentation requested in ITB 11.2 have been provided, and to determine the completeness of each document submitted. If any of these documents or information is missing, the bid may be rejected.
- Checking
by
Employer

27. Responsiveness of Technical Bid

Responsiveness

27.1. The Employer's determination of a bid's responsiveness is to be based on the contents of the bid itself, as defined in ITB 11.

27.2. A substantially responsive Technical Bid is one that meets the requirements of the Bid Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that

(a) if accepted, would:

(I) affect in any substantial way the scope, quality, or performance of the Works specified in the Contract; or

(II) limit in any substantial way, inconsistent with the Bid Document, the Em-

ployer's rights or the bidder's obligations under the proposed Contract; or

Responsiveness (b) if rectified, would unfairly affect the competitive position of other bidders presenting substantially responsive bids.

27.3. The Employer shall examine the technical aspects of the Bid submitted in accordance with ITB 15, Technical Proposal, in particular, to confirm that all requirements of Section 5 (Employer's Requirements) have been met without any material deviation or reservation.

27.4. If a bid is not substantially responsive to the requirements of the Bid Document, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

28. Nonconformities, Errors, and Omissions

Nonconformities, Errors, Omissions 28.1. Provided that a bid is substantially responsive, the Employer may waive any nonconformities in the bid that do not constitute a material deviation, reservation or omission.

28.2. Provided that a Technical Bid is substantially responsive, the Employer may request that the bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the Technical Bid related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the Financial Bid. Failure of the bidder to comply with the request may result in the rejection of its bid.

29. Qualification of the bidder

Qualification
of
the bidder

29.1. The Employer shall determine to its satisfaction during the evaluation of Technical Bids whether bidders meet the qualifying criteria specified in Section 3 (Evaluation and Qualification Criteria).

29.2. The determination shall be based upon an examination of the documentary evidence of the bidder's qualifications submitted by the bidder, pursuant to ITB 15.1.

30. Deleted

31. Employer's Right to Accept Any Bid, and to Reject Any or All Bids

31.1. The Employer reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to award of contract, without thereby incurring any liability to Bidders. In case of annulment, all bids submitted and specifically, bid securities, shall be promptly returned to the bidders.

Right to
accept or
reject

32. Notification of Award

Notification
of Award

32.1. The shortlisted bidder whose Financial Bid has been accepted will be notified of the award by the Employer prior to expiration of the bid validity period by uploading in the e-tender portal i.e. www.wbtenders.gov.in or by e-mail or facsimile confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the Letter of Acceptance/Notification of Award) will state the sum that the Employer will pay the Contractor in consideration of the execution of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the Contract Price). Until a formal contract is prepared and executed the Notification of Award shall constitute a notification of commencement of Works, subject only to the furnishing of a Performance Security in accordance with the provisions of ITB 34. The Employer shall handover the site to the Selected Bidder within 7 days from the Notification of Award/ Letter of Acceptance, whereupon the Contract shall come into force.

33. Signing of Contract

Signing of Contract

33.1. Promptly after issue of Notification of Award, the Employer shall send the Selected Bidder, the Form of Agreement to be executed. Each page of the Agreement should be signed by the Employer's authorized signatory and the Contractor's authorized signatory. If there are any corrections, cuttings, omissions, over writings, insertions, etc. (after issue of Bid Document) their number should be clearly mentioned on each page of the Agreement before signing.

33.2. Within 21 days of receipt of the form of Agreement, the Selected Bidder shall sign the Agreement and return it to the Employer. The Contract shall only come into existence, when the Performance Security is furnished in terms of ITB 34.

33.3. No payment for the work done will be made to the Selected Bidder till the Agreement is signed by the Selected Bidder and Performance Security has been submitted by the Selected Bidder.

34. Performance Security

Performance Security

34.1. Within 7 working days of the receipt of Notification of Award from the Employer, the Selected Bidder shall furnish the Performance Security in accordance with the conditions of contract, using for that purpose the Performance Security Bank Guarantee Form included in Section 8 (Contract Forms), or another form acceptable to the Employer. The Performance Security to be submitted by the Selected Bidder shall be of an amount equivalent to 10% of the Contract Price deducted by ` 50,00,000/- (Rupees Fifty Lakhs only, Participation Money already adjusted towards EMD) in favour of Executive Engineer, New Town Construction Division-II, Housing Directorate valid upto end of defect liability period. Such Performance Security of 10% shall for all purposes, be considered to be comprising of 8% of Contract Price (towards Performance Security) and 2% of Contract Price (towards EMD, which shall include the amount of ` 50,00,000/- (Rupees Fifty Lakhs only paid as Participation Money). Failure of the Selected Bidder to submit the Performance Security shall constitute sufficient grounds for the annulment of the award and forfeiture of the Participation Money. In that event, the Employer may award the Contract to the next lowest evaluated bidder whose offer is substantially responsive and is determined by the Employer to be qualified to perform the Contract satisfactorily at the price at which the Selected Bidder was awarded the Contract or the Employer, may, at its discretion go in for fresh tenders.



GOVERNMENT OF WEST BENGAL
OFFICE OF THE SUPERINTENDING ENGINEER, SOUTH CIRCLE,
HOUSING DIRECTORATE, P- 7 & 8, C.I.T. ROAD, 1ST FLOOR,
KOLKATA-700014

BID DOCUMENTS FOR
CONSTRUCTION OF OITIKA-OWNERSHIP HOUSING
FOR WBCS(EXE) OFFICERS
AT PRE. NO.-44-0676, PLOT NO.-II-D/37 IN AA-IID,
ACTION AREA -IID, NEW TOWN, KOLKATA.
ON TURNKEY BASIS

SECTION 3
Evaluation & Qualification Criteria (EQC)

This section contains all the criteria that the Employer shall use to evaluate bids and qualify Bidders. The bidder shall provide all the information requested in the forms included in Section 4 (Bidding Forms).

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1. Evaluation

In addition to the criteria listed in ITB the following criteria shall apply:

1.1.

Adequacy of Technical Proposal	Evaluation of the bidder's Technical Proposal will include an assessment of the bidder's technical capacity to mobilize key equipment and personnel for the Contract consistent with its proposal regarding work methods, scheduling, and material sourcing in sufficient detail and fully in accordance with the requirements stipulated in Section 5 (Employer's Requirements) and Section 3 (Evaluation and Qualification Criteria).
--------------------------------	---

2. Qualification Eligibility

2.1. Eligibility

2.1.1. Nationality

Criteria Requirement	Compliance Requirements	Documents Submission Requirements
Nationality in accordance with ITB 4.1	Must meet requirement	Form ELI-1 with Attachments

2.1.2. Conflict of Interest

Criteria Requirement	Compliance Requirements	Documents Submission Requirements
No conflict of interest in accordance with ITB 4.3	Must meet requirement	Letter of Technical Bid

2.1.3. Housing Department Eligibility

Criteria Requirement	Compliance Requirements	Documents Submission Requirements
Not having been declared ineligible by Housing Department or any Department of Government of India or any State Government, as described in ITB 4.4	Must meet requirement	Letter of Technical Bid

2.1.4. Government owned entity

Criteria Requirement	Compliance Requirements	Documents Submission Requirements
Bidder required to meet conditions of ITB Sub Clause 4.5	Must meet requirement	Letter of Technical Bid

2.2. Financial Situation

2.2.1. Historical Financial Performance

Criteria Requirement	Compliance Requirements	Documents Submission Requirements
Submission of audited balance sheets, other financial statements for the last 5(five) years to demonstrate the current soundness of the bidder's financial position and its prospective long term profitability. Using Forms FIN – 1 in Section 4 (Bidding Forms) the bidder must demonstrate that the bidder's net worth is positive	Must meet requirement	Forms FIN- 1, FIN – 2, FIN – 3 and FIN – 4 of Form – 17 of Section 4

2.2.2. Average Annual Turnover

Criteria Requirement	Compliance Requirements	Documents Submission Requirements
A bidder must have average annual turnover of at least ` 500 Crores (from construction works only) in every year during the last 5 (five) financial years or a gross turnover of no less than ` 2500 Crores (from construction works only) during the last 5 (five) financial years ending on the last day of the month previous to the one in which the tender is invited for meeting the eligibility criteria.	Must meet requirement	Forms FIN – 1 and FIN-2 of Form – 17 of Section 4

2.2.3. Financial Resources

Criteria Requirement	Compliance Requirements	Documents Submission Requirements
The bidder must demonstrate access to, or availability of, financial resources such as liquid assets, unencumbered real assets, lines of credit, and other financial means, other than any contractual advance payments to meet the overall cash flow requirement:	Must meet requirement	Form FIN-3 & FIN-4 of Form - 17 of Section 4 and Bank Solvency Certificate

2.2.4. Available Bid Capacity

Criteria Requirement	Compliance Requirements	Documents Submission Requirements
The bidder must demonstrate an Available Bid Capacity of ` 300 Crore or more	Must meet requirement	Form FIN-5 of Form - 17 (Bid Capacity) of Section 4

2.3. Construction Experience

2.3.1. Construction Experience

Criteria Requirement	Compliance Requirements	Documents Submission Requirements
The bidder shall have satisfactorily completed as a contractor, at least one multi-storied (G+12 storied, ≥40 m high) housing project of ` 300 Crores or two multi-storied (G+12 storied, ≥40 m high) housing projects worth not less than of ` 500 Crores on turn-key basis (including production of architectural, structural and related interdisciplinary services shop drawings & as-built drawings) at any place(s) in India during the last 5 (five) financial years ending on the last day of the month previous to the one in which the tender is invited or shall have partially completed to the extent of 80% or more of one ongoing multi-storied	Must meet requirement	Form FIN - 4 of Form - 17 and Form EXP -1 of Form - 18 of Section 4

(G+12 storied, ≥40 m high) housing project on turn-key basis (including production of architectural, structural and related interdisciplinary services shop drawings) and the value of such executed work shall be not less than ` 300 Crores at any place(s) in India during the last 5 (five) financial years ending on the last day of the month previous to the one in which the tender is invited.		
--	--	--

2.3.2. Contracts of Similar Size and Nature

Criteria Requirement	Compliance Requirements	Documents Submission Requirements
Participation as contractor in construction contracts (except road works).	Must meet requirement	Form 18 of Section 4

2.4. Personnel

The bidder, must engage the following technical personnel (having minimum 8-year experience for diploma holder and 5-year experience for degree holder) in their pay-roll of full time engagement per site:

- (a) 1-Graduate Civil Engineer for day to day management /supervision/inspection of progress of work
- (b) 2-Diploma Civil Engineers for day to day management /supervision/inspection of progress of work
- (c) 1-Surveyor (Conversant with TS survey instrument)
- (d) 2-Quantity Surveyors
- (e) 1-Planning Engineer (Conversant with MS Projects)
- (f) 1-Senior(Graduate) Safety Engineer
- (g) 1-Diploma Mechanical Engineer
- (h) 1-Graduate Electrical Engineer
- (i) 1-Diploma Electrical Engineer for day to day management /supervision/inspection of progress of work
- (j) 1 Electrical Supervisor/ Engineer Holding Electrical Supervisor's Certificate of Competency (granted by the authorities of the concerned State Government/West Bengal Licensing Board)

on the parts 1,2,3,4,5,6a,6b, 7a, 7b, 9, 10, 11, & 12 as per I.E. Rules or National Supervisors Certificate of Competency.

(k) ___ - Technicians/CAD Operators

(l) 1- Horticulturist/Gardener (having minimum 3-year experience with recognised diploma/degree/certificate course in Horticulture)

Apart from engineers cited above to be deputed at site for overseeing different phases of construction, a team of Key Personnel of following criteria is pre-requisite. 3 (three) lead project engineers and 1 (one) junior engineer in the payroll of the bidder and whose CV is to be submitted with the bidder should be named in the contract with whom day to day interactions shall be made by the representative(s) of the Employer for execution and supervision of the Works.

2.5. Equipment

The bidder must demonstrate that it has all the key (but not limited to) equipment as listed hereinafter.

Confirmation in writing on availability (as required per execution plan) of the following key and critical equipment (either owned by the bidder or leased by the bidder for this project to be valid at least till the completion of project) is compulsory. All Plants & Machineries should either be owned by the bidder or taken on lease and should be not more than 5 (five) years old.

Sl no	List of Plants & Machineries	Requirement
1	Cement concrete batch mix plant arrangement (Minimum capacity 30 Cum/hr)	1
2	Field testing set including following equipment : a) As attached in the Form -8 b) c)	— —
3	Tower crane/ Hoist crane (material/passenger lifting machine) (for G+12 floors) up to 52 m height, 5 (t)	2
4	Construction elevator	6
5	Mechanical Winch	10
6	Latest model of theodolite + levelling machine /	1

	Total Station Survey Instrument	
7	Truck & tipper/Dumper	5
8	Vibrator / equipment	10
9	Concrete pump	2
10	Mechanical excavator	1
11	Steel staging & shuttering material	100,000 sq. ft.
12	12t Vibro Roller	1
13	Hydraulic Excavator (capacity of 1-1.2 CUM)	3
14	Road marking machine	1
15	Diesel Generator Set (capacity of 125KVA)	1
16	Soil excavator cum loader	2
17	Hydra	1
18	Steel Reinforcement cutting and bending machine	4
19	Welding machine	2
20	Transit Mixture	2

The bidder shall provide further details of proposed items of equipment using the relevant form in Section 4 (Bidding Forms).

The bidder is to provide their own estimate of the number of equipment, commensurate with their work plan and methodology.

The bidder to fill up the table based on its assessment of requirement of the project to be completed within the stipulated time period.

The bidder shall give an undertaking to mobilize additional plant and equipment as will be found necessary during execution of the work to meet the target completion date, without any additional cost to the Employer.



GOVERNMENT OF WEST BENGAL

**OFFICE OF THE SUPERINTENDING ENGINEER, SOUTH CIRCLE
HOUSING DIRECTORATE, P- 7 & 8, C.I.T. ROAD, 1ST FLOOR,
KOLKATA – 700014.**

BID DOCUMENTS FOR

**CONSTRUCTION OF OITIKA-OWNERSHIP HOUSING
FOR WBCS(EXE) OFFICERS
AT PRE. NO.-44-0676, PLOT NO.-II-D/37 IN AA-IID,
ACTION AREA -IID, NEW TOWN, KOLKATA.
ON TURNKEY BASIS**

**SECTION 4
BIDDING FORMS**

FORM: 1

Letter of Technical Bid in form of Affidavit

(To be furnished on non-judicial stamp-paper of appropriate value, duly notarized)

Date : _____

NIQ No.: _____

Name of Contract:

“Construction of OITIKA-Ownership Housing for WBCS(Exe) Officers at Pre. No.-44-0676, Plot no.-II-D/37 in AA-IID, Action area -IID, New Town, Kolkata.”.

To,

The Superintending Engineer, South Circle.

Office of the Superintending Engineer, South Circle, Housing Directorate.

P- 7 & 8, C.I.T. Road, 1st Floor,

Kolkata – 700014

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB).
- (b) We offer to execute in conformity with the Bidding Documents the following works:
- (c) Our Bid consisting of the Technical Bid and the Price Bid shall be valid for a period of 120 days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
- (d) If our bid is accepted, we commit to furnish a performance security in accordance with the Bidding Documents.
- (e) Our company has been incorporated in accordance with the laws of India and governed by them.
- (f) Our company, including its suppliers, do not have any conflict of interest in accordance with ITB;
- (g) Our company is participating, as a bidder having satisfied the eligibility criteria in accordance with ITB;

- (h) Our company, its affiliates or subsidiaries, including any suppliers for any part of the contract, has not been declared ineligible by Housing Directorate, any department of Government of India or any State Government;
- (i) We agree to permit Housing Directorate or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by the Housing Directorate.
- (j) We understand that:
- I. The tender inviting and accepting authority can amend the scope and value of the contract bid under this project.
 - II. The tender inviting and accepting authority reserves the right to reject any application without assigning any reason.
- (k) All the statements made in the attached documents are true and correct. In case of any information submitted proved to be false or concealed, the application may be rejected and no objection /claim will be raised by the bidder company.

Enclosed:

1. Statutory Documents
2. Non Statutory Documents
3. Forms & Annexure duly filled up, signed & notarized (where applicable)

Name _____

In the capacity of _____

Signed _____

Duly authorized to sign the bid for and on behalf of (if applicable) _____

Date _____

FORM: 2

DECLARATION BY THE BIDDER

(Affidavit on Non-Judicial Stamp Paper of Rs.10/- duly attested by Notary / Magistrate)

This is to certify that We, _____,
in submission of this offer confirm that: -

We have inspected the site of work (plot no - IID / 37, New Town, Kolkata) and have made myself/ourselves fully acquainted with local conditions in and around the site of work. We have carefully gone through the Instructions to Bidders (ITB) and all the documents, Forms & Annexure, etc. mentioned therein along with the drawings attached. We have also carefully gone through the ITB, Employer's Requirements, General Conditions of Contract, Forms & annexures etc. to be submitted duly filled up & notarized in the form of Affidavit, where applicable, and time of completion (which is sacrosanct) of work: "construction of OITIKA-Ownership Housing for WBCS(Exe) Officers at Pre. No.-44-0676, Plot no.-II-D/37 in AA-IID, Action area -IID, New Town, Kolkata."

1. Our tender is offered taking due consideration of all factors including site information and conditions of proposed location of the upcoming Multi-storey Housing stated in the detailed Instructions to Bidders to execute all works up to the standards as laid out in Employer's Requirements and other sections of ITB.
2. We understand that the work being done on Turnkey Basis (including production of shop drawings and as-built drawings) though we require approvals from the Employer / Employer's Representative at different stages of the work starting from the inception to implementation of the works, such approvals do not absolve owning up of responsibility incumbent to us for adequacy of design standard, quality of construction & its safety, maintaining prescribed specification of the work and upholding secured movement of all the stakeholders inside the premises.
3. We promise to abide by all the stipulations of the Contract documents and carry out and complete the work up to the satisfaction of the Employer.
4. We also agree to procure Plants and Machineries at our cost required for the work.
5. We also submit that we have Organizational Structure comprising adequate Technical Personnel in the line of requirement of ITB.
6. We also agree to accomplish the job entrusted to us in the stipulated time laid out in ITB except situations not under our control.

7. We have not made any misleading or false representation in the forms, statements and attachments in proof of the qualification requirements;
 - a) We do not have records of poor performance such as abandoning the work, not properly completing the contract, inordinate delays in completion, litigation history or financial failures etc.
 - b) Business has not been banned with us by any Central / State Government Department/ Public Sector Undertaking or Enterprise of Central / State Government.
8. We have submitted all the supporting documents and furnished the relevant details as per prescribed format.
9. List of Similar Works satisfying Qualification Criterion as indicated hereinafter, does not include any work which has been carried out by us through a subcontractor on a back to back basis.
10. The information and documents submitted with the tender by us are correct and we are fully responsible for the correctness of the information and documents submitted by us.
11. We understand that in case any statement/information/document furnished by us or to be furnished by us in connection with this offer, is found to be incorrect or false, our EMD in full will be forfeited and business dealings will be banned.

SEAL, SIGNATURE & NAME OF THE BIDDER

Signing this document

PROFORMA

Similar nature of work done				Work in progress			
Sl. No.	Name of the work with Tender No.	Employer & Contact no	Estimated Amount	Sl. No	Name of the work with Tender No.	Employer & Contact no	Estimated Amount

Note:

1. In support of having completed above works attach self-attested copies of the completion certificate from the owner/client indicating the name of work, the description of work done by the bidder, date of start, date of completion (contractual & actual), value of contract as awarded and as executed by the bidder and value of material supplied free by the client.
2. Such credential certificates issued by Govt. Organizations/ Semi Govt. Organizations / Public Sector Undertakings / Autonomous Bodies / Municipal Bodies / Public Ltd. Cos. shall only be accepted for assessing the eligibility of a bidder. appropriate TDS Certificates / 26AS evidencing the value of work, must be submitted.
3. Information must be furnished for works carried out by the bidder in his own name as a prime contractor. Any proportionate share of any joint venture company as member of a joint venture will not be allowed.
4. If a bidder has got a work under Govt. Organizations/ Semi Govt. Organizations / Public Sector Undertakings / Autonomous Bodies / Municipal Bodies executed through a subcontractor on a back to back basis, the bidder will also be-considered for participation. such a work will be satisfying the Qualification Criteria if the client has issued a Completion Certificate in favour of that bidder.

Signed by an authorized officer of the company

Title of the officer

Name of the Company with Seal

Date _____

FORM: 3

LETTER OF PRICE BID

Date : _____

NIQ No.: _____

Name of Contract:

“construction of OITIKA-Ownership Housing for WBCS(Exe) Officers at Pre. No.-44-0676, Plot no.-II-D/37 in AA-IID, Action area -IID, New Town, Kolkata.”.

To

The Superintending Engineer, South Circle.

Office of the Superintending Engineer, South Circle,

Housing Directorate.

P- 7 & 8, C.I.T. Road, 1st Floor,

Kolkata – 700014

We, the undersigned, and declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with instructions to Bidders (ITB);

(b) We offer to execute in conformity with the Bidding Documents the following Works: -

(c) The total price of our bid is the sum total of the costs mentioned in the specified formats being Forms 3.1

(d) Our bid shall be valid for a period of **180** days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

- (e) If our bid is accepted, we commit to furnish a performance security in accordance with the Bidding Documents.
- (f) We understand that this bid, together with your written acceptance thereof included in your Notification of Award, shall constitute a binding contact between us, until a formal contract is prepared and executed; and
- (g) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.

Name _____

In the capacity of _____

Signed _____

Duly authorized to sign the bid for and on behalf of

Date _____

FORM: 3.1

BREAK UP OF CONSTRUCTION COST

Sl No	Items	Area to be Built (in Sq. Ft)	Rate/Sq. Ft	Cost (Area to be Built X Rate/Sq. Ft)
1				
2				
3				
4				
5				
6				
7				
8				
Cost (3.1) (Total Cost of Construction)				

Name _____

In the capacity of _____

Signed _____

Duly authorized to sign the bid for and on behalf of

Date _____

FORM: 4

(To be furnished as AFFIDAVIT in Non-Judicial Stamp paper of appropriate value duly notarized)

DEPLOYMENT OF MINIMUM NO. OF PLANT AND MACHINERY BY THE BIDDER

Whereas it is entirely the responsibility of the bidder to deploy sufficient plant and modern mechanical equipment to ensure compliance with the Contract, the following list is an indicative list of the minimum number of plant and machinery which the bidder must provide by way of undertaking in the form of AFFIDAVIT to this effect is to be submitted. All machineries & plants should be either own by the bidder or taken on registered lease & should be maximum 5 (five) years old.

Sl no	List of Plants & Machineries	Requirement
1	Cement concrete batch mix plant arrangement (Minimum capacity 30 Cum/hr)	1
2	Field testing set including following equipment: a) b) c)	— —
3	Tower crane/ Hoist crane (material/passenger lifting machine) (for G+12 floors) up to 52 m height, 5 (t)	2
4	Construction elevator	6
5	Mechanical Winch	10
6	Latest model of theodolite + levelling machine / Total Station Survey Instrument	1
7	Truck & tipper/Dumper	5
8	Vibrator / equipment	10
9	Concrete pump	2
10	Mechanical excavator	1
11	Steel staging & shuttering material	100,000 sq. ft.
12	12t Vibro Roller	1
13	Hydraulic Excavator (capacity of 1-1.2 CUM)	3
14	Road marking machine	1
15	Diesel Generator Set (capacity of 125KVA)	1
16	Soil excavator cum loader	2
17	Hydra	1
18	Steel Reinforcement cutting and bending machine	4
19	Welding machine	2
20	Transit Mixture	2

FORM: 5

BANK CERTIFICATE

This is to certify that _____
is a reputed company with a good financial standing.

If the contract for the work, namely OITIKA-Ownership Housing for WBCS(Exe) Officers at Pre. No.-
44-0676, Plot no.-II-D/37 in AA-IID, Action area -IID, New Town, Kolkata is awarded to the above
Company; we shall be able to provide overdraft/credit facilities to the extent of

` _____/- (Rupees _____
_____only) to meet their working capital requirements for
executing the above contract during the contract period.

Signature

Name of the Bank: _____

Bank Manager: _____

Address of the Bank:

Bank Seal

FORM: 6

POWER OF ATTORNEY IN FAVOUR OF SIGNATORY OF THE BID

(To be executed on non-judicial stamp paper of appropriate value)

KNOW ALL MEN BY THESE PRESENTS THAT WE, _____
_____ *[insert the name of the bidder]* _____ a Company incorporated under
the Companies Act, 1956 and having its registered office at _____ *[insert address]*
_____ (hereinafter referred to as the bidder) having been authorized by the Board of
Directors of the Company, inter alia, to execute contracts in the name of and for and on behalf of
the Company.

I _____ *[insert name of the person giving the Power of
Attorney]* presently holding the position of _____ *(insert
designation of the person giving the Power of Attorney)* in the company do hereby constitute,
appoint and authorize _____

_____ *(insert name, designation and residential address of the person to whom the Power of Attorney is
being given)* as our true and lawful attorney to do in our name and on our behalf all such acts, deeds,
things necessary and incidental for submission of our bid against NIQ no.

_____ floated by Housing Directorate. I hereby further
authorize the above attorney for signing and submission of the bid and all other documents,
information related to the bid including undertakings, letters, certificates, declarations,
clarifications, acceptances, guarantees, any amendments to the bid and such documents related to
the bid, and providing responses and representing us in all the matters before Housing Directorate
in connection with the bid for the said tender till the completion of the bidding process. I
accordingly hereby nominate, constitute and appoint above named _____
_____ severally, as the lawful attorney to do all or any
of the acts specifically mentioned immediately herein above.

WE do hereby agree and undertake to ratify and confirm whatever either of the said Attorney shall
lawfully do or cause to be done under and by virtue of this Power of Attorney and the Acts of
Attorney to all intents and purposes are done as if the same had been done on behalf of the
Company if these presents had not been made.

IN WITNESS whereof I, _____ have executed these presents
this the _____ day of _____ at _____

Specimen Signature of Attorney

Name _____

EXECUTANT

Designation _____

Name of Company

Designation _____

Signature of the Attorney Attested

EXECUTANT

Name _____

Designation _____

Office Seal _____

FORM: 7

MACHINERIES (IN FAVOUR OF OWNER / LESSEE)

(Original document of own possession and / or arranged through Registered lease deed to be annexed)

(If already engaged anticipated date of release of such machineries to be annexed with an undertaking). All machineries & plants should be either own by the bidder or taken on registered lease & should be maximum 5 (five) years old.

Sl. No	Name of Machine / Instrument	Make	Type	Capacity	Motor/ Engine No.	Machine No.	Possession Status		Date of release (if Engaged)
							idle	Engaged	
1									
2									
3									
4									
5									

For each item of equipment, the application should attach copies of

- Document showing proof of full payment
- Receipt of Delivery
- Road Challan from Factory to delivery spot is to be furnished.

Specimen Signature

Name _____

Designation _____

Name of Company

Office Seal _____

FORM: 8**EQUIPMENT FOR TESTING OF MATERIALS & CONCRETE AT SITE LABORATORY****(indicative only)**

All necessary equipment for conducting necessary tests shall be provided at the site laboratory by the bidder at his own cost. The following minimum laboratory equipment shall be set up at site office laboratory:

Sl. No	Equipment	Number/ Quantity	Possession Status		Release Date (if Engaged)
			Idle	Engaged	
1	Cube testing machine	2			
2	Slump Cone	6			
3	Tensile Briquette testing machine	2			
4	Vicats apparatus with Desk Pot	2			
5	Megger& earth resistance tester	4			
6	Pumps and pressure gauges for hydraulic testing of pipes	4			
7	Weighing scale platform type 100 kg capacity	4			
8	Graduated glass cylinder	As per requirement			
9	Sets of sieves for coarse aggregate [40,20,10,4.75 mm]	4			
10	Sets of sieves for fine aggregate [4.75; 2.36, 18; 600; 300 & 150 micron	4			
11	Core cutter for soil compaction with accessories	2			

Sl. No	Equipment	Number/ Quantity	Possession Status		Release Date (if Engaged)
			Idle	Engaged	
12	Cube moulds size 150mm x 150mm x 150mm	18			
13	Cube moulds size 150mm x 150mm x 150mm	90			
14	Moisture content rapid moisture meter standard	4			
15	Hot Air Oven Tem. Range 500C to 3000C	2			
16	Electronic balance 600g x 0.01g. 10lg and 50kg	3			
17	Physical balance weight up to 5kg	1			
18	Digital thermometer up to 1500 C	2			
19	Poker Thermometer (Concrete Road) 00C to 500 & 1500C	2			
20	Measuring Jars 100ml, 200ml, 500ml	2 Nos. set of each size.			
21	Gauging trowels 100mm & 200mm with wooden handle	4			
22	Spatula 100mm & 200mm with long blade wooden handle	2 Nos. set of each size			
23	Vernire Calliper 12" and 6" sizes	2 Nos. each			
24	Digital PH motor least count 01mm	1			
25	Digital Micrometer least count .01mm	1			

Sl. No	Equipment	Number/ Quantity	Possession Status		Release Date (if Engaged)
			Idle	Engaged	
26	Digital paint thickness meter for steel 500 micron range	2			
27	GI tray 600 x 450 x 50mm, 450x300x40mm, 300xc250x40mm	2			
28	Electric Mortar mixer 0.25 Cum capacity	1			
29	Rebound hammer test Digital rebound hammer	1			
30	Screw gauge 0.1mm – 10mm, least count 0.05	2			
31	Water testing Kit	2			
32	Aggregate impact value testing machine with blow counter	As per requirement			
33	Crushing value apparatus	As per requirement			
34	Thickness gauge for measuring flakiness index	As per requirement			
35	Elongation gauge	As per requirement			
36	Measuring Cylinder 3,5,10 & 15 litre Cylinder	As per requirement			
37	Pycnometer	2			
38	Motorized Sieve shaker	2			

Any other equipment for laboratory tests at site will be the way it is outlined in relevant BIS and / or as directed by the Employer's Representative. Quality control engineer shall monitor collection of Sample and conducting regular testing at site maintaining propriety and the very best standard followed in industry of construction.

For each item of equipment, the application should attach copies of:

- a. Document showing proof
- b. Receipt of Delivery

All relevant IS Codes, special publications as per latest amendment/edition, latest edition of WB PWD SOR, WB PW(Road)D SOR and CPWD SOR shall be made available at site by the contractor at his own cost.

Specimen Signature

Name _____

Designation _____

Name of Company

Office Seal _____

FORM: 9

STRUCTURE AND ORGANISATION

Bidders shall provide the names of suitably qualified personnel to meet the requirements specified in Section 3 (Evaluation and Qualification Criteria). The data on their experience should be supplied using the Form below for each candidate.

- A. Name of Contractor :
- B. Office Address :
- i. Telephone No. and Cell Phone No. :
- ii. Fax No :
- iii. E mail :
- C. Details of Bank Accounts :
- i. Name of Bank :
- ii. IFSC Code :
- iii. Account No :
- iv. MICR No :
- v. Name of Branch :
- vi. Address :
- vii. Phone No :
- D. Attach an Organization -chart showing the structure of the company and names of Key personnel and technical staff along with their Bio-data

Specimen Signature

Name _____

Designation _____

Name of Company

Office Seal _____

Form PER-1: Proposed Personnel

Sl. No	Personnel
1	Title of position:
	Name :
2	Title of position:
	Name :

Form PER-2: Resume of Proposed Personnel

Position		
Personnel information	Name:	Date of birth:
	Professional qualifications:	
Present employment	Name of Employer:	
	Address of Employer:	
	Telephone:	Contact (manager/ personnel officer):
	Fax:	E-mail:
	Job title:	Years with present employer:

Summarize professional experience in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

Position held		Company/Project/Position/ Relevant Technical and management experience
From	To	

FORM: 10**Equipment**

The bidder shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment listed in Section 3 (Evaluation and Qualification Criteria) A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the bidder.

Item of Equipment								
Equipment Information:	Name of manufacturer:				Model and Power rating:			
	Capacity:				Year of manufacture:			
Current Status:	Current Location:							
	Details of Current commitments:							
Source:	Indicate source of the equipment:							
	Owned	<input type="checkbox"/>	Rented	<input type="checkbox"/>	Leased	<input type="checkbox"/>	Other	<input type="checkbox"/>
Owner*	Name of owner				Address of owner			
	Contact name and title				Telephone			
	Fax				E-mail			
Agreements*	Details of rented/lease/manufactures specific to the project							

*Omit this information for equipment owned by the bidder

Specimen Signature

Name_____Designation _____

Name of Company_____

Office Seal_____

FORM: 11

SITE ORGANISATION

(TO BE PROVIDED BY THE BIDDER)

Specimen Signature

Name _____

Designation _____

Name of Company

Office Seal _____

FORM: 12

METHOD STATEMENT

(TO BE PROVIDED BY THE BIDDER)

Specimen Signature

Name _____

Designation _____

Name of Company

Office Seal _____

FORM: 13

MOBILIZATION SCHEDULE

(TO BE PROVIDED BY THE BIDDER)

Specimen Signature

Name _____

Designation _____

Name of Company

Office Seal _____

FORM: 14

CONSTRUCTION SCHEDULE

(TO BE PROVIDED BY THE BIDDER)

Specimen Signature

Name _____

Designation _____

Name of Company

Office Seal _____

FORM: 16

BIDDERS QUALIFICATION

To establish its qualifications to perform the contract in accordance with Section 3 (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder.

Form ELI – 1: Bidder's Information Sheet

Bidder's Information		
Bidder's legal name		
Bidder's year of constitution		
Bidder's Registered address		
Bidder's authorized representative (name, address, telephone numbers, fax numbers, e-mail address)		
Attached are copies of the following original documents		
1	Articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and 4.2	↓
2	Authorization to represent the company named in above, in accordance with ITB 20.1.	↓
3	In case of a government-owned entity, any additional documents not covered under 1 above required to comply with ITB 4.5.	↓

Office Seal _____

FORM: 17

FORM FIN-1: FINANCIAL SITUATION

		FINANCIAL DATA FOR PREVIOUS 5 YEARS				
		YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
1.	Total Assets					
2.	Total liabilities (secured loans, unsecured loans and current liabilities)					
3.	Misc. expenditure to the extent not written off					
4.	Net worth (1-2-3)					
A.	Investments¹					
B.	Current Assets					
i.	Inventories					
ii.	Sundry debtors					
iii.	Cash & Bank and other current assets ²					
iv.	Loans & Advances ³					
	Total Current Assets					
C.	Current liabilities and provisions					
i.	Current liabilities and provisions					
ii.	Provisions					
iii.	Unsecured loans ⁴					
	Total Current liabilities and provisions					
D.	Working Capital Limits and Utilization					
1.	Fund based Limit ⁵					
2.	Non Fund based Limit ⁶					
	Utilized as on last day of Financial year ⁷					
3.	Fund based Limit					
4.	Non Fund based Limit					

5.	Fund based limit available (1 – 3)					
6.	Non Fund based limit available (2- 4)					
7.	Total Working Capital Limit Available (5 + 6)					
E.	Total Cash Flow available (A+B – C+D)					

Information from Income Statement						
	Total Revenue (₹)					
	Profit before taxes (₹)					
	Profits after taxes (₹)					
1	Investments shall include only those investments which are unencumbered as certified by the Statutory Auditor.					
2	Cash & Bank and other current assets will not include margin money deposit, earnest money deposit, retention money, money lying in any escrow account, unbilled revenue.					
3	Loans and advances shall not include tax deducted at source and advance tax, deposits lying with statutory authorities or deposits lying under any judicial order.					
4	Amounts repayable within one year shall be included.					
5	Secured loans, lease rentals payable within one year and debentures, preference shares payable within one year shall be included.					
6	Credit Limits shall be supported by Certificate from the Lead Bank					
7	Utilisation of working capital limits shall be supported by certificate of the Statutory Auditor.					
	<p>Attached are copies of financial statements (balance sheets including all related notes and income statements) for the last 5 years as indicated above, complying with the following conditions.</p> <p>All such documents reflect the financial situation of the bidder or partner to a JV and not sister or parent company</p> <p>(i) Historical statements must be audited by a certified accountant</p> <p>(ii) Historical statements must be complete, including all notes to the Financial Statements.</p> <p>(iii) Historical financial statements must correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted).</p>					

FORM FIN-2: AVERAGE ANNUAL TURNOVER FOR CIVIL CONTRACTUAL WORK

ANNUAL TURNOVER DATA FOR THE LAST 5 YEARS			
SL. NO	YEAR		AMOUNT IN INR (₹)
1			
2			
3			
4			
5			
AVERAGE ANNUAL TURNOVER			

The information supplied shall be the Annual Turnover of the Bidder in terms of the amounts billed to clients for each year for work in progress or completed, converted to INR (₹) at the rate of exchange at the end of the period reported.

FORM FIN-3: FINANCIAL RESOURCES

Specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines, of credit, and other financial means, net of current commitments, available to meet the total construction cash flow demands of the subject contract or contracts as indicated in Section 3 (Evaluation and Qualification Criteria)

FINANCIAL RESOURCES		
SL. NO	SOURCE OF FINANCING	AMOUNT IN INR(₹)
1		
2		
3		
4		
5		
6		

FORM FIN-4: CURRENT CONTRACT COMMITMENTS/WORKS IN PROGRESS

Bidders shall provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

Current Contract Commitments					
No	Name of Contract	Employer's Contract Address, Tel, Fax, e-mail	Value of Outstanding Work (₹)	Estimated Completion Date	Average Monthly Invoicing Over Last Six Months [INR(₹) /month]
1					
2					
3					
4					

Specimen Signature

Name_____Designation _____

Name of Company_____

Office Seal _____

3. A table containing of all the existing commitments & on-going works to be completed during the next _ years (prescribed time of the works for which Bids are invited) is as follows: -

Sl.no	Name of work/Project	Name of the Employer	Percentage of participation of Bidder in the Project	Stipulated period of completion as per agreement/LOA with the start date	Value of Contract as per Agreement/LOA	Value of work completed	Balance value of work to be completed	Anticipated date of Completion	Financial liability to incur for the said work/project during the period of the subject contract RS._____
1	2	3	4	5	6	7	8	9	10

Signature, Name & designation of authorized Signatory

For & on Behalf of

(Name of the applicant)

Notes:

1. All the documents to be submitted in support of this form must be duly signed and sealed by the applicant/bidder & authenticated by statutory Auditor's Firm.
2. To calculate the value of "B" in this form the work order issued on or before the date of publishing NIT should be taken as financial liability.

FORM FIN -5

BID CAPACITY

Information of audited financial statements for the last year to demonstrate the current soundness of the Bidder's financial position:

1. The Bidder's net worth for the last year calculated on the basis of capital, profit, and fee reserve available to the firm should be positive.
2. Bidders, who meet the minimum qualification criteria, will be qualified only if their available bid capacity at the expected time of bidding is equal to or more than ` 300 Crores Indian Rupees.

The available bid capacity will be calculated as under:

Assessed available Bid Capacity = $(A \times N \times 2 - B)$ where

A=Maximum value of engineering works in respect of the projects executed in any one year during the last 7 (seven) years (updated to the price level of the year indicated in table below under note) taking into account the completed as well as works in progress. The project includes turnkey project/item rate project/ Construction works.

N= Number of years (i.e., _____year) prescribed for completion of the works for which Bids are invited.

B= Financial liability of the bidder to be incurred for existing commitments & on-going works during the period of the subject contract.

To calculate the value of "A"

- i. A table containing value of Engineering Works in respect to Projects (turnkey project/item rate project/ Construction works) undertaken by the bidder during last 5(five) years as follows:

Sl. No	Year	Value (RS. In Crore) of works undertaken W.r.t. Projects
1	Year -5	
2	Year -4	
3	Year -3	
4	Year -2	
5	Year -1	

ii. Maximum value of projects that have been undertaken during the financial year _____ out of the last 5 (five) years & value thereof is RS. _____ Crores. (Rupees _____) Further,

value updated to the price of the year indicated in Table is as follows:

RS. _____ Crores x _____ (upgradation factor as per table annexed)

RS. _____ Crores (Rupees _____)

Table indicating the factor for the year for upgradation to the price level is indicated as under

Sl. No	F.Y./ Calendar year	Upgradation factor
1	Year -1	1.0
2	Year -2	1.05
3	Year -3	1.10
4	Year -4	1.15
5	Year -5	1.20

iii. Net worth for the last year of _____
 _____ (name of the company)

<p>_____ Signature, Name & designation of authorised Signatory</p> <p>For & on Behalf of</p> <p>_____ (name of the applicant)</p>	<p>_____ Name of the statutory Auditor's firm/Chartered Accountant</p> <p>Seal of the Audit firm</p> <p>Signature: Name: Designation: Membership No: UDIN:</p>
--	--

3. A table containing of all the existing commitments & on-going works to be completed during the next _ years (prescribed time of the works for which Bids are invited) is as follows: -

Sl.no	Name of work/Project	Name of the Employer	Percentage of participation of Bidder in the Project	Stipulated period of completion as per agreement/LOA with the start date	Value of Contract as per Agreement/LOA	Value of work completed	Balance value of work to be completed	Anticipated date of Completion	Financial liability to incur for the said work/project during the period of the subject contract RS._____
1	2	3	4	5	6	7	8	9	10

Signature, Name & designation of authorized Signatory

For & on Behalf of

(Name of the applicant)

Notes:

1. All the documents to be submitted in support of this form must be duly signed and sealed by the applicant/bidder & authenticated by statutory Auditor's Firm.
2. To calculate the value of "B" in this form the work order issued on or before the date of publishing NIT should be taken as financial liability.

FORM: 18

FORM EXP-1: GENERAL CONSTRUCTION EXPERIENCE

GENERAL CONSTRUCTION EXPERIENCE					
Sl. No	Starting date (Month & Year)	Ending date (Month & Year)	Years	Contract identification and name, name and address of employer, brief description of the works executed by the bidder and the value of the contract	Bidder's Role
1					
2					
3					

Specimen Signature

Name_____Designation _____

Name of Company_____

Office Seal _____

FORM: 19

BID SECURITY

Bank Guarantee

_____ Bank's Name, and Address of Issuing Branch or Office _____

Beneficiary: The Superintending Engineer, South Circle. Office of the Superintending Engineer, South Circle, Housing Directorate. P- 7 & 8, C.I.T. Road, 1st Floor, Kolkata – 700014 (hereinafter referred to as “the Employer”).

Name and Address of Employer: Superintending Engineer, South Circle. Office of the Superintending Engineer, South Circle, Housing Directorate. P- 7 & 8, C.I.T. Road, 1st Floor, Kolkata – 700014.

Date: _____ Bid Security No: _____

We have been informed that _____ *name of the bidder* _____ (hereinafter called “the Bidder”) has submitted to you its bid dated _____ (hereinafter called “the Bid”) for the execution of _____ *name of contract* _____ under NIQ No _____ (the NIQ”).

Furthermore, we understand that, according to your conditions, bids must be supported by a bid security.

At the request of the Bidder, we _____ *name of bank* _____ hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of ₹ _____ *amount in figures* _____ (Rupees _____) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Bidder is in breach of its obligation(s) under the bid conditions, because the Bidder:

1. has withdrawn its Bid during the period of bid validity specified by the Bidder in the Form of Bid. Or
2. does not accept the correction of errors in accordance with the Instructions to Bidders (hereinafter “the ITB”) of the NIQ; or
3. has submitted any document and has made any statement in the Bid, which is either manufactured or false; or

4. having been notified of the acceptance of its Bid by the Employer during the period of bid validity,
 - (i) fails or refuses to execute the Contract Agreement or
 - (ii) fails or refuses to furnish the Performance Security, in accordance with the ITB.

This guarantee will expire:

- a) if the Bidder is the successful Bidder, upon our receipt of copies of the Contract Agreement signed by the Bidder and the performance security issued to you upon the instruction of the Bidder, and
- b) if the Bidder is not the successful Bidder, upon the earlier of
 - (i) our receipt of a notice from you that contract has been signed with the successful Bidder, or
 - (ii) twenty- eight days after the expiration of the Bidder's bid.

This Guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor.

This Guarantee will neither be cancelled nor revoked by the Bank without the written authorization of Housing Directorate.

Consequently, any demand for payment under this guarantee must be received by us at the office on or before that date.

_____ Bank's seal and authorized signature(s).

FORM: 20

FORM OF NOTIFICATION OF AWARD

[On the letter head of The Superintending Engineer, South Circle. Office of the Superintending Engineer, South Circle, Housing Directorate. P- 7 & 8, C.I.T. Road, 1st Floor, Kolkata – 700014 (hereinafter referred to as “the Employer”)]

NO.: _____/

Dated: _____

To

[Name & Address of the Bidder]

Dear Sirs,

Sub: Tender no. _____ for Construction of OITIKA-Ownership Housing for WBCS(Exe) Officers at Pre. No.-44-0676, Plot no.-II-D/37 in AA-IID, Action area -IID, New Town, Kolkata.

Ref: Your tender dated _____ and letter dated _____

This is to notify you that your tender for the work under reference has been accepted by the Competent Authority of _____

for a total Contract Price of ` _____/- (Rupees _____

_____ only). Pursuant to clause _____

of the Contract, you are required to furnish irrevocable Contract Performance Security for an amount equivalent to 10% (ten percent) of the Contract Price minus Participation Money. The Guarantee of an amount of

` _____/- (Rupees _____

_____ only) in favour of Executive Engineer, New

Town Construction Division-II, Housing Directorate valid upto end of defect liability period is thus required to be submitted within 7 working days of issue of this Notification of Award.

The time of _____ weeks/ days allowed for execution of the Project will be reckoned from the date of this Notification of Award. You are requested to contact _____
(complete designation and address of the project-in charge)

for carrying out the contract.

You are also requested to attend this office within 7 working days from the date of issue of this letter for execution of the formal agreement. It may be noted that no payment shall be made for any work carried out by you till the Agreement is executed and till such time the Contract Performance Security has been submitted by you.

This Notification of Award is being sent to you in duplicate and you are requested to return without delay one copy of the letter duly signed and stamped, in token of your acknowledgement.

Kindly note that this Notification of Award shall constitute a binding contract between us pending execution of formal Agreement.

Your letter referred to above shall form part of the Contract.

Yours faithfully,

The Superintending Engineer, South Circle.
Office of the Superintending Engineer, South Circle,
Housing Directorate.
P- 7 & 8, C.I.T. Road, 1st Floor,
Kolkata – 700014.



GOVERNMENT OF WEST BENGAL
OFFICE OF THE SUPERINTENDING ENGINEER, SOUTH
CIRCLE HOUSING DIRECTORATE, P- 7 & 8, C.I.T. ROAD,
1ST FLOOR, KOLKATA-700014.

BID DOCUMENTS FOR
CONSTRUCTION OF OITIKA- OWNERSHIP HOUSING FOR
WBCS (EXE) OFFICERS
AT PRE. NO.-44-0676, PLOT NO.-II-D/37 IN AA-IID,
ACTION AREA -IID,NEWTOWN, KOLKATA.
ONTURNKEY BASIS

SECTION 5
EMPLOYER'S REQUIREMENT

PROJECT BRIEF

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1. INTRODUCTION TO THE PROJECT

The site (5.414 ACRE) falls under NKDA, and is located at premises number, 44-0676, Plot No - IID / 37. Street No -0676 & Street No -0757, are two streets adjacent to the plot. 348 nos 3 bed room apartments, and 48 nos 2 bed room apartments along with other facilities shall be constructed exclusively for WBCS (Executive) officers. Prior to floating this tender, Design was approved by prospective owners, was granted sanction by the NKDA and was approved by West Bengal Fire & Emergency Services, and was approved by West Bengal Pollution Control Board as well. Structural design was vetted by a competent vetting authority. West Bengal Housing Directorate is the implementing agency for this project and New Town Construction Division, Housing Directorate shall have the administrative authority for all financial dealings related to construction of 6 multi-storied frame-structured Buildings, ancillary buildings and allied works (like Sanitary & Plumbing, Electrical installations, fire detection & fighting system, IBMS, CCTV, PA system, HVAC, Lifts etc.).

2. CONCEPT PLANNING

Proposed housing for WBCS(exe) officers at premises no. -44-0676 plot no.-D/37 in aa-IID,action area-IID,New Town, Kolkata was envisaged by the society of WBCS(exe) officers to ensure ownership flats for them .the uniqueness of this proposal is though there are different sizes of units are considered but that is because of varied personal requirement not any other hierarchy as all probable owners are belong to same hierarchy .this was the main design guideline to ensure equality in all respect through innovation. In addition to it effort was given to ensure well lit, cross ventilated habitable spaces to reduce dependency on mechanical /artificial applications. Accordingly, an optimum built environment has been arrived at with almost 78% of open space within the premises. All kind of sporting facilities along with a lap pool are provided so that recreational need of the inhabitants can be taken care of. A four storied commercial function has been tucked into one block to meet up the need of daily needs of the residents as well as ceremonial facilities like banquet hall, o.a.t. are introduced. All units are three side open to ensure privacy as well as to ensure living within the landscaped environment of the proposed condominium. STP for sewerage treatment, rain water harvesting as well as alternative power source in the form of solar panels are provided as a green initiative within this development.

3. SCOPE OF WORK

The project is broadly divided into three segments: -

- i. Construction of 6 residential towers and ancillary structures
- ii. Supply, installation of fittings, fixtures & equipment and providing a general training
- iii. Managing defects (if any) of the property throughout 5 years DLP

Scope is broadly defined by design drawings and supporting specifications prepared by the Employer; Contractor's Scope of work consist of construction of 6 residential towers (each approximately 40 m high), a swimming pool, landscaped open space, parking spaces, (internal) road infrastructure, drainage facilities, electrical infrastructure etc. for Oitika housing complex under turnkey contract. In order to successfully complete the project, it is crucial that the goals of both parties align with each other with regard to budget, engineering and construction, etc.

4. DETAILED SCOPE OF WORK

The layout or the design of the project that is taken into consideration for tender purpose is comprehensively complete, adequate and sufficient. Please refer to attached drawings, and refer to Condition of Contract. Scope written below shall be read in conjunction with a clause in the contract with regards to the time, a clause in the contract with regards to the price and payments.

- a) Preparation of cost estimates
- b) Site surveys
- c) Preparation & submission of additional drawings (as may be required by the Contractor) for obtaining statutory approvals and obtaining approvals / permits of the Statutory / local / Government agencies.
- d) Site clearance, Relocation of existing servicers, drains etc. including demolition, if required
- e) Excavation for pile foundation
- f) Pile foundation
- g) Ground development

- h) Super structure (G+12) for main buildings
- i) Ancillary buildings and yards (Services yards & Gate houses)
- j) Infrastructure (Construction of approach roads, pathways, drainage and landscaping etc.)
 - Roads and Parking
 - Water supply & distribution
 - Sewerage System
 - Electricity supply, Installations & distribution
 - Waste disposal system
- k) Finishing works
- l) Boundary wall
- m) Underground reservoirs
- n) External works
 - A swimming pool,
 - External services
 - Landscaped courts, Play field etc.
- o) Landscaping and Horticulture as per approved Concept Plan.
- p) Fulfilling all obligations as per contract.
- q) Clearance of site before Handing over of the facilities.
- r) Handing over of the facilities and providing services as per contract during DLP.

5. DETAILED DRAWING AND CONSTRUCTION

The Contractor shall prepare and submit to the Engineer-In-Charge for approval, before the work is commenced, all details and installation/ fabrication drawings signed by a principal of the Contractor. These drawings must be submitted by the Contractor to give ample time for all parties concerned to study and make comment thereon.

The work described on any shop drawing submitted shall be carefully checked by the contractor for all clearance at site, field conditions, maintenance of architecture features in proper coordination with all trades on the job. To this end, the Contractor, during the production drawing stage, shall ensure that he coordinates with all other relevant trades that might interfere with the proper installation of his work. Any unresolved conflict between grades shall be referred to the Engineer-In- Charge. Equipment layouts shall be

detailed on the drawings, showing the exact method of installing and clearly illustrating components to be used in making all connections.

6. PROVIDING & CONSTRUCTION OF BUILDINGS & SERVICES WITH ASSOCIATED INFRASTRUCTURE

This development shall include a Commercial Block to cater for Resident's daily needs, a swimming pool, Guard post/Gate house on each entry/exit, Motorable Internal road network, Car Parking, EV charging stations, Transformer yard, & Generator plant for Electrical power, Solar panels, internal & external water supply network, Sewer line, STP, Irrigation infrastructure etc.

7. SAFETY AND SECURITY

This campus is designed considering all fire safety measures and has been approved by Fire and Emergency Department of West Bengal. This shall be a gated community; all gates shall be guarded by security personnel and CCTV/ surveillance system shall be installed. Only authorised person can enter the campus.

8. FINISHES

A list of finishing materials shall include but no limited to Vitrified tile, Ceramic Tile, Natural stone such as Granite, Marble, Black stone etc. Exterior grade/Outdoor tiles, Cement tiles, Interlock tiles, Glass-mosaic tiles for Swimming pool, Wooden flooring, Acrylic Emulsion Paint, Exterior Quality Paint, Epoxy Paint, Gypsum board.

9. DOCUMENTS TO BE SUBMITTED WITH DRAWINGS

The contractor shall submit to the Engineer-in-Charge, the following documents on completion of the work and before issuance of virtual completion.

- Warranty for all Equipment installed like Pumps, Panels, Sprinklers, Instruments etc.
- As-Built Drawings
- Material Test Certificates
- Catalogues/Brochures
- Operation and Maintenance Manuals
- List of recommended spares and consumables

- All approvals including technical approvals and sanctions
- 'NOC' from authorities before commencement of execution & after completion of entire work.

10. QUALITY CONTROL

This project shall progress with a philosophy based on the quest for progress and continuous improvement i.e. Total Quality Management (TQM) and shall follow Concept of Zero Defects policy and Zero accident policy.

11. SPECIFICATIONS OF FINISHING ITEMS

This has been detailed under general specification.

12. STRUCTURAL SYSTEM:

12.1. TYPE OF STRUCTURE

All Towers, namely Block 1,2, 3, 4, 5 & 6 are G+12 storeyed residential buildings. All of them shall have RCC. framed superstructure resting on pile foundation.

12.2. DESIGN BASIS

The superstructure is analysed and designed using STAAD-Pro & Etabs, a computer aided design programme. Foundation and all slabs are designed by manual calculation on the basis of output data obtained from the computer analysis results.

Block 3, 4 & 6 are having same structural arrangement as in Block 1 but are mirrorical at site, therefore design calculations has been provided for Block 1 only. The following code of practices are considered for the design calculations.

- IS-875-1987 (Part-1,2,4, & 5)
- IS-875-2015 (Part-3)
- IS-1893-2016 (Part-1)
- IS-13920-2016
- IS-2911-2010
- IS-456-2000
- SP-16
- SP-34

13. WATER SUPPLY, PLUMBING & SANITATION SYSTEM

13.1. GENERAL

The scope of work comprises supply, installation, commissioning and testing of the water supply, sewerage and drainage systems including sanitary fixtures and fittings, water pumping systems, & waste water treatment systems (STP); The scope of work shall include the following: -

- a) External and Internal Drainage system.
- b) External and Internal water supply system.
- c) Sanitary fixtures and fittings.
- d) Water supply pumps & Electrical control panels and related electrical works.
- e) Waste Water Treatment System (STP).
- f) Internal Fire Hydrant System

13.2. WATER SUPPLY SYSTEM

Supply of water shall be from single source, i.e. from NKDA supply. The meter regarding the allotment of ferrule for providing bulk connection shall be decided by the competent authority and the user group shall come under direct supervision of the authority.

13.3. DESIGN STANDARDS - WATER SUPPLY & SEWERAGE

13.3.1. SOURCE OF WATER

(Treated) water supply by Municipal body/ Corporation/ Development Authority is the only source of water. The water supply maintenance in New Town is being looked after by PHED (Public Health Engineering Department) on behalf of NKDA.

13.3.2. WATER STORAGE & WATER SUPPLY DISTRIBUTION

150% of daily domestic and flushing water and 100% of others usable water shall be stored within the project area as precautionary measure to deal with events like irregular water supply, probable breakdown of incoming water supply line etc. Both underground and overhead RCC storage tanks shall be provided; The domestic and flushing water shall be pumped up by separate water supply pump and shall fill the overhead fire protection water reservoir of each building. Overflow of roof top fire protection water reservoir shall be filled to roof top domestic and flushing water reservoir. While tank sizes shall be as

shown in the drawings, minimum capacity of tanks for water storage shall be as listed below: -

- a) Firefighting UGR -1,00,000 lit
- b) Overhead tank for Firefighting-5,000 lit./ tower
- c) Supply water storage UGR- 3,40,000 lit (One-day requirement)
- d) Rainwater harvesting UGR-3,40,000 lit

13.3.3. WATER TREATMENT PLANT (WTP)

No centralized water treatment plant within the plot shall be required now for using water that shall be sourced from municipal/ corporation supply, because supply water for domestic purpose comes as treated water.

13.3.4. WATER SUPPLY DISTRIBUTION (INTERNAL)

Domestic and flushing cold water shall be distributed from roof top water reservoir by ring main / branch water supply line on the roof top of the buildings. Domestic and flushing cold water shall be distributed to various toilets, bath and kitchens. Through separate down take pipes from roof top ring main / branch water supply line by gravitational flow and flow shall be controlled by valves. CPVC pipes shall be used for concealed and exposed lines in all toilets, kitchen for hot water and PVC medium class pipes (schedule-80) shall be used for all concealed and exposed cold water supply in the shaft and roof top of the buildings as ring main and others. GI medium class pipe also shall be used as puddle flange pipe for UG and overhead water reservoirs.

13.3.5. HOT WATER FACILITIES

Cold water supply line shall be installed in toilets, kitchens, all balconies in all residential units. Centralised heating system shall not be there, individual electrical water heaters (Geyser) shall be installed by end users in toilet & kitchen as per requirement, all water heaters shall be filled up from domestic cold water supply line and they shall be supplying hot water to equipment.

13.4. SEWERAGE SYSTEM

13.4.1. DESIGN METHODOLOGY

Several parameters are being utilized, one such crucial parameter is depth of discharge points around the premise which are set by the authority. A set of manholes comprised in the series of pipes have been designed, where manhole is the starting point, manhole is the discharge point of the sewer system, the sequential structure of piped network sewer system partially considers shortest travel distance approach. The inflow, design flow rate for a pipe between manholes have been precomputed and ground elevation at manholes are being set allowing for gravitational flow.

13.4.2. PER CAPITA

As per mandate, the local authority namely NKDA shall supply 120 LIT./Person/Day treated water for residents, and 40 LIT./Person/Day for floating population. Daily fresh water demand shall be 340 KLD. An estimated discharge to the HIDCO main sewer line shall be (approximately) 96 LIT./Person/Day amounting to a total 212 KLD.

13.4.3. SEWERAGE SYSTEM (INTERNAL)

Soil, waste & vent pipe system for all buildings shall be two pipe system, as recommended in code of practice there shall be separate soil and waste pipes. Vertical soil and waste stack shall be directly connected with horizontal soil and waste pipes at the ground floor by slow bend of upper grade quality. All horizontal soil pipes of ground floor come to ground level and directly connected with manhole. All horizontal waste pipes of ground floor come to ground level and connected to manhole through gully trap.

13.4.4. SEWERAGE SYSTEM (EXTERNAL)

As recommended by the Central Public Health and Environmental Engineering Organization (CPHEEO) in their manual and in accordance with other relevant Indian standards, the waste water volume shall be taken as 85% of the water supply. The soil water at the ultimate stage shall be collected by a network of sewer lines and shall be taken to a designated area, which shall be connection point to NKDA sewer manhole outside the plot area. All sewer lines shall be double wall corrugated High Density Polyethylene Pipes.

13.4.5. STP

225 KLD Capacity MBBR S.T.P. shall be installed on site. Treated effluent from the proposed S.T.P. shall be discharged to HIDCO main sewer line and effluent from proposed S.T.P. shall be treated to a certain BOD level as set by the pollution control board. The Drainage & Sewerage maintenance in New Town is being looked after by PHED (Public Health Engineering Department) on behalf of NKDA.

13.5. STORM WATER DRAINAGE SYSTEM

Linking of storm water line with sanitary sewer line shall not be done. Ground water, storm water shall pass through buried pipes and through open channels as per landscape design and shall be connected to covered storm water drains outside the premises. The Drainage & Sewerage maintenance in New Town is being looked after by PHED (Public Health Engineering Department) on behalf of NKDA.

13.6. RAINWATER HARVESTING SYSTEM

Only rainwater from roof top shall be collected for harvesting purpose. Roof top rain water network of all blocks shall pass through rain water re-charge pits and it shall be connected to a rain water harvesting tank. Required volume of water for one-day usage shall be stored and overflow from rainwater harvesting tank shall be discharge by gravitational flow to storm water drainage line. 12 numbers of Rainwater recharge pit shall be constructed within the site.

14. WASTE MANAGEMENT

Colour coded collection buckets (i.e. Blue bins for dry non-degradable litter, Green bins for degradable waste, Yellow pots for Pathological waste, soiled infectious waste etc. and Red pots) for waste collection from residential buildings shall be separate for vegetable waste and food waste, waste glass, cotton, polyethylene, plastics etc. Either dedicated sanitary workers shall collect garbage from all flats or residents themselves can transfer garbage to separate pots kept in a designated area/zone where garbage shall stay till the time they get carried to the on-site organic waste composter machine. Approximately 440 kg. of Vegetable waste and food waste generation from 6 blocks shall be collected manually by sanitary workers from the garbage bins and garbage shall be carried to organic waste composter. Rest garbage (if any) shall be disposed of to a designated area

outside of the project premises for collection by the solid waste management vehicles operated by NKDA or their approved agents to operate in New Town.

15. BUILDING MATERIALS, FITTINGS & FIXTURES

Cement, Sand, Aggregate, Reinforcement Steel, Concrete Block, Sewer Brick, Wood, MS Steel, SS Hardware, Aluminium windows, UPVC pipes, CPVC Pipes, HDPE pipes, Concrete Hume pipes, Natural stone, Vitrified tiles, Cement Tiles, Vitreous China Sanitary ware, SS accessories, Fire Hydrant & Wet Riser, Hose Reel, Fire Alarm, DG Sets, Electrical Fittings, LED Lighting, Ventilation (Exhaust) Fans etc.

16. FIRE FIGHTING

All towers shall have refuge platforms. All shaft including electrical shafts running horizontally & vertically shall be sealed floor wise with fire resistant materials of 2 hrs. rated. The inspection panel door and any other opening in the electrical shaft shall be provided with 2 hours rating fire door. The exit route including stairs shall be free from any obstruction. Alternative power supply shall be provided to Firefighting pumps. This development shall have following systems:

a) FIRE HYDRANT & WET RISER WITH HOSE REEL SYSTEM

Wet Riser & hydrant system shall essentially consist of, Piping, Isolation Valves, Hydrant Valves, Hose with Coupling, Branch Pipe with Nozzle, Hose Reel etc. Hydrant ring main shall be installed Underground / Aboveground & hydrant shall be placed around buildings.

b) AUTOMATIC SPRINKLER SYSTEM

Automatic Sprinkler System shall be installed in Common areas & Public areas in Block 2 & Block 5. The pipeline shall be kept pressurized by water up to the sprinkler bulb. In the event of fire, the, glass bulb of the sprinkler will shatter at a predetermined temperature.

c) FIRE DETECTION AND ALARM SYSTEM

Fire Alarm System shall consist of Analog Addressable Fire Alarm Panel, Addressable Multi criteria sensors, Heat Detector, Manual Call point, Strobe Cum Hooter etc.

d) PORTABLE FIRE EXTINGUISHERS

A pair of CO2 4.5 KG & 6 KG Fire Extinguishers, Mechanical Foam Type Fire Extinguishers shall be installed.

17. ELECTRICAL SERVICES

West Bengal State Electricity Distribution Company Limited (WBSEDCL) a wholly owned enterprise of Government of West Bengal shall provide electricity connection for this housing complex, the development shall require approval from WBSEDCL considering the following:

- a) Total demand load 3080.00 KVA approximately.
- b) 2nos 11KV / 415 Volt Distribution substations.
- c) 6 nos of 630 KVA rated Transformer will have to be installed

11 KV distribution system and construction of HV substation inside the residential complex will be designed by WBSEDCL as per their prevailing practice. From this service area L.T power will be fed to the Metering Rooms of individual Towers at their respective ground floor metering rooms through underground LT cable.

Aluminium conductor cable shall be used for flats, this cable shall terminate at MCB isolator box. From output side of MCB isolator, copper wire shall be laid through pre-laid PVC conduit up to the MCB DB of flats. All Electrical fittings & fixtures shall be installed in common areas such as lift lobbies, reception lobbies, Club, Gymnasium, Guest rooms, whereas only provisions (i.e. points) shall be kept inside flats.

378 nos 3 PH KWh meter shall be installed [328 nos. of 3BHK flat (5.5 / 6.25KW) & 48 nos. of 2BHK flat (5.0 KW)]. 6 nos 3 PH KWh meter shall be installed for Common area load. 3 nos CT operated LT bulk 3 PH KWh meter for utility load. 2 nos CT operated LT bulk 3 PH KWh meter for CLUB Load & Banquet load.

2 nos. 500 KVA DG set shall be installed.

All towers shall have Lighting Protection System.

Solar PV Power plant shall have to be provided / installed at roof top, Deliverable Power: 2 sets of 10KWp plant. System shall be connected to WBSEDCL grid through NET metering.

18. SITE OFFICE

Contractor shall arrange a Site Office (furnished temporary structure with AC) for Employer's personnel at site and shall provide Personal Computer, High speed Internet connection and office furniture. They will also install (current version of) Auto cad, MS office suite, Microsoft Project Management software to all the computers of engineers and concerned representative of Employer.

19. SITE LABORATORY

Equipment for testing of materials & concrete at site laboratory shall be no less than the as listed (minimum requirement) in the contract document.

20. MANDATORY TESTS

Mandatory laboratory test to be performed at the time of different construction activities shall be (minimum) as listed (Indicative only) in the tender document.

TECHNICAL SPECIFICATION

PART - A

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GENERAL SPECIFICATIONS

PART-A

LIST OF BUREAU OF INDIAN STANDARD CODES

- IS 848 Specification for synthetic resin adhesives for plywood (Phenolic and Amino plastic
- IS 1122 Method of test for determination of true specific gravity of natural building stones
- IS 1124 Method of test for determination of water absorption, apparent specific gravity and porosity of natural building stones
- IS 1130 Marble (blocks, slabs and tiles)
- IS 1328 Specification for Veneered decorative plywood
- IS 1734 (Part-1) Methods of test for plywood
- IS 2380 Methods of test for wood particle boards and boards from other lignocellulosic materials
- IS 3316 Specifications for structural granite
- IS 3734 (Part-1) Rubber – Tolerance for products
- IS 4101 (Part 1) Code of practice for external facing and veneers: Stone facing
- IS 7638 Wood/Lignocellulosic based panel products – Methods of sampling
- IS 12049 Dimensions and tolerances relating to wood based panel materials
- IS 12823 Wood products – Pre laminated particle boards – Specification
- IS 14223 (Part 1) Polished Building Stones (Part-1) Granite
- IS 14842 Coir Veneer board for general purposes – Specification
- IS 269 Specification for 33 grade ordinary Portland Cement
- IS 401 Code of practice for preservation of timber
- IS 451 Technical supply conditions for wood screws
- IS 455 Specification for Portland slag cement
- IS 661 Code of practice for thermal insulation of cold storages
- IS 702 Specification for industrial bitumen
- IS 1124 Method of test for determination of water absorption, apparent specific gravity and porosity of natural building stones
- IS 1130 Specification for marble (blocks, slabs and tiles)
- IS 1141 Code of practice for Seasoning of timber

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- IS 1200-(Part XI) Method of measurement of Building and Civil Engineering work (Part 11) paving, floor finishes, dado and skirting
- IS 1237- Edition 2.3 Specification for cement concrete flooring tiles
- IS 1322 Specification for bitumen felts for water proofing and damp proofing
- IS 1443 Code of practice for laying and finishing of cement concrete flooring tiles
- IS 1489 (Part-I) Specification for Portland pozzolana cement (Part-I) fly ash based
- IS 1489- (Part II) Specification for Portland pozzolana cement (Part II) calcined clay based
- IS 1580 Specification for bituminous compounds for water proofing and caulking purpose
- IS 2114 Code of practice for laying in-situ terrazzo floor finish
- IS 2571 Code of practice for laying in-situ cement concrete flooring
- IS 3622 Specification for sand stone (Slab & Tiles)
- IS 3670 Code of practice for construction of timber floors
- IS 4457 Acid and/or alkali Resistant tiles.
- IS 5318 Code of practice for laying of hard wood parquet and wood block floors
- IS 5766 Code of practice for laying of burnt clay brick floor
- IS 8041 Specification for rapid hardening Portland cement

GENERAL

All materials to be used in works shall conform to Indian Standards Specification as published by B.I.S from time to time (and in the absence thereof as approved by the Engineer-in-Charge). Unless specifically mentioned otherwise the following modes of measurements shall be adopted. In general, the mode of measurement of the civil engineering works shall be guided by I.S.I. Code No.: 1200-1964 (Revised) for Indian Standard Method of measurement of Building work.

1. BRICKS, CONCRETE BLOCKS

1.1. COMPOSITE CONCRETE BLOCK

Hollow (open and closed cavity) load bearing concrete blocks, Hollow (open and closed cavity) non-load bearing concrete blocks, and Solid load-bearing concrete blocks and no-load bearing concrete blocks shall comply with IS 2185 (Part 1). Reference shall be made to IS 2572, IS 2185 (part 1) and IS 2212. The nominal dimensions of concrete block shall be as follows:

(a) Length: 400, 500 or 600 mm

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(b) Height: 200 or 100 mm

(c) Width: 100, 125, 200, 250 or 300 mm.

The concrete mix used for blocks shall not be richer than one part by volume of cement to 6 parts by volume of combined aggregates before mixing. 'Grade A' blocks shall be used as load bearing units and shall have a minimum block density of 1500 kg/m^3 . These shall be manufactured for minimum average compressive strengths of 7.0, 8.5, 10.0, 12.5 and 15.0 N/mm^2 respectively at 28 days. 'Grade B' shall be used as load bearing units and shall have a block density between 1100 kg/m^3 and 1500 kg/m^3 . These shall be manufactured for minimum average compressive strengths of 3.5 N and 5.0 N/mm^2 respectively at 28 days. 'Grade C' the solid concrete blocks shall be used as load bearing units and shall have a block density not less than 1800 kg/m^3 . These shall be manufactured for minimum average compressive strength of 4.0 N and 5.0 N/mm^2 respectively. The grading of the combined aggregates shall conform as near as possible to the requirements indicated in IS 383. Size & Grade selection for blocks shall be as specified in structural drawings or as approved by the Engineer-in-Charge.

1.2. AUTOCLAVED AERATED CONCRETE BLOCK

Autoclaved Aerated Concrete Block shall conform to IS Code – 2185 (Part-3) 1984 (Reaffirmed 2005)

i. Physical properties

All Autoclave Aerated Concrete Block shall be sound, free of cracks or other defects which interfere with the proper placing of block units, impair the strength or performance of the construction. The drying shrinkage of block shall be determined in the manner described in IS 6441 (part-2) -1972 and shall not be more than 0.05% for grade –1 block.

ii. Dimensions & Tolerances

Autoclave Aerated Concrete Block shall be referred to by its normal dimension the term 'normal' means that the dimension includes the thickness of the mortar joints. The actual dimension shall be 10 mm short of the normal dimension (or mm short in special areas finer joints as specified). The normal dimension of the concrete block shall be as follows: -

- Length: 400, 500 or 600 mm

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- Height: 200, 250 or 300 mm
- Width: 100, 125, 200 or 250 mm

The maximum variation in the length of the Autoclave Aerated Concrete Block shall not be more than plus/minus 5 mm and maximum variation in the height and width of Autoclave Aerated Concrete Block, not more than plus/minus 3 mm.

The faces of Autoclave Aerated Concrete Block shall be flat & Rectangular, opposite faces shall be parallel and all arises shall be square. The bedding surfaces shall be at right angle to the face of the Blocks.

iii. Compressive strength

The compressive strength of block shall be determined in accordance with IS 6441 (part-5) - 1972. The autoclaved Autoclave Aerated Concrete Block shall be of Grade-1 according to their compressive strength as indicated in table below:

Density in oven dry condition (Kg/m ²)	Compressive Strength (Min) Grade-I (N/mm ²)	Thermal Condition in Air dry condition (W/m.k)
651 to 750	5.00	0.30
751 to 850	6.00	0.37
851 to 1000	7.00	0.42

iv. Materials

Cement complying with any of the Indian Standard may be used as per the direction of the manufacturer. Use of Fly ash conforming to IS 3812-1981 shall be permitted to a limit of 20% in cement conforming to IS 269-1976. The lime shall satisfy the requirement for class C lime specified as IS 712-1973. The aggregate used for the manufacture of Autoclave Aerated Concrete Block shall conform to the following requirements: -

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- Sand-Conforming to IS 383-1970 except for the grading which may be made to suit the product and silica content shall not be less than 80%.
 - Fly ash – Conforming to IS 3812-1981 with loss on ignition not more than 6%.
 - The water used in the manufacture of Autoclave Aerated Concrete Block shall be free from matter harmful to concrete or reinforcement or matter likely to cause efflorescence in the block and shall meet the requirements of IS 456-2000
 - Additives and Admixtures shall be added either as additives to the cement during manufacturing or as additive or admixtures to the concrete mix. Additive or admixtures used in the manufacture of concrete block shall be accelerating, water reducing and air – entraining admixtures conforming to IS 9103-1979, water proofing agent conforming to IS 2645-1975, and colouring pigments.
- v. R.C.C band shall be provided on 100 mm /125mm/200mm/ 250mm thick masonry to increase the strength and compatibility. The RCC band shall be provided at sill level and at lintel level over throughout the wall. This thickness of the band shall be approved by the Engineer-in-Charge or as specified in drawing. Autoclave Aerated Concrete Block with 100 mm thick masonry shall be provided with two number 6mm dia reinforcement steel bar at every third course or as specified in drawing or as approved by the Engineer-in-Charge.

1.3. MECHANIZED FLY ASH BRICK

All Fly ash bricks shall be machine made, quality controlled as per IS 12894-2002. Average wet compressive strength shall be not less than 7.5N/mm^2 (75kgf/cm^2). Visually all bricks shall be sound, compact and uniform in shape, free from visible cracks, warpage and organic matters. Raw material shall conform to Grade 1 of IS 3812 fly ash 60-65%, Sand/Stone dust- 20-25%, Hydrated lime- 8-12%, Gypsum-5%. The minimum average wet compressive strength of bricks shall not be less than the one specified for each class as mentioned in IS: 12894, when tested as described in IS 3495 (Part 1). The wet compressive strength of any individual brick shall not fall below the minimum average wet compressive strength specified for the corresponding class of bricks by more than 20 percent. The average drying shrinkage of the bricks when tested by the method described in IS 4139, being the average of three units, shall not exceed 0.15 percent. The bricks when tested in accordance with the procedure laid down in IS 3495 (Part 3), shall have the rating of efflorescence not more than 'moderate' up to Class 12.5 and 'slight' for higher classes. The bricks, when tested in accordance with the procedure laid down

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in IS 3495 (Part 2), after immersion in cold water for 24 hour, shall have average water absorption not more than 20 percent by mass up to class 12.5 and 15 percent by mass for higher classes. Size of modular Fly ash brick will be: L- 190(\pm 4) mm, W- 90(\pm 2) mm, H -90 (\pm 2) mm.

1.4. BURNT CLAY BUILDING BRICKS

The common burnt clay bricks shall comply with IS 1077. The bricks shall be made of suitable clay and shall be thoroughly burnt at the maturing temperature of clay. They shall be free from cracks, flaws and nodules of free lime. They shall have rectangular face with sharp straight edge at right angle. They shall be of uniform colour and texture. All bricks shall be made from locally available suitable soils, and shall be free from cracks, flaws and nodules of free lime. Size of common burnt clay modular bricks shall be: L- 190 (\pm 7) mm, W- 90(\pm 4) mm, H -90(\pm 4) mm. Hand-moulded or Machine-moulded Second Class Bricks shall be of Class designation 7.5 having average compressive strength not less than 7.5N/mm² and shall show water absorption within 20% when tested in accordance with procedure laid down in IS 3495. The bricks when tested in accordance with the procedure laid down in IS 3495 (Parts1 to 4) shall have a rating of efflorescence not more than 'slight' and the average warpage shall not exceed 3%.

1.5. SEWER BRICK

Sewer bricks shall be used for the lining of walls, roofs and floors of sewers for ordinary sanitary (domestic) sewage. The general practice in the country is also to utilize common building bricks in the construction of sewers which is not satisfactory. However, these sewer bricks shall not be used for sewers dealing with industrial effluent (sewage) for which the use of acid resistant bricks in accordance with IS 4860 shall be considered. Sewer bricks shall conform to IS 4885. Size of Sewer bricks will be: L- 190 mm, W- 90 mm, H -90mm/40 mm. The average compressive strength obtained on a sample of sewer bricks when tested in accordance with the procedure laid down in IS 3495 (Part I) shall be not less than 17. 5 N/mm² (175 kgf/cm² approximately) and the individual strength of any brick shall be not less than 16 N/mm² (160 kgf/cm² approximately). The average value of water absorption for five bricks after 24 h cold water immersion test when tested in accordance with IS 3495 (Part 2) shall not exceed 10 % of the average dry weight of the brick and the absorption for any individual brick shall not exceed 12%.

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2. COARSE AGGREGATES FOR CEMENT CONCRETE WORKS

- IS 383-Specification for coarse and fine aggregate from Natural Source for Concrete
- IS 456-Code of practice for plain and reinforced concrete
- IS 516-Method of test for strength of concrete
- IS 1791-Specification for batch type concrete mixers
- IS 9103-For admixtures for concrete

Unless otherwise specified in the contract all stone aggregates shall be sourced from Pakur and shall conform to IS 383:2016. Stone aggregate shall consist of naturally occurring (uncrushed, crushed or broken) stones. It shall be hard, strong, dense, durable and clean, and free from veins, adherent coatings, & injurious amounts of disintegrated pieces, alkali, vegetable matter and other deleterious substances. It shall be roughly cubical in shape. Flaky and elongated pieces shall be avoided. For any of the following nominal sizes of graded coarse aggregates, grading shall be in conformity with the requirements laid down in the Indian Standards Specification IS: 383-2016.

Serial number	IS Sleeve designation	Percentage passing for Single –Sized Aggregate of nominal size					Percentage passing for Graded Aggregate of nominal size			
		40	20	16	12.5	10	40	20	16	12.5
1	63	100	-	-	-	-	-	-	-	-
2	40	85-100	100	-	-	-	90-100	100	-	-
3	20	0-20	85-100	100	-	-	30-70	90-100	100	100
4	16	-	-	85-100	100	-	-	-	90-100	-
5	12.5	-	-	-	85-100	100	-	-	-	90-100
6	10	0-5	0-20	0-30	0-45	85-100	10-35	25-55	30-70	40-85
7	4.75	-	0-5	0-5	0-10	0-5	0-5	0-10	0-10	0-10

3. SAND

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The sand shall consist of natural sand, crushed stone sand or crushed gravel sand or a combination of any of these. The sand shall be hard, durable, clean and free from adherent coatings and organic matter and shall not contain the amount of clay, silt and fine dust more than specified hereunder. The sand shall not contain any harmful impurities such as iron pyrites, alkalis, salts, coal or other organic impurities, mica, shale or similar laminated materials, soft fragments, sea shells in such form or in such quantities as to affect adversely the hardening, strength or durability of the mortar.

All sand shall be obtained from approved source. The contractor shall get the sample (along with source of supply, precise locality from where the materials were obtained, with the name of quarry or pit) of sand to be used in different kinds of works approved by the Engineer-in-Charge before using the same in work.; Sand which in the opinion of the Engineering in- Charge or his representative is dirty, must be washed to his satisfaction at the cost and expenses of the contractor. Clay, fine silt and fine dust shall be not more than 5% by mass in natural or crushed gravel or crushed stone sand when determined in accordance with IS: 2386 (Part II). The particle size grading of sand for use in mortars shall be within the limits as specified in Table below: -

Method Of Test IS : 2386 (Part I)			
JS designation	SIEVE	Percentage Mass	Passing By
	4.75 mm	100	
	2.36 mm	90 to 100	
	1.18 mm	70 to 100	
	600 micron	48 to 100	
	300 micron	5 to 70	
	150 micron	0 to 15	

Sand for all cement concrete work must be coarse. The sand shall pass through a mesh, 4.75 mm. square measured in the clear. Sand shall not be used for concrete works if it contains more than 10% of fine grains passing through a 76 mesh sieve as used for cement test, sand for concrete shall be of grading zone 2 unless specific permission is obtained from the Engineer-in-Charge. Medium sand may be used for cement mortar, for masonry, plaster etc. fineness modulus shall be between 2 and 1.8. Sand filling in plinth or foundation where specified may be done with fine sand or Silver sand.

4. CEMENT

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Each bag of cement shall have BIS Certification Marking, no cement except those approved by Engineer-in-Charge shall be used in work or brought to site by contractor

Chemical properties of Ordinary Portland Cement (OPC) when tested according to IS 4032 shall comply with limits as stated below: -

- a) Magnesia, percent by mass: (Max) 6.0
- b) Total sulphur content, percent by mass: (Max) 3.5
- c) Chloride content, percent by mass: (Max) 0.1

OPC 43 Grade Cement shall comply with IS 8112: 2013; Limit of addition of performance improver (if added) shall comply with limits set in IS 3812, IS 12089, IS 15388, IS 1760, IS 1727. Physical properties of OPC when tested according to IS 4031 shall comply with limits as stated below:-

- a) Fineness(Min) : 225 m²/kg, 370 m²/kg, for 43-S grade
- b) Setting time: 30min(initial), 60 min(initial) for 43-S grade - 600min(final)
- c) Compressive strength:
 - i. At 72hr ± 1 hr (Min) 23 MPa
 - ii. At 672hr ± 4 hr (Min) 43 MPa - 58 MPa(Max)

OPC 53 Grade Cement shall comply with IS 12269: 2013; Limit of addition of performance improver (if added) shall comply with limits set in IS 3812, IS 12089, IS 15388, IS 1760, IS 1727. Physical properties of OPC when tested according to IS 4031 shall comply with limits as stated below: -

- a) Fineness(Min) : 225 m²/kg, 370 m²/kg, for 53-S grade
- b) Setting time: 30min(initial), 60 min(initial) for 53-S grade - 600min(final)
- c) Compressive strength:
 - i. At 72hr ± 1 hr (Min) 27 MPa
 - ii. At 672hr ± 4 hr (Min) 53 MPa

Portland Slag Cement (PSC) shall conform to IS 455 and when tested for fineness, the specific surface of Slag cement shall be not less than 225 ml/kg. Portland slag cement shall be manufactured either by intimately intergrading a mixture of Portland cement clinker and granulated Slag with addition of gypsum (natural or chemical) or calcium sulphate, or by an

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intimate and uniform blending of Portland cement and finely ground granulated slag. The slag constituent shall be not less than 25 percent nor more than 65 percent of the Portland slag cement. The Portland Slag Cement shall comply with the following chemical requirements when tested in accordance with the methods given in IS 4032: 1985:

- a) Magnesium Oxide (MgO): (Max) 8.0
- b) Sulphur trioxide: (Max) 3.0
- c) Sulphide sulphur (S): 1.5

The setting time of slag cement

- i. Initial setting time Not less than 30 min
- ii. Final setting time Not more than 600 minutes

Compressive Strength

The average compressive strength of at least three mortar cubes (area of face 50 cml) composed of one part of cement, three parts of standard sand by mass and (P/4+ 3.0) percent' (of combined mass of cement plus sand) water, and prepared, stored and tested in the manner described in IS 4031 (Part 6): 1988; shall be as follows:

- i. 72 ± 1 h Not less than 16 MPa
- ii. 168 ± 2 h Not less than 22 MPa
- iii. 672 ± 4 h Not less than 33 MPa

Portland Pozzolana Cement (PPC) shall comply with IS 1489. The contractor shall submit a certificate from the manufacturer stating the amount (min. > 10% to max. < 25% by mass) of fly ash /pozzolana in the finished cement; the certificate shall also confirm that the amount of fly ash/pozzolana shall not vary more than 3 % from the value so declared in the Certificate. PPC shall comply with parameters as given below: -

- a) Magnesia percent by mass (max): 5.0
- b) Sulphuric anhydride percent by mass (max): 3.0
- c) Total chloride content in cement shall not exceed 0.05 percent by mass

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- d) Fineness (Min) :300 m²/kg,
- e) Setting time: 30min (initial) - 600min (final)
- f) Compressive strength:

The average compressive strength of not less than three mortar cubes (area of face 50 cm²) composed of one part of cement, three parts of standard sand by mass, and P/4 + 3.0 percent (of combined mass of cement and sand) water, and prepared, stored and tested in the manner described in IS 4031 (Part 6): 1988 shall be as follows: -

- i. At 72hr ± 1 hr (Min): 16 MPa
- ii. At 672hr ± 4 hr (Min): 33 MPa

Cement bags must be stored in a water-tight shed having wooden floor or platforms raised at least 50 mm. from ground as approved by the Engineer-in-Charge. Cement which is partially set or which is lumpy or caked is to be treated as damaged and shall be removed from the site immediately. Combined PWD Schedule may be seen for list of relevant IS Code for Cement to be used in work and for mandatory tests to be conducted before use of Cement material into works.

5. WATER

Water used for mixing and curing shall be clean and free from injurious quantities of alkalies, acids, oils, salts, sugar, organic materials, vegetable growth or other substance that may be deleterious to bricks, stone, concrete or steel. Potable water is generally considered satisfactory for mixing. The Ph value of water shall comply to IS 456 (not less than 6). The following concentrations represent the maximum permissible values: (of deleterious materials in water).

- 5.1. Limits of Acidity: To neutralize 100ml sample of water, using phenolphthalein as an indicator, it shall not require more than 5ml of 0.02 normal NaOH. The details of test shall be as given in IS 3025 (part 22).
- 5.2. Limits of Alkalinity: To neutralize 100ml sample of water, using mixed indicator, it shall not require more than 25ml of 0.02 normal H₂SO₄. The details of tests shall be as given in IS 3025 (part 23)-1986 (Reaffirm 2003).
- 5.3. Percentage of Solids: Maximum permissible limits of solids when tested in accordance with IS 3025 shall be as under:
 - i. Organic 200mg/ litre
 - ii. Inorganic 3000 mg/ litre

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- iii. Sulphates 400 mg/ litre
- iv. Chlorides 2000 mg/ litre.for concrete not containing embedded steel and 500 mg. /ltr. for reinforced concrete work.
- v. Suspended matter 2000 mg/ litre

5.4. The physical and chemical properties of ground water shall be tested along with soil investigation and if the water is not found conforming to the requirements of IS 456-2000, the tender documents shall clearly specify that the contractor has to arrange good quality water for construction indicating the source. Water from each source shall be tested before the commencement of the work and thereafter once in every three months till the completion of the work. In case of ground water, testing shall also be done for different points of drawdown. Water from each source shall be tested during the dry season before monsoon and again after monsoon.

6. STEEL

All steel shall be clean and free from loose mill scales, dust, loose rust and coats of paints, oil or other coatings. Any scale or loose rust shall be removed before use without any claim for extra charge for the same.

Mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement
Part 1 Mild Steel and medium tensile Steel bars (Third Revision) IS 432 (Part I): 1982

- a) High strength deformed steel bars and wires for concrete reinforcement shall comply with limits as laid in IS 1786: 2008, as indicated in the drawing: -

Sl. no	Grade	Yield Stress (N/mm ²)	Ultimate Tensile Stress(N/mm ²)	Elongation %
1	Fe 415	415	485	14.5
2	Fe 500	500	545	12
3	Fe 550	550	585	8
4	Fe 500D	500	565	16
5	Fe 550D	550	600	14.5

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- b) Structural steel including micro-alloyed steel plates, strips, shapes and sections (angles, tees, beams, channels, etc.), flats, bars, etc., for use in structural works shall conform to IS 2062:2011, as specified in drawings: -

Sl. no	Grade Designation	(Min) Tensile Strength (N/mm ²)	(Min) Yield Stress (N/mm ²)			Percentage Elongation
			<20	20-40	>40	
1	E 250	410	250	240	230	23
2	E 275	430	275	265	255	22
3	E 300	440	300	290	280	22
4	E 350	490	350	330	320	22
5	E 410	540	410	390	380	20
6	E 450	570	450	430	420	20
7	E 550	650	550	530	520	12
8	E 600	730	600	580	570	12
9	E 650	780	650	630	620	12

No steel excepting those approved by the Engineer-in-Charge shall be used in work or brought to site by the contractor. For list of relevant IS Code for reinforcement in concrete Page-B-66 of Volume-I & for structural steel clause 2.1.7.5 (Page-12) of Volume-III may be seen. Clause pertaining to Steel/ Iron as noted in PWD Schedule may be seen for Mandatory tests before use of steel materials into works.

7. CEMENT CONCRETE

7.1. Grades of Cement Concrete

M15, M25, M30, M35, M45 as designated in IS 456-2000 and as approved by Engineer –in-Charge.

7.2. M15:

M 15 Mix Designs shall comply with all applicable provisions as in IS-10262-2009; trial mix method shall be followed at site to achieve desired strength as approved by Engineer –in-Charge.

- i. Type of Cement: OPC or as approved by Engineer –in -Charge

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- ii. Maximum Nominal Aggregate Size: 20 mm
- iii. Characteristic Strength @ 28 days: 15N/mm²

7.3. M25

M 25 Mix Designs shall comply with all applicable provisions as in IS-10262-2009; trial mix method shall be followed at site to achieve desired strength as approved by Engineer –in-Charge.

- i. Type of Cement: OPC or as approved by Engineer –in -Charge
- ii. Maximum Nominal Aggregate Size: 20 mm
- iii. Characteristic Strength @ 28 days: 25N/mm²

7.4. M30,

M 30 Mix Designs shall comply with all applicable provisions as in IS-10262-2009; trial mix method shall be followed at site to achieve desired strength as approved by Engineer –in-Charge. For concrete of grade M 30 and above the rate of increase of compressive strength with age shall be based on actual investigations.

- i. Type of Cement: OPC or as approved by Engineer –in -Charge
- ii. Maximum Nominal Aggregate Size: 20 mm
- iii. Characteristic Strength @ 28 days: 30N/mm²

7.5. M35

M 35 Mix Designs shall comply with all applicable provisions as in IS-10262-2009; trial mix method shall be followed at site to achieve desired strength as approved by Engineer –in-Charge. The rate of increase of compressive strength with age shall be based on actual investigations.

- i. Type of Cement: OPC or as approved by Engineer –in -Charge
- ii. Maximum Nominal Aggregate Size: 20 mm
- iii. Characteristic Strength @ 28 days: 35N/mm²

7.6. M45

M 45 Mix Designs shall comply with all applicable provisions as in IS-10262-2009; trial mix method shall be followed at site to achieve desired strength as approved by Engineer –in-Charge. The rate of increase of compressive strength with age shall be based on actual investigations.

- i. Type of Cement: OPC or as approved by Engineer –in -Charge
- ii. Maximum Nominal Aggregate Size: 20 mm

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iii. Characteristic Strength @ 28 days: 45N/mm²

8. CHEMICAL ADMIXTURES

Dosage of admixtures may vary according to manufacturer's specification. Two or more admixtures may not be compatible in the same solution. It is therefore mandatory that when two admixtures manufactured by the same manufacturers is being used simultaneously, the manufacturer shall certify their compatibility. In case the two or more admixtures are produced by different manufacturers, then, before their use in concrete, test shall be performed by the manufacturer to establish their compatibility, all such test reports shall be furnished to the Engineer-in-Charge for approval.

No admixtures shall be accepted for use in concrete unless these are tested in accordance with IS 9103 and the test results are approved by the Engineer-in-Charge.

Admixtures may be any one of the following classes for use in concrete: -

- 8.1. Water Reducing Admixtures
- 8.2. Retarding Admixtures
- 8.3. Accelerating Admixtures.
- 8.4. Water Reducing and Retarding Admixtures.
- 8.5. Water Reducing and Accelerating Admixtures.
- 8.6. Permeability Reducing (water proofing) Admixtures.

9. SMOKE CONTROL OF BUILDING MATERIAL

IS 12777:1989 code of practice shall be the guiding moralities for selecting various materials for surface interior finishes.

- i. Class -1 materials can be used in all situations
- ii. Class -2 materials shall not be used on walls, façade of the building, staircase & corridors
- iii. Class-3 materials shall be used only in living rooms & as lining to solid partitions
- iv. Class -4 materials may be restrictively used subject to approval from Engineer-in -charge but in any case shall not be used in Kitchens, corridors, Staircases.

10. TIMBER

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All timber shall be of best quality well-seasoned and/or well-treated for preservation and protection against decay etc. It shall be uniform in substance, straight in fibre, free from large or dead knots, sap, flaws, sun cracks, shakes or blemishes of any kind. Any insect damage or splits across the grain shall not be permissible. The colour of the timber shall be uniform throughout, firm and shining with a silky lustre when planed and shall not emit dull sound when struck.

Timber for frames shall be Group I quality Shorea robusta(Sal)/ Tectona grandis (Teak) in compliance with BIS IS 12896:1990[R 2005]: -

- i. Strength coefficient: ≥ 80
- ii. Durability: Class I (min 10 years)
- iii. Seasoning: Class B

11. TIMBER DOORS, WINDOWS ETC. AND THEIR FITTINGS

Thickness & width of timber frames shall comply with IS 4021. Width shall be (min) 100 mm & thickness shall be (min) 60 mm for all timber frames carrying 35 mm thick single shutter and 32 mm thick single shutter.

Gluing of joints shall be by putting Synthetic adhesive conforming to IS 851:1978/ISO 19209: 2017 or Synthetic resin adhesive conforming to IS 848:2006 or Polyvinyl acetate dispersion based adhesive conforming to IS 4835:1979.

Wood Primer for wooden frame shall comply with IS 3536:1996.

50 mm X 125 mm decorative wooden architrave shall be fixed all around the frame as shown in drawing.

11.1. PANELLED SHUTTER

Panelled shutters for doors shall be constructed in the form of timber frame work of stiles and rails with panel inserts of timber. The shutters may be single or multi- panelled, as shown in the drawings or as directed by the Engineer-in-Charge. Timber for frame work, material for panel inserts and thickness of shutters shall be as specified. All members of the shutters shall be straight without any warp or bow and shall have smooth well planned face at right angles to each other. Any warp or bow shall not exceed 1.5 mm. The right angle for the shutter shall be checked by measuring the diagonals and the difference between the two diagonals shall not be more than ± 3

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mm. Timber for stiles and rails shall be of the same species. Unless otherwise specified the lock rails of door shutter shall have its centre line at a height of 800 mm from the bottom of the shutters. Stiles and bottom rail shall be made out of one piece of timber only. Timber panels shall be made of timber of large width; the minimum width and thickness of the panel shall be 150 mm, and 15 mm respectively. The panel inserts shall be either framed into the grooves or housed in the rebate of stiles and rails.

Minimum dimensions of components of frame work shall be: -

- i. Stile, top and freeze rail : Width-100mm,Thickness- 35mm
- ii. Lock rail : Width-150mm,Thickness- 35mm
- iii. Bottom rail : Width-200mm,Thickness- 35mm
- iv. Muntin : Width-100mm,Thickness- 35mm

11.2. FLUSH DOOR SHUTTERS

35 mm & 32 mm thick warp-free, borer proof & termite resistant Flush door shutters shall correspond to requirements of IS 2202-Part 1 and shall be a factory manufactured proprietary product with 10 years warranty against manufacturing defect. Timber specie for Flush door shutters shall comply with requirements of Group I per IS 12896 and shall have adequate strength, weight, retention of shape, ease of working, ability to season well, finish smooth and shall be sufficiently durable (min 10 years) and/or treatable. Flush door shutters shall be manufactured out of seasoned, chemically treated and kiln-dried timber to make door shutters dimensionally stable. Flush door shutters shall have either a solid wood filler core or solid block board core or particleboard or MDF board or a combination of block board and particleboard or block board and MDF board with boiling water proof grade cross bands and wooden face veneers bonded with phenol formaldehyde synthetic resins (BWP grade) in hot press process under high pressure. This process shall make flush doors 100% boiling water proof and suitable for local climatic conditions. The wooden strips for Solid block board core shall be cut out from the timbers seasoned to a moisture content not exceeding 12% and the width of each strip of wood shall not exceed 30 mm.

Commercial plywood used in flush door shutters shall conform to IS 710 with surface requirements conforming to type AB of IS 303. Decorative plywood used in flush door shutters shall conform to Type I of IS 1328.

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Door works shall be carried out as per detailed drawings or as directed by the Engineer- in-Charge, specified timber shall be used, and it shall be sawn in the direction of the grains and be straight and square. These shall be well made, reasonably smooth and free from sharp edges, corners, flaws and other defects. Screw holes shall be counter sunk to suit the head of specified wood screws. All door hardware fittings shall be approved by the Engineer-in-Charge before fixing.

12. FIBRE REINFORCED POLYMER (FRP) DOOR FRAME & SHUTTER

Corrosion resistant, anti-ageing, termite proof FRP door shutter & frame shall be a factory manufactured proprietary product and shall comply with requirements of IS 14856:2000. The Polymer shall be either thermoplastic or thermo set resin, such as polyester, Isopolyester, Vinyl ester, epoxy or Phenolic base. The fibre moulded skins may be of glass or other synthetic (Carbon or aramid) or natural (jute or Coir) or other reinforcing materials. The sandwich core to impart monolithic composite structures shall be approved by Department of Science & Technology or similar competent Authority. Frame without Core shall have intermittent stiffness for rigidity and will have provision for hinge fixing, including anchors. Frame with Core will be filled with inner Core in addition to all the features mentioned for frame without Core. FRP door shutters shall satisfy all performance criteria (i.e. shock resistance, impact indentation etc.) when tested according to procedures laid in IS 4020. Thickness of door frame and door shutter, finish & door hardware fittings shall be approved by the Engineer-in-Charge before fixing.

13. ARCHITECTURAL HARDWARE

13.1. HINGES

SS201 grade/SS 304 grade stainless steel butt hinges shall be a proprietary product durable for long life operation (tested to 200,000 cycles) shall have certificate of compliance & shall comply with IS 12817: 2013 code; unless otherwise specified, hinges shall be naturally finished bright with smooth surface without chemical coating. Pairs of 100-102mm x75-76mm x 2.5-3mm CE11 butt hinge suitable for both commercial and residential use on doors up to 80kg shall be supplied with self-tapping fixing screws, size of screws shall be as per Hinge manufacturer's recommendation.

13.2. EURO PROFILE CYLINDER MORTICE LOCK AND LATCH

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Mortice Lock & Latch shall have certificate of compliance and BIS Certification mark & shall have powder coated lock case, 76mm width of lock case, 56mm backset, Solid Brass reversible latch and dead bolts, Stainless Steel forend (brushed Stainless Steel finish). It shall be a proprietary product durable for long life operation, supplied with Euro Profile cylinder - tested to EN1303 standards and with 2 keys (under master key). For internal doors, Euro Profile Cylinder shall have a key operation from outside & thumb turn operation from inside. If used by the product manufacturer for manufacturing various components, Mild Steel shall comply with IS 226, Stainless Steel shall comply with IS 6911, Brass shall comply with IS 292, IS 319 and IS 410.

13.3. EURO-PROFILE CYLINDER MORTICE NIGHT LATCH

Euro profile cylinder mortice night latch shall have certificate of compliance and BIS Certification mark; night latch shall be suitable for use on external entrance door providing automatic locking. Latch bolt shall be operated by key from both outside & inside. Mortice night latch shall comply with IS 3847 code, shall have certificate of compliance and BIS Certification mark. If used by the product manufacturer for manufacturing various components of mortice night latch, Mild Steel shall comply with IS 226, Stainless Steel shall comply with IS 6911, Brass shall comply with IS 292, IS 319 and IS 410.

13.4. EURO PROFILE CYLINDERS

Suitable for a convenient everyday locking solution- 5 pin Euro profile cylinder shall be tested to the British Standard BS EN1303:2005; the cylinder shall be suitable for use on PVCu, wood and composite doors that require a standard level of security. 60MM euro profile cylinders shall be available in double cylinder, duo KA packs, as well as Thumb Turn. Available finish options shall include Polished Brass, Satin Nickel and Matte Black finish to choose from. All cylinders shall be tested for minimum 500,000 operation cycles.

13.5. STAINLESS STEEL HANDLES

SS201 grade /SS 304 grade stainless steel tubular sprung handle (handle diameter: 19mm) on rosette supplied with keyhole escutcheons. Proprietary SS handle shall comply with applicable BIS standards and shall comply with provisions of BS EN 1634 1, EN 1670 Corrosion, EN 1906 code.

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13.6. DOOR STOPPER

Type-1: 22mm dia wall mounted Door Buffer with rubber end and Concealed Screw System for door protection & reduce collision of door and wall.

Type 2: Door mounted hanging type Door Stoppers to stop door auto closing motion.

13.7. FLOOR SPRING (80KG) WITH LOCK

Floor spring shall have adjustable latching and closing speed. Floor spring shall be suitable to take load up to 80Kg (power size 3) and shall help the door stay open once open 90°. CE rated proprietary floor spring unit shall be tested for 5,00,000 operation cycles.

13.8. UNIVERSAL HYDRAULIC DOOR CLOSER (EXPOSED TYPE)

Hydraulic door closer shall comply with IS 3564 code in general. Hydraulic surface mounted door closer suitable for medium (up to 80 KG) weight internal and external doors of width 1100 mm (Max) shall have Casted aluminium body, shall be of selectable size class 2,3 & 4; UL certified proprietary door closer with optional hold open function, suitable for both indoor and outdoor use shall have adjustable swing and latch valves, non-handed installation tested for minimum 3,00,000 operation cycles shall be suitable for speed adjustable fully controlled closing.

13.9. MAGIC EYE

1.5 Inch diameter SS 304 circular magic eye with 180-degree vision range suitable for shutter thickness up to 54 mm.

13.10. PANIC BAR

900 mm wide, 1-point locking, heavy duty panic push bar device made of SS 304 grade shall be suitable for doors from 40 mm up to 60 mm thickness, door height up to 2400 mm, & width up to 1200 mm. Panic bar shall be minimum 2 hrs fire rated.

13.11. BIOMETRIC MORTICE LOCK / DIGITAL LOCK

The mortice lock shall be a smart solution suitable for both “residential” & “light” commercial applications. Access mode shall be through pre-set 4 to 12-digit password (including Master

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password), Finger print; but if the lock is put on safe mode, only mechanical key override shall work & the lock shall not open from outside by either password or fingerprint access. The mortice lock shall be fitted with 360 ° fingerprint registration mechanism. The mortice lock by eliminating the hassle of manual locking shall automatically lock the door & also shall unlock the door in case of a fire (i.e. when the temperature reaches 65° C).

14. PAINTS

All paints shall be delivered in strong containers, marked with the colour of the paint, brand, volume of paint content in litres and of the best quality of approved make and brand as approved by the Engineer-in-Charge. Preparatory treatment and painting operations of calcareous surfaces, such as concrete, masonry and plaster surfaces in building work shall be in accordance with procedures laid in IS 2395. The painting operations including tools for painting shall be in accordance with the provisions suitable for the respective paints covered in IS 1477. All painting works shall be carried out in strict accordance with the manufacturer's recommendation and as per relevant applicable standards. Under no circumstances shall the paint be diluted with Linseed oil or otherwise. Any paint or enamel although of approved brand, which so hardens in the container that it cannot be readily broken up with a stirrer to a smooth uniform painting consistency, shall be rejected. Any paint or enamel too thick for proper brush application shall be rejected.

14.1. Masonry Painting system shall be: -

- 2 coats of Emulsion Paint applied over 2 coats of primer- putty mix, complete in accordance with manufacturer's recommendation.
- 2 coats of Emulsion Paint applied over 1 coat of primer applied over 2 coats of putty, complete in accordance with manufacturer's recommendation.

a) Wall Putty (Type-1):

Wall putty (finished thickness minimum 1.5 mm) shall be water-based Primer-Putty Mix, one of its kind self-primed putty that doesn't require a primer coat but provides a strong foundation for topcoats and enhances the desired performance of finish paints, both in looks and durability. Wall Putty shall have properties as listed below: -

- i. No added Lead, Mercury or Chromium compounds
- ii. Provides excellent adhesion to top coat emulsions

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- iii. Gloss Levels/ Sheen Levels: Matt
 - iv. Flash Points: (IS 101/1987 Part 1, Sec 6): Non Flammable
 - v. To be used only on interior surfaces
- b) Wall Putty (Type-2):

A white cement based putty with redispersible polymer and functional additives that helps give interior and exterior rough plasters an even finish, along with proving to be a great undercoat adhesion to emulsion paints. Wall Putty shall have properties as listed below: -

- i. Tensile Adhesion Strength [EN 1348]: $> 1.0\text{N/m}^2$
 - ii. Compressive Strength [EN 1015-11]: $3.5\text{-}7.5\text{ N/m}^2$
 - iii. Setting Time [EN 196]: $\geq 100 - \leq 500\text{ min}$
 - iv. Water Absorption: $\leq 0.8\text{ml}$
 - v. Water Absorption Coefficient [DIN 52617]: ≤ 1.0
 - vi. Water Retentivity [DIN 18555-7]: $\geq 98\%$
 - vii. Zero VOCs
 - viii. Provides smooth and uniform finish to rough plasters
 - ix. Good Flexural Strength
 - x. Resists growth of algae and fungi on wall
 - xi. Coverage: $1 - 1.5\text{ sq.m/kg}$ for up to 1.5 mm thickness in 2 coats
 - xii. Flash point IS101/1987 Part 1, Sec 6: N/A
- c) Interior Wall Primer:

Wall primer shall be water-based, water thinned, specially fortified with fungicides and suitable as undercoat for wall finishes like distempers and plastic emulsions. Wall Primer shall have properties as listed below: -

- i. Matt & smooth finish
 - ii. Higher opacity and whiteness
 - iii. Non-reactive to cement, soaps and other alkaline solutions.
 - iv. Moisture resistant
 - v. Can be used on interior or exterior surface
 - vi. Lead content below 90ppm
- d) Distemper paint:

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The material shall consist of pigments, suitable extenders and preservatives in a medium consisting of any suitable oil emulsion with other ingredients as may be necessary to produce a material so as to comply the requirements of the standard IS 428; the material shall be in the form of a homogeneous paste, free from lumps and skins & shall have no odour of purification as such when mixed with water. Paints shall have properties as listed below: -

- i. Shall be water-based acrylic distemper
- ii. Shall be Type-1 Oil based Emulsion and shall conform to IS 428: 2013
- iii. Formulated to provide a stylish matt finish washable with a wet cloth
- iv. Available in wide range of factory-made shades
- v. Flash point IS101/1987 Part 1, Sec 6:Non-flammable

e) Emulsion paint:

Technologically advanced Emulsion paint (for Interior walls) shall have properties as listed below: -

- i. Washable type.
- ii. Soft sheen, Silky smooth finish: 5 - 15 at 60 deg GH
- iii. Contains less than 50 g/L VOCs.
- iv. Class 1 rating for surface spread of flame when tested as per BS 476: Part 7: 1997.
- v. Flash point IS101/1987 Part 1, Sec 6: >90° C
- vi. The anti-bacterial, anti-fungal formula retards microbial growth on the dried paint film conforming to EN ISO 22196 standard.
- vii. More than 400% elongation when tested as per ASTM D 412.
- viii. Proprietary Surface Protector to enables easy removal of the toughest stains and for an increased durability of the paint film making internal walls look new and stay new for longer.
- ix. Crack bridging ability of 0.4mm (400nm) when tested as per BS EN 1062-7.
- x. Coverage: 22 - 24 sq. m./lit for 1 coat on a smooth primed surface
- xi. 5 year performance warranty on Interior paint system covering film integrity, protection against flaking or peeling, shade fading & fungus attack.

f) Exterior Wall Primer:

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Exterior Wall Primer shall be a white cement-based, polymer-modified, exterior wall coating system suitable for application on exteriors that gives a tough film and as a result, helps to provide longer life of total paint system, does not chalk and can be applied easily on cured fresh plaster. Exterior primer shall have properties as listed below: -

- i. Product shall not contain added Lead, Mercury, Arsenic or Chromium - No VOC [ASTM 6886]
- ii. Coverage: 90-110 Sq.ft./Kg/Coat
- iii. Excellent opacity and whiteness [+94.5%]
- iv. Does not require curing with water after application and is easier to apply
- v. Touch dry in 1 hr (min) & hard dry in 6 hrs (min)
- vi. Provides excellent adhesion to top coat emulsions

g) Exterior Emulsion paint:

Exterior Emulsion shall be a water-based exterior wall finish with silicon additives. Emulsion paint shall have properties as listed below: -

- i. Smooth Matt finish, Sheen levels: 3 - 12 at 60 deg GH
- ii. The VOC Level: 22.22 grams per litre.
- iii. Weather Guard: Modified acrylic binder builds excellent resistance to chalking, cracking, peeling
- iv. Provides better anti algal protection
- v. Flash point IS101/1987 Part 1, Sec 6: N/A
- vi. Coverage 10 - 12 sq.m/Litre on normal masonry surface by brushing
- vii. 3 years performance warranty on Exterior paint system

Prior to the start of mass painting, make & shade selection shall be done by the Engineer-in - Charge, on-site mock-ups will be done for each types and shades & application of paint on internal & external surface shall be approved by the Engineer-in -Charge.

14.2. FIRE RETARDANT PAINT -STEEL

All factories manufacturing Fire retardant paints irrespective of their size and risk shall make suitable provision for water supplies for firefighting and shall comply with provisions in IS 9109:2000. A ready to use Epoxy intumescent coating or water based intumescent coating consisting of polyvinyl acetate resins and fillers for the fire protection (for up to 120 minutes) of structural steel that effectively retards the flame spread and penetration of heat through

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their intumescent sublimative-ablative and synergetic flame suppressing action. Unless specified in drawings or documents Fire retardant paints shall be applied as specified by manufacturers.

14.3. EPOXY PAINT

A two parts i.e. (an epoxide resin base and polyamine hardener) Epoxy paint system shall comply with IS 14209:2016 & shall have excellent adhesion properties, shall offer a balanced aesthetic, corrosion protective surface. Epoxy paint system shall offer good resistance to water and humidity, an outstanding resistance to chemical, low porosity and strong bond strength while providing a dry tough & protective coating to the substrate. Minimum 2-3 coats by brushing shall be applied to get the desired dry film thickness (DFT) as specified by the manufacturer. All installations shall follow IS 463- code of practice for laying of epoxy resin floor toppings.

14.4. ALUMINIUM PAINT

Aluminium paint of approved brand and manufacture that comes in compact dual containers with the paste and the medium separately shall be used. The two shall be mixed together to proper consistency before use. Chemical Resistant, Heat Resistant, Water Resistant Aluminium paint shall be a solvent-based paint system designed to provide an aluminium finish over wood and metal surfaces, it shall be suitable for interior and exterior use and shall withstand temperatures up to 260°C, Aluminium Paint shall meet IS 2339:2013 specification & VOC value shall be within (cat.: A/i): 500 g/l. Where recommended by the paint manufacturer, 1st coat of Aluminium Paint or Redoxide Primer shall act as primer.

- i. Volume Solids: 37%
- ii. Film thickness
 - Wet: 32-40 microns.
 - Dry: 12-15 microns.
- iii. Application: Brushing or Spraying

14.5. SYNTHETIC ENAMEL PAINT & PRIMER

A solvent-based quality alkyd coating of approved shade formulated with weather resistant inert pigments manufactured by an approved brand suitable for painting over galvanized steel & metal structure shall comply to IS: 2933 & shall have excellent adhesion to steel &

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metal structure. Synthetic Enamel Paint shall be applied over a Zinc chromate primer base coat.

A second coat of ready mixed Red Oxide Zinc Chromate Primer conforming IS 2074 shall be applied where the steel members are prone to corrosion.

14.6. WOOD PRIMER

Unless otherwise specified in the contract document the material intended for use as a primer for wood shall be a specially formulated solvent based undercoat with excellent sealing and filling properties which protects wood from swelling due to absorption of moisture. Primer for wooden substrates shall have properties as listed below: -

- i. Drying time (IS 101-Part3): Surface dry within 30 -120 min(max), hard dry 16 hrs
- ii. Flash point IS101/1987 Part 1, Sec 6: > 30°C [> 85°F], flammable.
- iii. Water content (IS 101-Part2): Max 1 % by mass
- iv. Volume solids (IS 101-Part8): Min 40 % by mass
- v. Shall not contain Lead exceeding 5 % by mass
- vi. Finish: Smooth, Matt

15. NATURAL STONE

15.1. Marble

The marble shall be classified broadly in two categories, white marble & coloured marble. Unless otherwise specifically mentioned in contract document or in drawing, all marbles shall be of Indian origin available at Makrana, Doongri, Bundi, Bar, Narnaul, Bhainslana etc. Marble blocks, slabs and tiles shall comply with requirements of IS 1130: 1969. All marbles shall be First Quality Marble with properties as listed below: -

- i. Moisture absorption [IS: 1124]: Max 0.4% by weight
- ii. Hardness [Mohs Scale]: Min 3
- iii. Specific gravity [IS: 1122]: Min 2.5

The marble slabs and tiles shall be supplied with the following finishes: (a) Sand and/or abrasive finish, or (b) Hone finish, or (c) Polished finish.

15.2. Granite

Based on appearance Granites shall be broadly classified in two categories, (i) Pink Granites [mostly alkali granites]; and (ii) Grey and multi-coloured Granites [mostly calc-alkaline granites].

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(iii) Black Granite. Unless otherwise specifically mentioned in contract document or in drawing, all Granite slabs & tiles shall be of Indian origin sourced from several parts of India and shall comply with requirements of IS 14223-1:1995. Granites shall be free from all imperfections and injurious minerals that may interfere with the appearance, strength, structural integrity and its amenability to take good polish. All Granites shall have properties as listed below: -

- i. Moisture content [IS 13030] : Max 0.15%
- ii. Water absorption [IS 1124]: Max 0.5%
- iii. Porosity [IS 1124]: Max 2.5%
- iv. Compressive strength [IS 1121] : 1000-2200 kg/cm²
- v. Tensile strength [IS 1121]: Min 90 kg/cm²
- vi. Hardness (Mohs): 6-7
- vii. Resistance to wear [IS 1706]: not more than 2.5

The Granite slabs and tiles shall be supplied with the following finishes: (a) Polished granite [shall be mirror finish - Gloss meter reading min 95 %] or (b) Flamed.

15.3. Limestone

Limestones including fine-grained varieties of limestone (i.e. Kota Stone) shall have a uniform texture and all stones shall be without any soft veins, cracks or flaws. Limestone Slabs and tiles shall comply with requirements of IS 1128: 1974. Limestone slabs & tiles shall be of Indian origin sourced from Kota, Cuddapah, Chittorgarh, Jaisalmer, and other parts of India. The physical properties of limestone slabs & tiles shall conform to the requirements given below: -

- i. Water absorption [IS: 1124]: 0.15 % by weight
- ii. Transverse strength [IS: 1121-1]: 70 kg/cm²
- iii. Durability [IS: 1126]: Shall not develop signs of spalling, disintegration or cracks

Limestone slabs and tiles shall be supplied with the following finishes: (a) polished; (b) Honed; (c) Brushed.

15.4. Sandstone

The Sandstone shall be without any soft veins, cracks and flaws and shall have a uniform texture and colour. Sandstone slabs and tiles shall comply with requirement of IS 3622: 1977. Sandstone slabs & tiles shall be of Indian origin sourced from various parts of India. The physical properties of Sandstone slabs shall conform to the requirements given below: -

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- i. Water absorption [IS: 1124]: ≤ 2.5 % by mass
- ii. Transverse strength [IS: 1121]: Min 7 N/mm²
- iii. Resistance to wear [IS: 1706]: Max 2.5 mm for any individual specimen
- iv. Durability [IS 1126:2013]: No visible cracks

Sandstone slabs and tiles of various colours (such as red, yellow, natural Grey etc.) shall be supplied to sizes as stated in contract document in the following finishes: (a) Polished; (b) Honed; (c) Brushed; (d) Tumbled; (e) Sawn/Machine-cut.

16. CEMENT CONCRETE FLOORING

Cement Concrete Flooring shall be laid on base concrete where so provided. Cement concrete of specified mix grade shall be used and it shall generally conform to the specification. Flooring of specified thickness shall be placed in the panels & shall be laid in the pattern including the border as given in the drawings or as directed by the Engineer-in-Charge. The panels shall be of uniform size and no dimension of a panel shall exceed 1.5 m and the area of a panel shall not be more than 1.5 sq.m.

17. CEMENT CONCRETE TILES / CHEQUERED TILES

Cement Concrete Flooring Tiles shall comply with requirements of IS 1237: 1980. Cement concrete tiles shall be manufactured from a mixture of cement [OPC/PPC/white Portland], natural aggregates [IS 383] and Pigments [synthetic colouring material or otherwise] where required, by pressure process (with or without vacuum dewatering) or vibration (with or without vacuum dewatering) or a combination of both, so that the tiles meet the requirements specified in the standard; 300 x 300 mm tiles shall be (min) 20 mm [max +15 %] thick & 400 x 400 mm tiles shall be (min) 30 mm [max +15 %] thick. Heavy duty Cement Concrete tiles shall have 6 mm wearing layer. Pigments (if used) in tiles shall comply with requirements of IS 44/ IS 50/ IS 54/ IS 55/ IS 56/ IS 411 and shall not be used at the ratio of more than 10 % by mass of cement used in the mix. Lead pigments shall not be used. Pigments shall not contain zinc compounds or organic dyes. Tiles shall conform to the requirements given below: -

- i. Flatness of the Tile Surface: Max 1mm
- ii. Perpendicularity: Max 2%
- iii. Wet Transverse Strength: 3 N/mm².
- iv. Water Absorption: Max 10%

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- v. Average wear: 3.5 mm

The tiles shall be supplied with initial grinding and grouting of the wearing layer. The wearing layer of the tiles shall be free from projections, depressions, cracks (hair cracks not included), holes, cavities and other blemishes. The colour and texture of the wearing layer shall be uniform throughout its thickness.

18. VITRIFIED TILES

- a) Double charge polished vitrified tiles [Group B I A] floor tiles suitable for use in residential spaces shall have properties as listed below: -

- i. Deviation in Thickness [ISO 10545-2 / IS 13630 Part 1]: Max. $\pm 5.0\%$
- ii. Deviation in length & width [ISO 10545/ IS 13630/IS 15622]: Max. $\pm 0.10\%$
- iii. Deviation in Straightness of Sides [ISO 10545-2 / IS 13630 Part 1]: Max. $\pm 0.10\%$
- iv. Deviation in Rectangularity [ISO 10545-2 / IS 13630 Part 1]: Max. $\pm 0.10\%$
- v. Glossiness [ISO 2813]: 90
- vi. Skid resistance [ISO 10545-17]: 0.4
- vii. Surface Flatness [ISO 10545-2/ IS 13630 Part 1]: Max. $\pm 0.20\%$
- viii. Water Absorption [ISO 10545- 3 / IS 13630 Part 2]: $\leq 0.5 \%$
- ix. Breaking Strength [ISO 10545-4/IS 13630 Part 6]: $\geq 1300 \text{ N}$
- x. Modulus of Rupture [ISO 10545-4 / IS 13630 Part 6]: Individual min - 40 N/mm^2
- xi. Resistance to Household Chemical [ISO 10545- 13 /IS 13630 Part 7]: Min Class UA
- xii. Resistance to stain [ISO 10545-14]: Min Class 4
- xiii. Deep Abrasion [ISO 10545-6 / IS 13630 Part 12]: 140
- xiv. Scratch Hardness of Surface [EN 101/ IS 13630]: min 5

- b) 9 mm (up to 10.5 mm) thick High Definition Digital Polished [Group B II a] floor tiles suitable for use in residential spaces shall have properties as listed below: -

- i. Deviation in Thickness [ISO 10545-2 / IS 13630 Part 1]: Max. $\pm 5.0\%$
- ii. Deviation in length & Width [ISO 10545/ IS 13630/IS 15622]: Max. $\pm 0.10\%$
- iii. Deviation in Straightness of Sides [ISO 10545-2 / IS 13630 Part 1]: Max. $\pm 0.10\%$
- iv. Deviation in Rectangularity [ISO 10545-2 / IS 13630 Part 1]: Max. $\pm 0.10\%$
- v. Surface Flatness [ISO 10545-2/ IS 13630 Part 1]: Max. $\pm 0.40\%$
- vi. Water Absorption [ISO 10545- 3 / IS 13630 Part 2]: $3\% < \text{Average} \leq 6 \%$
- vii. Breaking Strength [ISO 10545-4/IS 13630 Part 6]: $\geq 1500 \text{ N}$

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- viii. Modulus of Rupture [ISO 10545-4 / IS 13630 Part 6]: Individual min - 30 N/mm²
 - ix. Resistance to Chemical [ISO 10545-13 / IS 13630 Part 8]: Min Class AA
 - x. Resistance to stain [ISO 10545-14 / IS 13630 Part 8]: Min Class 1
 - xi. Resistance to Surface Abrasion [ISO 10545-7 / IS 13630 Part 11]: Min Class III
- c) 9 mm thick Full body vitrified [Group B I a] floor tiles suitable for use in heavy foot traffic areas shall have properties as listed below: -
- i. Length & Width [IS 15622/IS 13630/ISO 10545]: $\pm 0.10\%$
 - ii. Rectangularity [IS 13630/IS 15622/ ISO 10545] : $\pm 0.10\%$
 - iii. Surface quality: $\geq 95\%$ (of tiles shall be free from visible defects)
 - iv. Water absorption [IS 15622]: $E \leq 0.08\%$ (Average) & Individual 0.1%(max)
 - v. Modulus of Rupture [IS 15622]: Individual min 32 N/mm²
 - vi. Breaking strength [IS 15622/IS 13630/ISO 10545] : min 1300N
 - vii. Moisture expansion [IS 15622/IS 13630]: 0.02mm/m
 - viii. Scratch Hardness of Surface [IS 13630]: min 5
 - ix. Deep abrasion resistance 140 max
 - x. Stain resistance [ISO 10545]: Min Class 2(if Unglazed)
 - xi. Resistance to Acid, Alkalis, Chemicals [ISO 10545]: Min Class AA
 - xii. Skid resistance [DN 51130]: R10
- d) 8 to 10 mm thick Anti-Skid, homogeneous & granular finish Vitrified tiles suitable for use in Internal area of building shall have properties as listed below: -
- i. Comply with IS:15622:2017 & IS 4457:2007
 - ii. Skid resistance: > 0.5
 - iii. Mohr's hardness > 5.0
 - iv. Stain resistance: Class-1,
 - v. Water Absorption: $E < 0.5\%$,
 - vi. Modulus of Rupture: > 35 N/sq.mm
 - vii. Abrasion resistance: Max 175

19. CERAMIC TILES

- a) 7.5 to 8.5 mm thick High Definition Digital Ceramic wall tiles [Group B III] shall have properties as listed below: -

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- i. Length & Width [IS 15622:2017]: Max. $\pm 0.20\%$
 - ii. Deviation in Thickness [IS 15622:2017]: Max. $\pm 5.0\%$
 - iii. Deviation in Rectangularity [IS 15622:2017]: Max. $\pm 0.20\%$
 - iv. Surface Flatness [IS 15622:2017]: Max. $\pm 0.30\%$
 - v. Surface Quality [IS 15622:2017]: Min. 95% free from visible defects
 - vi. Water Absorption[IS 15622:2017]: Average $\geq 10\%$
 - vii. Breaking Strength[IS 15622:2017]: $\geq 700\text{ N}$ (min 600 N)
 - viii. Modulus of Rupture[IS 15622:2017]: $\geq 12\text{ N/mm}^2$
 - ix. Resistance to Chemical : Min Class AA[IS 15622:2017] or Class B [ISO 13006:2018]
 - x. Resistance to Surface Abrasion [IS 15622 :2017]: Class I
 - xi. Scratch Hardness [IS 13630 Part 13]: Min 3
- b) 7.5mm thick anti-skid ceramic floor tiles [$3 < E \leq 6$ Group B II] shall have properties as listed below:-
- i. Rectified tiles
 - ii. Length and Width Length & Width [EN 98/IS 13630]: Max. $\pm 0.10\%$
 - iii. Deviation in Thickness [EN 98/IS 13630]: Max. $\pm 4.0\%$
 - iv. Deviation in Rectangularity [EN 98/IS 13630]: Max. $\pm 0.10\%$
 - v. Surface Flatness [EN 98/IS 13630]: Max. $\pm 0.40\%$
 - vi. Surface Quality [EN 98/IS 13630]: Min. 95% free from visible defects
 - vii. Ramp value $> R11$
 - viii. Coefficient of friction [ISO 10545-17]: 0.6-0.7
 - ix. Breaking Strength[EN 100/IS 13630-Part 6]: $\geq 1000\text{ N}$
 - x. Modulus of Rupture[EN 100/IS 13630-Part 6]: $\geq 28\text{ N/mm}^2$
 - xi. Water Absorption [EN 99/IS 13630-Part 3]: $5 \pm 0.5\%$ (Individual max 6.2%)
 - xii. Stain resistance [IS 13630]: Class 1
 - xiii. Resistance to House hold Chemicals [IS 13630]: Min Class AA
 - xiv. Resistance to Surface Abrasion [EN 154/IS 13630-Part 11]: PEI 5
 - xv. Scratch Hardness [Mohs]: Min 8
- c) 10mm thick Ceramic tiles [Group B III] suitable for external use shall have properties as listed below:-
- i. Length & Width [IS 13630]: $\pm 0.10\%$
 - ii. Rectangularity [IS 13630/IS 15622/ ISO 10545] : $\pm 0.20\%$
 - iii. Surface quality : $\geq 95\%$ (of tiles shall be free from visible defects)

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- iv. Water absorption [IS 15622]: $E \geq 10\%$
- v. Modulus of Rupture [IS 15622]: $\min 15 \text{ N/mm}^2$
- vi. Breaking strength[IS 15622] : $\min 1500\text{N}$
- vii. Moisture expansion[IS 15622/IS 13630]: 0.04mm/m
- viii. Thermal Shock Resistance[IS 13630]: Passed 10 Cycles
- ix. Stain resistance [ISO 10545]: Min Class 1
- x. Resistance to Acid, Alkalis, Chemicals [ISO 10545]: Min Class AA

20. TILE ADHESIVE

- a) Single component, high strength, high performance, self-curing, water repellent Polymer modified cement based tile adhesive specially designed for fixing ceramic tiles, vitrified tiles & Porcelain tiles on 4-6mm thick bed shall comply with IS 15477 (Type2).
 - i. Tensile adhesion strength (min) : 1.25 N/mm^2
 - ii. Shear adhesion strength(min) : 1.50 N/mm^2

21. CEMENT POLYMER GROUT

Non shrinking Cement Polymer Grout made of white cement, fine graded filler, chemical additives including powder polymers and colour-fast pigments shall have compressive strength 12.5 N/mm^2 . The proprietary product suitable for both external & internal use shall be designed for grouting gap up to 4mm in ceramic tiles, vitrified tiles, glass mosaic tiles, marble, granite and other natural stones. Make & Colour Shades of Cement Polymer Grout shall be as approved by the Engineer –in –Charge.

22. EPOXY BASED GROUT

The Epoxy grout shall be a waterless mix formed by mixing a base material (part A) and a hardener (part B). The grout shall consist of mix of 0.70 kg of organic coated filler of desired shade and mixing of 0.10kg of hardener and 0.20 kg of resin per kg. They shall have very low water absorption, higher compressive strength and shall be resistant to staining. Proprietary Epoxy grout shall be easy to maintain requiring no additional sealer to protect the surface.

23. WOODEN FLOORING

23.1. All timber used for timber floors shall be thoroughly seasoned in accordance with IS 1141.

After seasoning the timber shall be treated with preservative in accordance with IS 401.

23.2. Main beams and joists of the class of wood sections as specified in the drawing or as instructed by the Engineer-in-Charge shall be fixed in position to dead levels. The width of the

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joints shall not be less than 50 mm. The arrangement and spacing of beams joists etc. shall be as per design furnished.

23.3. Only selected boards of the class of timber and thickness specified in the manufacturer's description of the item shall be used. Unless otherwise specified or shown in the drawings, the width of boards selected shall uniform, not be less than 100 mm nor more than 150 mm. The minimum length of boards shall be such that the boards shall rest at least on three supports, the length of the boards shall not exceed 3 metre anywhere.

23.4. Unless otherwise described in the item, the longitudinal joints of planks shall be tongued and grooved to a minimum depth of 12 mm while the heading joints shall be of the square butt type and shall occur over the centre line of the supporting joists.

23.5. The surface of the floor shall be finished as directed by the Engineer-in-Charge. The lower face shall be painted or treated with wood preservative.

24. ALUMINIUM DOORS, WINDOWS AND VENTILATORS

Aluminium doors, windows and ventilators shall comply with requirements of IS 1948. The side hung opening position of all doors and windows shall be said to be right-hand or left hand according to the side on which they are hinged looking from the inside. Aluminium alloy used in the manufacture of extruded window sections shall correspond to IS: 733-1956. Hollow aluminium alloy coupling sections used shall conform to IS: 1285-1958. The pins for hinges shall be of stain less steel of non-magnetic type or of aluminium alloy HR30. Irrespective of hinges being anodized or not, the aluminium alloy pins shall be anodized to a minimum film thickness of 0.025mm. The nominal weight per metre length for Glazing Bar, Mullion Bar, Opening Frame, Frame Bar, Ventilation Bar, and Outer Bar for Ventilation, Coupling, and Coupling with Weather Bar shall correspond to IS 1948.

24.1. Weight per metre length for sections used in 40 mm series Casement window shall be:-

- i. 40mm x 41mm 1.25mm thick Outer / H Frame: 0.522kg/m
- ii. 40mm x 41mm 1.5mm thick Outer Half: 0.64kg/m
- iii. 63mm x 41mm 1.5mm thick Mullion: 0.817-0.892kg/m

24.2. Weight per metre length for sections used in 40 mm series double shutter Casement window shall be:-

- i. 95mm x 39.75mm 1.40mm thick Outer / H Frame: 0.850kg/m
- ii. 95mm x 60mm 1.4mm thick Mullion: 1.389kg/m

24.3. Weight per metre length for sections used in frame for 2 Track Sliding panel shall be:-

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- i. Bottom frame: 0.875kg/m
 - ii. Top & side frame: 0.77kg/m
- 24.4. Weight per metre length for sections used in frame for 3 Track Sliding panel shall be:-
- i. Bottom frame 1.233kg/m
 - ii. Top & side frame 1.067kg/m
- 24.5. Weight per metre length for sections used in shutter for 2/3 Track Sliding panel shall be:-
- i. Bottom & top member for Shutter : 0.472kg/m
 - ii. Style side member for Shutter : 0.493kg/m
 - iii. Interlock member for Shutter: 0.612kg/m.
- 24.6. Weight per metre length for sections used in Curtain wall shall be:-
- i. Mullions: 1.819kg/m
 - ii. Sub frame for glass fixing: 0.31 kg/m

Screw threads of machine screws used in the manufacture of aluminium doors, windows and ventilators shall conform to the requirements of IS: 1362-1959. The lockable handle shall be of make approved by the Engineer-in-Charge and of required colour to match the colour of powder coated /anodized aluminium window sections.

The manufacturer shall prepare shop drawings for each type of aluminium doors & windows and submit drawings for Engineer-in-Charge's approval. Aluminium door, Windows and ventilators shall be supplied in either matt, scratch-brush or polished finish. They may also be anodized, colour anodizing if so required by the Engineer-In Charge. A thick layer of clear transparent lacquer shall be applied on Aluminium members to protect surface from wet cement.

The manufacturer shall warrant Aluminum frame windows and doors for 10 years to be free of manufacturing and/or material defects.

25. GLAZING UNITS

Window glazing units shall be factory made units with 5mm-6mm thick single glass and glazing works shall be in compliance with IS 3548; Putty for glazing shall conform to IS: 419 and Polysulphide based sealants shall conform to IS 11433-part 1.

Unless specified in drawings, all units shall be a single glazed unit comprising of float glass panes sealed using a thermo plastic solvent free polysosutylene primary sealant and a silicone secondary sealant.

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26. GLASS

All glasses shall be of the specified type, Glass panelling (Glazing) shall be done with float sheet glass as per IS 14900. Unless specified in the contract document “B Quality” or “Ordinary Quality” sheet glass shall be used for glazing and “A Quality” or “Select Quality” sheet glass shall be used for safety glasses. Flat transparent sheet glass shall comply with requirements of IS 2835.

Safety glass meant for general purposes such as for use in glazing windows, doors of buildings shall comply with IS: 2553 (Part 1): 2018. Toughened safety glass if marked in door/window / glazing schedule shall be of nominal thickness and range of thickness as specified in Table 1 of IS 2835 : 1987.

Fully tempered clear float glass if marked in the door/window / glazing schedule shall be to BS 952, Type I, Class 1, Quality Q3, and 6 mm thick unless otherwise indicated on drawings . Alternatively, tampered float glass shall comply with ASTM C1048, Type 1, Class 1 (clear), Quality Q3, kind FT.

Spandrel panel if marked in the door/window / glazing schedule shall be float glass with silicone polyester enamel pacifier coating applied to surface.

Glazing for fire doors shall be clear 6.5 mm thick fire-resisting glass. The minimum fire rating of the glass as marked in the door/window / glazing schedule shall comply with BS 476: Parts 20, 21, 22 & 23. The glass shall be manufactured in accordance with BS 6206, Class C (for glass < 900mm). Wire glass if used shall be (min) 6.0 mm thick “Polished Georgian Square” and manufactured in accordance with BS 6206 Class C.

High performance glazing If marked in the door/window / glazing schedule shall have (a) shading coefficient: 0.1-0.4 W/m² deg K; (b) U- Value: 1.7-3.0 W/m² deg K; (c) Visual light transmission: 40-60%.

27. STEEL DOORS, WINDOWS AND VENTILATORS

Steel doors shall comply with requirements of IS: 1038. Rolled steel sections for the fabrication of steel doors shall conform to IS: 7452. Steel used in the manufacture of these sections shall conform to IS: 7452. Coupling sections shall be manufactured from (minimum) 1.6 mm thick galvanized steel plate. Screw threads of machine screws used in the manufacture of steel doors shall conform to the requirements of IS: 4218.

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Door frames shall be fabricated from 1.2 mm (18 SWG) - 1.6 mm thick (12 SWG) skin pass galvanized iron sheet conforming to IS 277 formed to single or double rebate profile of required size. Frames shall be constructed of sections which have been cut to length and mitred. The corners of fixed and opening frames shall be welded to form a solid fused welded joint. Welds shall be properly ground, and complete cross section of the corner shall be checked up to see that the joint is completely solid and there are no visible cavities.

Door shutter shall be fabricated from 0.8 mm (22 SWG) - 1.2mm thick (18 SWG) skin pass galvanized iron sheet conforming to IS 277. Overall thickness of shutter shall be 46mm.

In fill material for 2 hrs fire rated fire doors shall be either Rockwool or Mineral Wool or Honeycomb Kraft Paper.

Door frames & door shutters shall be primed with Zinc-Phosphate Stoving Primer and shall be finished with 60-65mm (dry film) thick Epoxy Polyester paint. Manufacturer shall supply all doors & door frames that are template drilled for fixing accessories such as hinges, locks etc. The manufacturer shall prepare shop drawings for each type of doors & windows and submit drawings for Engineer-in-Charge's approval.

In the case of double doors, the first closing leaf shall be the left hand leaf locking at the door from the push side. The first closing shutter shall have a concealed steel bolt at top and bottom. The manufacturer shall warrant steel doors for 5 years to be free of manufacturing and/or material defects.

28. ROLLING SHUTTERS

Rolling shutters shall conform to IS 6248. These shall include necessary locking arrangement and handles etc. These shall be suitable for fixing in the position as specified i.e. outside or inside on/or below lintel or between jambs of the opening. The door shall be either push and pull type or operated with mechanical device supplied by the firm. Unless specified in drawings, shutters up to 10 sq. metre shall be of push and pull type and shutters with an area of over 10 sq. metre shall be provided with reduction gear operated by mechanical device with chain or handle.

The shutter be built up of inter locking lath section formed from cold rolled steel strips. The thickness of the sheets from which the lath sections have been rolled shall be not less than 0.90 mm for the shutters up to 3.5 m width. Each lath section shall be continuous single piece without any welded joint.

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The spring shall be of coiled type. The spring shall be manufactured from high tensile spring steel wire or strips of adequate strength conforming to IS 4454- Part I.

The suspension shaft of the roller shall be made of steel pipe conforming to heavy duty as per IS 1161. For shutter up to 6 metre width and height not exceeding 5 metre, steel pipes of 50 mm nominal bore shall be used. The shaft shall be supported on mild steel brackets of size 375 x 375 x 3.15 mm for shutters up to a clear height of 3.5 metre. The size of mild steel brackets shall be 500 x 500 x 10 mm for shutters of clear height above 3.5 m and up to 6.5 m. The suspension shaft clamped to the brackets shall be fitted with rotatable cast iron pulleys to which the shutter is attached. The pulleys and pipe shaft shall be connected by means of pre tensioned helical springs to counter balance the weight of the shutter and to keep the shutter in equilibrium in any partly open position.

When the width of the opening is greater than 3.5 mtr. The cast iron pulleys shall be interconnected with a cage formed out of mild steel flats of at least 32 x 6 mm and mild steel dummy rings made of similar flats to distribute the torque uniformly. Self-aligning two row ball bearing with special cast iron castings shall be provided at the extreme pulley and caging rings shall have a minimum spacing of 15 mm and at least 4 number flats running throughout length of roller shall be provided.

In case of shutters of large opening with mechanical device for opening the shutter the roller shall be fitted with a purion wheel at one end which in contact with a worm fitted to the bracket plate, caging and pulley with two ball bearing shall be provided.

Guide Channel: The width of guide channel shall be 25 mm, the minimum depth of guide channels shall be 65 mm for clear width of shutters up to 3.5 m, 75 mm for clear width of shutters above 3.5 m up to 8 m. The gap between the two legs of the guide channels shall be sufficient to allow the free movement of the shutter and at the same time close enough to prevent rattling of the shutter due to wind. Each guide channel shall be provided with a minimum of three fixing cleats or supports for attachment to the wall or column by means of bolts or screws. The spacing of cleats shall not exceed 0.75 m. alternatively, the guide channels may also be provided with suitable dowels, hooks or pins for embedding in the walls. The guide channels shall be attached to the jambs, plumb and true either in the overlapping fashion or embedded in grooves, depending on the method of fixing as per IS 6248.

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Cover: Top cover shall be of mild steel sheets not less than 0.90 mm thick and stiffened with angle or flat stiffeners at top and bottom edges to retain shape. Lock plates with sliding bolts, handles and anchoring rods shall be as per IS 6248.

The arrangement for fixing in different situations in the opening shall be as per IS 6248. Brackets shall be fixed on the lintel or under the lintel as specified with rawl plugs and screws bolts etc. The shaft along with the spring shall then be fixed on the brackets.

Unless otherwise specified in drawings or directed by the Engineer-in-Charge rolling grill shutter and the rolling grill portion of the rolling shutter-cum-grill shall be fabricated with 8mm diameter mild steel round bars. Straight bars and bars bent to the required profile are placed alternatively and held in position with 20 mm wide and 5 mm thick mild steel flat links. Straight bars shall be spaced not exceeding 150 mm centre to centre and the bars bent to required profile shall be placed symmetrically between two consecutive straight bars. The total height of the grill portion in all the segments of rolling shutter- cum-grill shall not exceed 1.0 m and the height of the grill portion in any individual segment shall not be more than 0.5 m.

29. M.S. SHEET SHUTTERS

These shall be manufactured as per size and specification shown drawing and shall be fabricated from galvanized mild steel sheets and angle iron. Unless otherwise specified in drawing, the shutters shall be fabricated of 40 x 40 x 6 mm M.S. angle frame @ 3.5 kg/ metre and two diagonal braces of the same section. The frame shall be welded at the junctions. M.S. sheet of 1 mm thickness or as specified, shall be fixed to the frame with rivets or welds as approved by the Engineer-in-Charge. The shutters shall also be provided with locking arrangement, pull handles of required shape and size as approved by the Engineer-in-Charge. All the members of the door including angle iron shall be thoroughly cleaned off rust, scales, dust etc. and given a priming coat of approved steel primer i.e. Red Oxide/ Zinc chrome primer confirming to IS 2074.

30. STEEL WORK WELDED IN BUILT-UP SECTIONS FOR HAND RAIL USING M.S. TUBULAR/ERW TUBULAR PIPES AND G.I. PIPES

Hot finished welded (HFW) Hot finished seamless (HFS) and electric resistance welded tube shall conform to IS 1161. G.I. pipes used for Hand rail to be conforming to IS 1239-Part I for medium grade. GI pipes to be screwed and socketed type and of required nominal bore. Galvanising of GI pipes shall conform to IS 4736. All screwed tubes and socket of GI pipes shall have pipe threads

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conforming to the requirements of IS 554. The fittings for GI pipes to be conforming to IS 1239 (Part-II).

Straightening, shaping to form, cutting and assembling, shall generally be done as specified in IS 800 as far as applicable. Shop drawings giving complete information for the fabrication of the component parts of the structure including the location, type, size, length and details or rivets, bolts or welds, shall be prepared in advance of the actual fabrication and approved by the Engineer-in-Charge. Welding shall be done by electric arc process as per IS 816 and IS 823. A priming coat of approved steel primer such as Red Oxide/Zinc Chromate primer conforming to IS 2074 shall be applied before any member of steel structure are placed in position or taken out of workshop.

31. WATER PROOFING

31.1. ACRYLIC POLYMER MODIFIED ELASTOMERIC WATERPROOFING MEMBRANE COATING

The proprietary coating system shall be a two component acrylic polymer modified elastomeric waterproofing membrane which consists of a powder and acrylic emulsion. It shall require only on-site mixing of water as per manufacturer's recommended proportions to produce a coating which can be simply applied by a stiff brush, or trowel to obtain the desired thickness. The product shall consist of specially selected cements, graded hard-wearing aggregates and additives supplied in powder and liquid component of blended acrylic copolymers.

The polymer shall provide exceptional adhesion, toughness and durability with life expectancy no less than 10 years. All the surfaces which are to receive the coating shall be made free from oil, grease, wax, dirt or any other form of foreign matter which might affect adhesion. Any spalled and deeply disintegrated concrete shall be removed to sound concert to the satisfaction of the Engineer -in-Charge.

31.2. POLYMER MODIFIED CEMENTITIOUS WATERPROOFING SLURRY

Apply a two component polymer mortar composite flexible water proofing slurry to a minimum thickness of 2 mm (Coverage: 3.6 kg/m², 2 mm DFT, Crack bridging: 0.5 mm, VOC: < 50 g/L) in two coats on the concrete surface to protect the underlying screed against moisture penetration. All corners, joints, edges, floor drains and other penetrations shall be sealed with non-woven sealing tape which shall be embedded onto the 1st coat of the waterproofing coating. Standard ceramic floor tiles shall be fixed on top with cementitious tile adhesive using the thin bed fixing method. Tile joints filling shall be done with a polymer modified cementitious joint filling grout.

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The laying of waterproofing system shall be done by the authorised applicator of the manufacturer, and as approved by the Engineer -in-Charge. Life expectancy of the waterproofing system shall be no less than 10 years.

31.3. GLASS FIBRE FABRIC FOR WATERPROOFING AND COATING APPLICATIONS

Glass Fibre Fabric (0.13 mm thick, 2.5 mm x 2.5 mm approx. mesh size) shall be a bi-directional, light weight, high tensile strength woven fibre glass fabric coated with unique alkali resistant white resin coating that does not rot, tear or wear and is widely used for a wide range of applications in the construction industry as reinforcement for Cementitious polymer modified waterproofing slurry coating systems.

Before application, the fabric shall be cut to the required length & shall be applied on green / freshly applied coating systems by spreading from one end to the other; an overlap of ≥ 20 mm along the entire length & width shall be maintained in case of joints for larger spans, and fabric shall be embedded by roller or brush.

31.4. FIBRE REINFORCED ELASTOMERIC LIQUID WATER PROOFING MEMBRANE

Fibre reinforced elastomeric liquid water proofing membrane having life expectancy no less than 10 years shall be a ready-to-use waterproofing system for external applications, this shall be a white product with high solar reflectance and Sun Reflectivity Index (SRI) of 105. The system shall be made from resilient acrylic polymers and synthetic resins in water dispersion, and when in dry form shall produce a continuous, flexible waterproofing membrane. This shall be resistant to all atmospheric conditions and UV rays, and shall assure long-lasting protection for the substrate. Fibre reinforced elastomeric liquid water proofing membrane with fibres in water emulsion with high reflectance and emissivity with a solar reflectance index SRI of 105 shall comply with the requirements of EN 1504-9 ("Products and systems for protecting and repairing concrete structures: definitions, requirements, quality control and conformity assessment. General principles for the use of products and systems") EN 1504-2 coating (C) principles PI, MC and IR ("Concrete surface protection systems").

This shall possess a paste like consistency having highly reflective white colour.

This shall have density of 1.35 with dry solid content of 61.4%.

This shall have minimum tensile strength of 1.0N/mm^2 as per ISO 37 or ASTM D-412.

This shall confirm to results after testing as per EN1062-11 for exposure to artificial weather conditions.

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The Sun Reflectivity Index when tested as per ASTM E1980 shall be 105 minimum.

Elongation at break (% age) of 150 % minimum as per ASTM D-412.

Adhesion strength is more than 1.0 N/mm² as per ASTM D-4541.

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PART-B

EXECUTION

32. GENERAL

32.1. SAFETY IN CONSTRUCTION

The contractor shall employ only such methods of construction, tools and plant as are appropriate for the type of work or as approved by Engineer-in-Charge in writing.

32.2. PROTECTIVE FABRIC SCREENS

Before execution, profile of protective fabric screen shall be approved by the Engineer-in-Charge. Protective Fabric screening shall be provided by the contractor with PVC woven cloth covering full height of the structure. The contractor shall maintain the protective screen in acceptable working conditions for the entire duration of the repair work as required by the Engineer-in-Charge.

32.3. SCAFFOLDING NET

Scaffolding net of required width made of high density Polyethylene UV stabilized knitted on warp knitting machines having density 100 gm/sq.m. and shading coefficient minimum 75% around the construction site/ for vertical extension as per requirement including fastening/tying with building/scaffolding pipes or with any other fixtures etc. shall be used. A continuous length of net having no joints, shall be used to cover the span between the supports. The work shall be carried out as per IS-11057.

32.4. PROVISIONS FOR SPLIT A.C. INSTALLATION

Wherever split Air Conditioning are planned or shown in the drawing, necessary openings in wall, beams shall be provided at locations as directed by Engineer-in-Charge; provisions shall be made by keeping 75 mm PVC pipe sleeves at suitable locations for taking refrigerant pipes and cable to outdoor units, so as to avoid unnecessary cutting/ damage to walls at a later stage. The slope of sleeve of PVC pipe shall be towards exterior. 40 mm PVC/ HDPE drain pipe as approved by Engineer-in -Charge shall be provided and shall be taken to nearest drain or up to the stack for collection & disposal of condensate. The slope of such pipe also shall be downwards. Joints in pipe shall be avoided as far as possible.

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33. CARRIAGE OF MATERIALS & STORAGE

33.1. MODE OF CARRIAGE

Tools and plants, required for the work shall be arranged by the Contractor; depending upon the feasibility and economy contractor shall determine the mode of carriage viz. whether by mechanical or manual labour and shall notify the Engineer-in -Charge in writing.

33.2. GENERAL CONSIDERATION FOR STACKING AND STORAGE

There shall be proper planning of the layout for stacking and storage of different materials, components and equipment with proper access and proper manoeuvrability of the vehicles carrying the material. While planning the layout, the requirements of various materials, components and equipment at different stages of construction shall be considered. For further details, refer IS- 4082.

34. EARTHWORK

34.1. SITE CLEARANCE

Surface dressing shall include cutting and filling and clearing of shrubs, rank vegetation, grass, brushwood, trees and saplings and removal of rubbish and other excavated material outside the periphery of the area under surface dressing. High portions of the ground shall be cut down and hollows depression filled up to the required level with the excavated earth so as to give an even, neat and tidy look. All useful materials obtained from clearing and grubbing operation shall be stacked in the manner as directed by the Engineer -in-Charge.

34.2. THE DESIGN FOR TEMPORARY SITE BENCH MARK

The location & size, depth etc. shall be as directed by the Engineer-in-Charge

34.3. EXCAVATION IN ALL KINDS OF SOILS

All excavation shall be done manually or by mechanical means as directed by Engineer-in charge considering feasibility, urgency of work, availability of labour /mechanical equipment and other factors involved; excavation operations manually or by mechanical means shall include excavation and 'getting out' the excavated materials. In case of excavation for trenches, basements, water tanks etc. 'getting out' shall include throwing the excavated materials at a distance of at least one metre or half the depth of excavation, whichever is more, clear off the edge of excavation.

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In all other cases 'getting out' shall include depositing the excavated materials as specified. The excavation shall be done true to levels, slope, shape and pattern indicated by the Engineer in-Charge.

34.4. FILLING

Normally excavated earth from same area shall be used for filling. Filling with excavated earth shall be done in regular horizontal layers each not exceeding 20 cm in depth to the satisfaction of the Engineer-in-Charge. The contractor shall make good all subsidence and shrinkage in earth fillings, embankments, traverses etc. during execution and till the completion of work unless otherwise specified. In case of earth to be imported, the area from where the earth is to be imported, shall be pre-determined wherever possible before the start of the work. The levels shall be properly checked during the progress of work and on completion.

Sand for filling shall be clean and free from dust organic and foreign matter and its grading shall be within the limits of grading zone IV or V.

34.5. EXCAVATION IN TRENCHES FOR PIPES, CABLES ETC. AND REFILLING

When the depth of trench in soft/loose soil exceeds 2 metres, stepping, sloping and/ or planking and strutting of sides shall be done if deemed necessary, in case of loose and slushy soils, the depths at which these precautions are to be taken, shall be determined by the Engineer-in-Charge according to the nature of soil. IS: 3764 shall be the guideline for designing shoring and strutting arrangements. Filling in trenches shall be commenced soon after the joints of pipes, cables, conduits etc. have been tested and passed. Excavated material containing deleterious material, salt peter earth etc. shall not be used for filling. Ramming shall be done with iron rammers where feasible and with blunt ends of crow bars where rammers cannot be used. Special care shall be taken to ensure that no damage is caused to the pipes, Cables, Conduits etc. laid in the trenches.

35. SHORING

For greater depths (more than 2m), the excavation profiles shall be widened by allowing steps of on either side as directed by the Engineer-in-Charge; Alternatively, the excavation can be done so as to give slope of 1:4 (1 horizontal: 4 vertical). Where the soil is soft, loose or slushy, the width of steps shall be suitably increased or sides sloped or the soil shored up as directed by the Engineer-in-Charge. It shall be the responsibility of the contractor to take complete instructions in writing

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from the Engineer-in-Charge regarding the stepping, sloping or shoring to be done for excavation deeper depth (more than 2 metres) for which no extra payment shall be made. The contractor shall take guidance from IS 3764 for designing the shoring and shall submit shop drawing to Engineer-in-Charge for approval. Excavation works shall not be carried out below the foundation level of the adjacent buildings until underpinning, shoring etc. is done as per the directions of the Engineer-in-Charge.

36. DE-WATERING

De-watering shall be done conforming to IS 9759 Code (guide lines for dewatering during construction) and / or as per the specifications approved by the Engineer-in-Charge. Design of an appropriate and suitable dewatering system shall be the Contractor's responsibility. Such scheme shall be modified / augmented as the work proceeds based on fresh information discovered during the progress of work, at no extra cost. At all times during the construction work, efficient drainage of the site shall be carried out by the Contractor. De-watering shall be carried out by suitable means with adequate stand-by arrangements of pumps etc. and it shall be ensured that its disposal is carried out as per the regulations of the local bodies. The water / slush / muck etc. shall not be disposed off into the public drainage system of sewer manhole or storm water drain, but shall be disposed by any other manner, subject to the approval of the local bodies in this regard. Unless otherwise stated in the contract document, the cost of dewatering or working under water and / or liquid mud for execution of all the items for the work shall be considered as included in quoted rates - Nothing extra shall be payable on these accounts. all permissions in this regard, to be taken from local authorities, shall be obtained by the Contractor.

37. MORTARS

37.1. LIST OF BUREAU OF INDIAN STANDARDS CODES

— Code of Practice for Preparation and use of Masonry Mortars IS 2250

37.2. CEMENT

The cement shall be any of the grade and the type as specified & shall be appropriate for the intended use. Unless specified and approved by the Engineer –In -Charge different types of cement shall not be mixed together; pursuant to written approval if more than one type of cement is used in any work, a record shall be kept showing the location and the types of cement used.

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Because of the faster hydration process, the concrete releases heat of hydration at a much faster rate initially and release of heat is the higher in case of Grade. 53. The heat of hydration being higher, the chances of micro-cracking of concrete is much greater. Thus, during initial setting period of concrete, the higher heat of hydration can lead to damaging micro-cracking within the concrete which may not be visible at surface. This cracking is different from shrinkage cracks which occurs due to faster drying of concrete in windy conditions. The situation can be worse when we tend to increase the quantity of the cement in the concrete with a belief that such increases are better for both strength and durability of concrete. Thus, it is very essential to be forewarned that higher grade cement specially grade 53 shall be used only where such use is warranted for making higher strength concrete and also where good Quality Assurance measures are in place, by which proper precaution are taken to relieve the higher heat of hydration through chilling of aggregates or by proper curing of concrete. There are instances where higher grade cement is being used even for low strength concrete, as, mortar or even for plastering. This can lead to unnecessary cracking of concrete/ surfaces. Another issue to be cautioned against is the tendency of the manufacturers to project Grade 53 cement as stronger cement, whereas Grade 43 is enough to produce the concrete of desired characteristic strength. The scenario of method of production of cement by various manufacturers shall also be kept in mind while ordering various grades of cement. The ability to produce cements of particular fineness get fixed by the machinery installed by the manufacturers, and thus the ability to produce other various grades of cement by a particular manufacturer also gets limited. Whereas tendency is to supply the consumer what he orders for by the manufacturers by simply stamping such grades on the bags. Thus, it is often observed that cement bags marked as respective grades may actually be containing cements of much higher grade.

Cement in bags shall be stored and stacked in a shed which is dry, leak-proof and as moisture-proof as possible. For extra safety during monsoon, or when cement is expected to be stored for an unusually long period, each stack shall be completely enclosed by a water proofing membrane, such as polyethylene, which shall cover the top of the stack. Care shall be taken to see that the water proofing membrane is not damaged at any time during use. Any damage occurring to cement due to faulty storage in contractor's shed or on account of negligence on his part shall be the liability of the contractor.

37.3. SAND

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Silt contents in Sand shall be determined by field test to the satisfaction of Engineer-in-Charge.

Bulking of sand shall be determined by field test to the satisfaction of Engineer-in-Charge.

38. CONCRETE WORKS

38.1. LIST OF BUREAU OF INDIAN STANDARDS CODES

- IS 383 Specification for coarse and fine aggregate from natural sources for concrete.
- IS 456 Plain and reinforced concrete - Code of practice
- IS 516 Method of test for strength of concrete
- IS 1199 Method of sampling and analysis of concrete
- IS 1791 General requirements for batch type concrete mixers
- IS 2386 Method of test for aggregates for concrete
 - Part I - Particle size and shape
 - Part II - Estimation of deleterious materials and organic impurities
 - Part III - Specific gravity, density, voids absorption and bulking.
 - Part IV - Mechanical properties.
 - Part V – Soundness
- IS 2505 General requirements for concrete vibrators - immersion type.
- IS 2506 General requirements for concrete vibrators - screed board concrete vibrators
- IS 2645 Specification for integral water proofing compounds for cement mortar and concrete
- IS 3812 Specification for flyash for use as pozzolana and admixture in cement mortar and concrete.
- IS 4656 Specification for form vibrators for concrete.
- IS 9103 Specification for concrete admixtures

38.2. AGGREGATE

- i. The aggregate must also be checked for organic impurities. Stone aggregate shall be checked for Percentage of soft or deleterious material through Field/Laboratory test as required in accordance with IS 2386-Part II; Minimum quantity of material for carrying out test shall be as directed by the Engineer in-Charge.
- ii. All samples shall be brought to an air-dry condition before weighing and sieving. The air dry sample shall be weighed and sieved successively on the appropriate sieves starting with the largest. On completion of sieving the material retained on each sieve, together with any material cleaned from the mesh, shall be weighed.

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- iii. The results shall be calculated and reported in either one of the following methods as approved by the Engineer-in-Charge:
 - i. The cumulative percentage by weight of the total sample passing each of the sieves, to the nearest whole number
 - ii. The percentage by weight of the total sample passing one sieve and retained on the next smaller sieve, to the nearest 0.1 percent.
- iii. List of mandatory test

Material	Test	Field/ Laboratory	Test procedure	Minimum quantity
Stone aggregate	Percentage of soft or deleterious material	Field/ Lab	IS 2386-Part II	As decided by Engineer-in-Charge
	Particle size		Table-A	
	Estimation of organic impurities		IS 2386-Part II	
	Surface moisture		IS 2386	
	Determination of 10% fine value			
	Specific gravity			
	Bulk density			
	Aggregate crushing strength			
	Aggregate Impact value			

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Concrete	Slump test	Field	REF. 3.3.5	
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iv. Table-A

DETERMINATION OF PARTICLE SIZE		
I.S. Sieve Designation	Maximum weight for	
	45 cm dia sieve Kg	30 cm dia sieve kg
45 mm	10	4.5
40 mm	8	3.5
31.5 mm or 22.1 mm	6	2.5
20 mm	4	2.0
16 mm or 12.5 mm	3	1.5
10 mm	2	1.0
5.6 mm	1.5	0.75

v. Slump Test Procedure

Mould shall consist of a metal frustum of cone having the following internal dimensions:

Bottom diameter :20 CM

Top diameter :10 CM

Height :30 CM

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The internal surface of the mould shall be thoroughly cleaned and free from superfluous moisture and any set concrete before commencing the test. The mould shall be placed on a smooth horizontal, rigid and non- absorbent surface viz. levelled metal plate. The operator shall hold the mould firmly in place while it is being filled with test specimen of concrete. The mould shall be filled in four layers, each approximately one quarter of height of mould. Each layer shall be tamped with twenty-five strikes of the rounded end of the tamping rod. The strokes shall be distributed in a uniform manner over the cross section of the mould and for the second and subsequent layers shall penetrate into the under-lying layer. The bottom layer shall be tamped throughout its depth. After the top layer has been rodded, the concrete shall be struck off level with trowel or the tamping rod, so that the mould is exactly filled. Any mortar which shall leak out between the mould and the base plate shall be cleaned away.

The mould shall be removed from the concrete immediately after filling by raising it slowly and carefully in a vertical direction. The moulded concrete shall then be allowed to subside and the slump shall be measured immediately by determining the difference between the height of the mould and that of the highest point of specimen. The above operations shall be carried out at a place free from vibration or shock, and within a period of two minutes after sampling.

The slump shall be recorded in terms of millimetres of subsidence of the specimen during the test. Any slump specimen which collapses or shears off laterally give incorrect result. If this occurs, the test shall be repeated with another sample. The slump test shall not be used for very dry mixes.

39. REINFORCED CEMENT CONCRETE WORK

39.1. LIST OF BUREAU OF INDIAN STANDARD CODES

- IS 226 Structural Steel
- IS 2285 Methods for chemical analysis of steel (Issues in various parts)
- IS 456 Code of Practices for plain and Reinforced concrete.
- IS 516 Method of test for strength of concrete.
- IS 1199 Method of sampling and analysis of concrete.
- IS 1200 (Part II) Method of measurement of building and civil engineering work – concrete work
- IS 1200 (Part V) Method of measurement of building and civil engineering work – concrete work (Part 5- Form work)
- IS 1599 Method for bend test

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- IS 1387:1993 General requirements for the supply of metallurgical materials
- IS 14687 Guidelines for false work for concrete structures
- IS 1608 Method for tensile testing of steel products
- IS 1786 Specification for high strength deformed steel and wires for concrete reinforcement.
- IS 1791 Specification for batch type concrete mixes
- IS 2502 Code of practice for bending and fixing of bars for concrete reinforcement.
- IS 2751 Recommended practice for welding of mild steel plain and deformed bars for reinforced construction.
- IS 4925 Batch plants specification for concrete batching and mixing plant
- IS 4926 Ready – Mixed Concrete
- IS 5522:2014 Specification for Indian Standard Stainless Steel sheet and strips for utensils
- IS 10262 Recommended guidelines for concrete mix design
- IS 13311(Part I) Indian standard for non-destructive testing of concrete. Method of test for ultrasonic pulse velocity
- IS 13311 (Part II) Indian standard for non-destructive testing of concrete. Method of testing by rebound hammer.
- IS 16172:2014 Specification for Reinforcement couplers for mechanical splices of bars in concrete

39.2. LIST OF MANDATORY TESTS

- a) Reinforced cement concrete (Nominal Mix)- Field/Lab Test
- b) Reinforced Cement Concrete (Design Mix) – Sump Test/Cube test/Field Test/Lab Test
- c) Reinforced Cement Concrete (Ready Mix)- Sump Test/Cube test/Field Test/Lab Test
- d) Steel for Reinforce cement concrete- Physical Test and Chemical tests

39.3. CONCRETE

i. WORKABILITY OF CONCRETE

The concrete mix proportions shall be such that the concrete is of adequate workability for the placing conditions and can be compacted properly with available means; workability shall be as per IS 1199:2018. Slump at the site shall be checked after each 30-minute interval of up to 120 minutes (2 hours).

Placing Conditions	Slump chart
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	Workability	Slump Value
Blinding concrete; Shallow sections; Pavements using pavers	Very Low	0-25 mm
Mass concrete: Lightly reinforced sections in slabs, beams, walls, columns; Floors; Hand placed pavements; Canal lining; Strip footings	Low	25-50 mm
Heavily reinforced sections in slabs, beams, walls, columns	Medium	50-100 mm
Slip form work; Pumped concrete	Medium	75-100 mm
Trench fill; In-situ piling	High	100-150 mm
Tremie concrete	Very High	

For most of the placing conditions, internal /needle vibrators are suitable. The diameter of the needle shall be determined based on the density and spacing of reinforcement bars and thickness of the section.

ii. CONCRETE MIX PROPORTIONING

The mix proportions shall be selected to ensure the workability of the fresh concrete and when concrete is hardened, it shall have the required strength, durability and surface finish. The determination of the proportions of cement, aggregates and water to attain the required strengths shall be made by designing the 'concrete mix' – to the satisfaction of the Engineer-in-Charge; such concrete shall be called 'Design mix concrete'. The target mean strength of concrete mix shall be equal to the characteristic strength plus 1.65 times the standard deviation.

iii. BATCHING

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For projects having sanctioned more than 100 Crores, the concrete shall be sourced from captive on site automatic batching and mixing plants (or from a ready mixed concrete plant when approved in writing by the Engineer-in-Charge). The concrete produced and supplied by ready mixed concrete plants shall be in accordance with IS 4926. In case of concrete from captive on site automatic batching and mixing plants, similar quality control shall be followed. To avoid confusion and error in batching, consideration shall be given to using the smallest practical number of different concrete mixes on any site or in anyone plant. In batching concrete. The quantity of both cement and aggregate shall be determined by mass; admixture. if solid, by mass; liquid admixture may however be measured in volume or mass; water shall be weighed or measured by volume in a calibrated tank – all to the satisfaction of the Engineer-in-Charge. For Batch mixing plant at site the grading of aggregate shall be controlled by obtaining the coarse aggregate in different sizes and blending them in right proportions, the different sizes being stocked in separate stock piles. The material shall be stock-piled for several hours preferably a day before use. The grading of coarse and fine aggregate shall be checked as frequently as possible, the frequency for a given job being determined by the Engineer-in-Charge to ensure that the specified grading is maintained.

The concrete production equipment shall be calibrated initially at the time of installation & reconditioning of the equipment and subsequently shall be at the following intervals:

- a) Mechanical/knife edge system: At least once every two months
- b) Electrical/load cell system: At least once every three months

iv. BATCHING PLANTS AND EQUIPMENT

- (a) Hoppers for weighing cement, mineral admixtures, aggregates and water and chemical admixture (if measured by mass) shall consist of suitable container freely suspended from a scale or other suitable load-measuring device and equipped with a suitable discharging mechanism. The method of control of the loading mechanism shall be such that, as the quantity required in the weighing hopper is approached the material may be added at controllable rate and shut off precisely within the weighing tolerances specified in Annex C. The weighing hoppers for cement, mineral admixtures aggregate shall be capable of receiving their rated load, without the weighed material coming into contact with the loading mechanism. Where the rated capacity of a batching plant mixing cycle is less than 2.0 m³, additional precautions shall be taken to ensure that the correct number of batches are loaded into the truck mixer. The weighing hoppers shall be constructed so as to discharge efficiently and prevent the build-up of materials. A tare adjustment, up to 10

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- percent of the nominal capacity of the weigh scale, shall be provided on the weighing mechanism so that the scale can be adjusted to zero at least once each day. Dust seals shall be provided on cement hoppers between the loading mechanism and the weigh hopper, and shall be fitted so as to prevent the emission of cement dust and not affect weighing accuracy. The hopper shall be vented to permit escape of air without emission of cement dust.
- (b) Vibrator or other attachment, where fitted, shall not affect the accuracy of weighing. There shall be sufficient protection to cement and aggregate weigh hoppers and weighing mechanisms to prevent interference with weighing accuracy by weather conditions or external build-up of materials.
 - (c) Where chemical admixture dispensers are used, they shall be capable of measurement within the tolerance in annex C and calibrated container or weigh scales shall be provided to check the accuracy of measurement at least once a month.
 - (d) Where a continuous mixer with ribbon loading is used the batching procedure specified by the manufacture of the plant shall be followed.
 - (e) Each control on the batching console and weigh-dial or display shall be clearly labelled with its function and where concerned with the batching of materials, the materials type.
 - (f) When more than one type or grade of cement is being used, the weighing device and discharge screw or other parts of the transfer system shall be empty before changing from one type of cement to another.
 - (g) When pulverized fuel ash and other mineral admixtures are batched through the cement weigh system, the weighing device and discharge screw or other parts of the transfer system shall be empty when the weighing system has returned to zero reading or completed the batch.
 - (h) Where a back weigh system is utilized to weigh materials a system shall be in place so as to prevent materials being loaded during the process of weighing.

v. MIXING

- (a) Concrete shall be mixed in mechanical batch type concrete mixers conforming to IS 1791 having two blades and fitted with power loader (lifting hopper type). Half bag mixers and mixers without lifting hoppers shall not be used for mixing concrete. Before mixing the stone aggregate shall be washed with water to remove, dirt, dust and other foreign materials. For guidance, the mixing time may be 1½ to 2 minutes, for hydrophobic cement it may be taken as 2½ to 3 minutes.

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- (b) The mixer shall be tested under normal working conditions in accordance with the method specified in IS 4643 with a view to check its ability to mix the ingredients to obtain concrete having uniformity within the prescribed limits. The uniformity of mixed concrete shall be evaluated by finding the percentage variation in quantity (mass in water) of cement, fine aggregate and coarse aggregate in a freshly mixed batch of concrete.
- (c) Machine Mixing: The mixer drum shall be flushed clean with water. Measured quantity of coarse aggregate shall be placed first in the hopper. This shall be followed with measured quantity of fine aggregate and then cement. In case fine aggregate is damp, half the required quantity of coarse aggregate shall be placed in the hopper, followed by fine aggregate and cement. Finally, the balance quantity of coarse aggregate shall be fed in the hopper, & then the dry materials are slipped into the drum by raising the hopper. The dry material shall be mixed for at least four turns of the drum. While the drum is rotating, water shall be added gradually to achieve the water cement ratio as specified or as required by the Engineer- in-Charge. After adding water, the mixing shall be continued until concrete of uniform colour, uniformly distributed material and consistency is obtained. Mixing shall be done for at least two minutes after adding water. If there is segregation after unloading from the mixer, the concrete shall be remixed. The drum shall be emptied before recharging. When the mixer is closed down for the day or at any time exceeding 20 minutes, the drum shall be flushed cleaned with water.
- (d) Ready Mix Concrete shall be to the satisfaction of the Engineer-in-Charge.

vi. TRANSPORTATION AND HANDLING

Concrete shall be transported from the mixer to the place of laying as rapidly as possible by methods which will prevent the segregation or loss of any of the ingredients and maintaining the required workability.

vii. PLACING

- (a) The concrete shall be deposited as nearly as practicable in its final position to avoid re-handling. It shall be laid gently (not thrown) and shall be thoroughly vibrated and compacted before setting commences and shall not be subsequently disturbed. Method of placing shall be such as to preclude segregation. Care shall be taken to avoid displacement of reinforcement or movement of form work and damage due to rains. As a general guidance, the maximum free fall of concrete may be taken as 1.5 metre. Concreting shall be commenced only after Engineer-in-Charge has inspected the centering, shuttering and reinforcement as placed and passed the

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same. Method of applying pressure to concrete is by pumps shall be either of the two types as mentioned below: -

- i. Piston type pumps
 - ii. Squeeze pressure type pumps.
- (b) Effective range of pumps to be used in the work shall be decided after studying the site conditions. Selection of pumps bases on discharge capacity shall be decided after studying the requirements for the project. Discharge capacity shall be worked out by the contractors and approval obtained from the Engineer-in-Charge.
- (c) All Ready Mixed Designed concrete from plant shall be laid with the help of concrete pump of adequate capacity.

viii. COMPACTION

- (a) Concrete shall be thoroughly compacted and fully worked around embedded fixtures and into corners of the form work. Compaction shall be done by mechanical vibrator of appropriate type till a dense concrete is obtained. The mechanical vibrators shall conform to IS 2505, IS 2506, IS 2514 and IS 4656. To prevent segregation, over vibration shall be avoided.
- (b) Compaction shall be completed before the initial setting starts. For the items where mechanical vibrators are not to be used, the contractor shall take permission of the Engineer-in- Charge in writing before the start of the work. After compaction the top surface shall be finished even and smooth with wooden trowel before the concrete begins to set.

ix. CONSTRUCTION JOINTS

The position and arrangement of construction joints shall be as shown in the structural drawings or as directed by the Engineer-in-Charge. Concreting shall be carried out continuously up to construction joints. Number of such joints shall be kept minimum. Joints shall be kept as straight as possible. Construction joints shall comply with IS 11817.

x. CURING

- (a) Moist Curing: Exposed surfaces of concrete shall be kept continuously in a damp or wet condition by ponding or by covering with a layer of sacking, canvas, Hessian or similar materials and kept constantly wet for at least 7 days from the date of placing concrete in case of ordinary Portland cement and at least 10 days where mineral admixtures or blended cements are used. The period of curing shall not be less than 10 days for concrete exposed to dry and hot weather conditions. In the case of concrete where mineral admixtures or blended

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cements are used, it is recommended that above minimum periods may be extended to 14 days.

- (b) **Membrane Curing:** Approved curing compounds may be used in lieu of moist curing with the permission of the Engineer-in- Charge. Such compound shall be applied to all exposed surfaces of the concrete as soon as possible after the concrete has set. Impermeable membrane such as polythene sheet covering the concrete surface may also be used to provide effective barrier against the evaporation.
- (c) Freshly laid concrete shall be protected from rain by suitable covering. Over the foundation concrete, the masonry work may be started after 48 hours of its compaction but the curing of exposed surfaces of cement concrete shall be continued along with the masonry work for at least 7 days. And where cement concrete is used as base concrete for flooring, the flooring may be commenced before the curing period of base concrete is over but the curing of base concrete shall be continued along with top layer of flooring for a minimum period of 7 days.

xi. CEMENT MORTAR

- (a) This shall be prepared by mixing cement and sand in specified proportions. Proportioning on weight basis shall be preferred taking into account specific gravity of sand and moisture content. Boxes of suitable size shall be prepared to facilitate proportioning on weight basis. Cement bag weighting 50 kg shall be taken as 0.035 cubic metre. Other ingredients in specified proportion shall be measured using boxes of size 40 x 35 x 25 cm. Sand shall be measured on the basis of its dry volume in the case of volumetric proportioning.
- (b) The mixing of mortar shall be done in mechanical mixers operated by power to the satisfaction of the Engineer-in-Charge. The Engineer-in-Charge may, however, permit hand mixing at his discretion if in his opinion the use of mechanical mixer is not feasible.
- (c) **Mechanical Mixing:** Cement and sand in the specified proportions shall be mixed dry thoroughly in a mixer. Water shall then be added gradually and wet mixing continued for at least three minutes. only the required quantity of water shall be added which will produce mortar of workable consistency but not stiff paste. Only the quantity of mortar, which can be used within 30 minutes of its mixing shall be prepared at a time. Mixer shall be cleaned with water each time before suspending the work.
- (d) **Hand Mixing:** The measured quantity of sand shall be levelled on a clean masonry platform and cement bags emptied on top. The cement and sand shall be thoroughly mixed dry by being turned over and over, backwards and forwards, several times till the mixture is of a uniform colour. The quantity of dry mix which can be used within 30 minutes shall then be

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mixed in a masonry trough with just sufficient quantity of water to bring the mortar to a stiff paste of necessary working consistency.

- (e) Mortar shall be used as soon as possible after mixing and before it begins to set, and in any case within half hour, after the water is added to the dry mixture.
- (f) Plastering and special finishes obtained through form work, unless otherwise specified.

39.4. STEEL FOR REINFORCEMENT

i. SELECTION AND PREPARATION OF TEST SAMPLE

All the tests pieces shall be selected by the Engineer-in-Charge or his authorized representative either from cutting of bars or from any bar after it has been cut to the required or specified size and the test piece taken from and any part of it. In neither case, the test pieces shall be detached from the bar or coil except in the presence of the Engineer-in-Charge or his authorized representative. The test pieces obtained in accordance with as above shall be full sections of the bars as rolled and subsequently cold worked and shall be subjected to physical tests without any further modifications. No deduction in size by machining or otherwise shall be permissible. No test piece shall be enacted or otherwise subject to heat treatment. Any straightening which a test piece may require shall be done cold.

Tensile Test: 0.2% proof stress and percentage elongation –This shall be done as per IS 1608, read in conjunction with IS 226.

RE- test: This shall be done as per IS 1786.

Rebend test: This shall be done as per IS 1786.

ii. STACKING AND STORAGE

Steel for reinforcement shall be stored in such a way as to prevent distorting and corrosion. Care shall be taken to protect the reinforcement from exposure to saline atmosphere during storage, fabrication and use.

iii. IDENTIFICATION

Care shall also be taken to properly identify these bars at site. The staff shall be specially trained for looking for identification marks on these bars given by the manufacturers which are generally given colour code.

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iv. ASSEMBLY OF REBARS

The rebars shall be bend correctly and precisely to the size and shape as shown in the detailed drawing or as directed by Engineer-in-Charge. Overlapping of bars, where necessary shall be done as directed by the Engineer-in-Charge. The overlapping bars shall not touch each other and these shall be kept apart with concrete between them by 25 mm or $1\frac{1}{4}$ times the maximum size of the coarse aggregate whichever is greater. But where this is not possible, the overlapping bars shall be bound together at intervals not exceeding twice the dia. of such bars with two strands annealed steel wire of 0.90 mm to 1.6 mm twisted light. The overlaps/splices shall be staggered as per direction of the Engineer-in-Charge. But in no case the overlapping shall be provided in more than 50% of cross sectional area at one section.

v. PLACING IN POSITION

Fabricated reinforcement bars shall be placed in position as shown in the drawings & as directed by the Engineer-in-Charge.

39.5. FORM WORK (CENTRING & SHUTTERING)

i. FORM WORK

Form work shall include all temporary or permanent forms or moulds required for forming the concrete which is cast-in-situ, together with all temporary construction required for their support.

ii. TOLERANCE

Form work shall be designed and constructed to the shapes, lines and dimensions shown on the drawings with the tolerance given below:

Deviation from specified dimension of cross section of columns and beams	5 MM
Deviation from dimensions of footings	
Dimension in Plan	5 MM
Eccentricity in plan	5 MM

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Thicknes	5 MM
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iii. GENERAL REQUIREMENT

All propping and centering shall be either of steel tubes with extension pieces or built up sections of rolled steel. It shall be strong enough to withstand the dead and live loads and forces caused by ramming and vibrations of concrete and other incidental loads, imposed upon it during and after casting of concrete. It shall be made sufficiently rigid by using adequate number of ties and braces, screw jacks or hard board wedges where required shall be provided to make up any settlement in the form work either before or during the placing of concrete Form shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections, care shall be taken to see that no piece is keyed into the concrete.

iv. CENTERING/STAGING

Staging shall be as designed with required extension pieces as approved by Engineer-in-Charge to ensure proper slopes, as per design for slabs/ beams etc. and as per levels as shown in drawing. All the staging to be either of Tubular steel structure with adequate bracings as approved or made of built up structural sections made form rolled structural steel sections.

In case of structures with two or more floors, the weight of concrete, centering and shuttering of any upper floor being cast shall be suitably supported on one floor below the top most floor already cast.

Form work and concreting of upper floor shall not be done until concrete of lower floor has set at least for 14 days.

v. SHUTTERING

Shuttering used shall be of sufficient stiffness to avoid excessive deflection and joints shall be tightly butted to avoid leakage of slurry. If required, rubberized lining of material as approved by the Engineer-in-Charge shall be provided in the joints. Steel shuttering used or concreting shall be sufficiently stiffened. The steel shuttering shall also be properly repaired before use and properly cleaned to avoid stains, honey combing, seepage of slurry through joints etc. Runner Joists: RSJ,

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MS Channel or any other suitable section of the required size shall be used as runners. Assembly of beam head over props. Beam head is an adopter that fits snugly on the head plates of props to provide wider support under beam bottoms. Only steel shuttering shall be used, except for unavoidable portions and very small works for which 12 mm thick water proofing ply of approved quality may be used only after getting prior approval from Engineer-in-Charge.

Form work shall be properly designed for self-weight, weight of reinforcement, weight of fresh concrete, and in addition, the various live loads likely to be imposed during the construction process (such as workmen, materials and equipment). In case the height of centering exceeds 3.50 metres, the prop may be provided in multi-stages.

Suitable camber shall be provided in horizontal members of structure, especially in cantilever spans to counteract the effect of deflection. The form work shall be so assembled as to provide for camber. The camber for beams and slabs shall be 4 mm per metre (1 to 250) or as directed by the Engineer-in-Charge, so as to offset the subsequent deflection, for cantilevers the camber at free end shall be 1/50th of the projected length or as directed by the Engineer-in-Charge.

vi. REMOVAL OF FORM WORK (STRIPPING TIME)

If directed by the Engineer-in-Charge, in normal circumstance and where various types of cements are used, forms, may generally be removed after the expiry of the following periods: -

Type of Form work	Minimum period Before Striking Form work for	
	OPC 43 Grade	PPC
Vertical form work to columns, walls, beams	16-24 hr	24-36 hr
Soffit form work to slabs (Props to be re-fixed immediately after removal of formwork)	3 days	4 days

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Soffit form work to beams (Props to be re-fixed immediately after removal of formwork)	7 days	10 days
Props to slabs: (1) Spanning up to 4.5 m (2) Spanning over 4.5 m	7 days 14 days	10 days 20 days
Props to beams and arches: (1) Spanning up to 6 m (2) Spanning over 6 m	14 days 21 days	20 days 31 days

The number of props left under, their sizes and disposition shall be such as to be able to safely carry the full dead load of the slabs, beam or arch as the case may be together with any live load likely to occur during curing or further construction.

Work damaged through premature or careless removal of forms shall be reconstructed within 24 hrs.

vii. INSPECTION OF FORM WORK

The completed form work shall be inspected and approved by the Engineer-in-Charge before the reinforcement bars are placed in position.

viii. FAN CLAMPS

Fan clamp to be fixed during the laying of RCC slab, shall be of Type I, (100 mm exposed loop) this shall be made of 16 mm M.S. bar bent to shape with its ends hooked. The overall height of the clamps shall be made to suit the depth of slab. Exposed loop shall be painted.

ix. CUTTING & FILLING HOLES IN RCC FLOOR SLABS

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Square holes of size as specified in the drawing shall be cut in RCC floor slabs and roofs for passing downpipes etc. Any damage to the adjoining portion or to any other item shall be made good as directed by the Engineer-in-Charge. After insertion of downpipes etc. in the hole shall be repaired with cement concrete 1:2:4 (1 cement coarse sand: 4 graded stone aggregate 20 mm nominal size) and the surface finished to match with the existing surface. The top and bottom shall be finished properly to make the joint leak proof.

40. MASONRY WORK

40.1. LIST OF BUREAU OF INDIAN STANDARD CODES

- IS 383 Specification for coarse and fine aggregate
- IS 456 Plain and reinforced concrete - Code of practice
- IS 712 Specification for building limes.
- IS 1077 Common burnt clay building bricks.
- IS 1200 (Part 3) Method of measurements of brick works
- IS 2212 Code of practice for brick work. (1st Revision)
- IS 2645 Specification for integral water proofing compounds for cement mortar and concrete
- IS 3346:1980 Method of the determination of thermal conductivity of thermal insulation materials
- 13. IS 3812 Specification for fly ash for use as pozzolana and admixture.
- IS 4082:1977 Stacking & storage of construction materials and components at site – Recommendations
- IS 4885 Specification for sewer brick
- IS 6441 (Part-1): 1972 Methods for test for Autoclaved Cellular Concrete Products:
Determination of unit weight or bulk density and moisture content
- IS 6441 (Part-2): 1972 Methods for test for Autoclaved Cellular Concrete Products:
Determination of dry shrinkage
- IS 6441 (Part-5): 1972 Methods for test for Autoclaved Cellular Concrete Products:
Determination of compressive strength
- IS 9103 Specification for concrete admixtures

40.2. LIST OF MANDATORY TESTS

- a) Concrete Block- Laboratory Test
- b) Sewer Bricks- Laboratory Test

40.3. BRICKS, CONCRETE BLOCKS

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- (a) Block work for wall thickness 200 mm shall be done with block laid flat with its height (100 mm) vertical. It shall be done with cement mortar 1:6 (1 cement: 6 coarse sand) Block work for wall thickness 100 mm shall be done with the same block laid such that its height of 100 mm being horizontal. It shall be done with cement mortar 1:4 (1 cement: 4 coarse sand).
- (b) All loose materials, dirt and set lumps of mortar which may be lying over the surface on which block work is to be freshly started, shall be removed with a wire brush and surface wetted. Blocks shall be laid on a full bed of mortar, when laying, each block shall, be properly bedded and set in position by gently pressing with the handle of a trowel. Its inside face shall be buttered with mortar before the next block is laid and pressed against it. Joints shall be fully filled and packed with mortar such that no hollow space are left inside the joints.
- (c) The walls shall be taken up truly in plumb or true to the required batter where specified. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. Vertical joints in the alternate course shall come directly one over the other. Quoin, Jambs and other angles shall be properly plumbed as the work proceeds. Care shall be taken to keep the perpends properly aligned within following maximum permissible tolerances:
 - (d) Deviation from vertical within a storey shall not exceed 6 mm per 3 m height.
 - (e) Deviation in verticality in total height of any wall of building more than one storey in height shall not exceed 12.5 mm.
 - (f) Deviation from position shown on plan of any block work shall not exceed 12.5 mm.
 - (g) Relative displacement between load bearing wall in adjacent storeys intended to be vertical alignments shall not exceed 6 mm.
- (h) All quoins shall be accurately constructed and the height of block courses shall be kept uniform. This will be checked using graduated wooden straight edge or storey rod indicating height of each course including thickness of joints. The position of damp proof course, window sills, bottom of lintels, top of the wall etc. along the height of the wall shall be marked on the graduated straight edge or storey rod. Acute and obtuse quoins shall be bonded, where practicable in the same way as square quoins. Obtuse quoins shall be formed with squint showing three quarters block on one face and quarter block on the other.
- (i) The block work shall be built in uniform layers. No part of the wall during its construction shall rise more than one metre above the general construction level. Parts of wall left at different levels shall be raked back at an angle of 45 degrees or less with the horizontal. Toothing shall not be permitted as an alternative to raking back. For 100 mm block partition to be keyed into main walls, indents shall be left in the main walls.

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- (j) All pipe fittings and specials, spouts, hold fasts and other fixtures which are required to be built into the walls shall be embedded, as specified, in their correct position as the work proceeds unless otherwise directed by the Engineer-in-Charge.
- (k) To facilitate taking service lines later without excessive cutting of completed work, sleeves shall be provided while raising the block work, where indicated in drawing, such sleeves in external walls shall be sloped down outward so as to avoid passage of water inside. Top of the block work in coping and sills in external walls shall be slightly tilted. Where block coping and sills are projecting beyond the face of the wall, drip course/throating shall be provided where indicated in drawing.
- (l) For block masonry of wall thickness 100 mm, horizontal reinforcement in the form of MS bars, 2 Nos, 6 mm dia each shall be provided at every alternate third course where indicated in drawing. These shall be securely anchored at their end where the partitions end. The free ends of the reinforcement shall be keyed into the mortar of the main block work to which the 100 mm work is joined. The mortar used for reinforced block work shall be rich dense cement mortar of mix 1:4 (1 cement: 4 coarse sand). Over laps in reinforcement, if any shall not be less than 30 cm.
- (m) The face of block work shall be finished flush; In flush finishing either the face joints of the mortar shall be worked out while still green to give a finished surface flush with the face of the block work or the joints shall be squarely raked out to a depth of 1 cm while the mortar is still green for subsequently plastering. The faces of block work shall be cleaned with wire brush so as to remove any splashes of mortar during the course of raising the block work. The block work shall be constantly kept moist on all faces for a minimum period of seven days. Block work done during the day shall be suitably marked indicating the date on which the work is done so as to keep a watch on the curing period.

40.4. CUTTING HOLES IN WALL

Holes of size as specified in drawing or (up to 450 × 450 mm) as directed by the Engineer-in-Charge shall be cut in the masonry. Any damage to the adjoining portion or to any other item shall be made good as directed by the Engineer-in-Charge. Brick work etc. shall be made good by using the same class of brick, tile or stone masonry as were cut during the execution of work. The mortar to be used shall be cement mortar 1:4 (1 cement: 4 fine sand) or as directed by the Engineer-in-Charge.

40.5. CUTTING CHASES IN WALLS

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- (a) Chases shall be made by chiselling out the masonry to proper line & depth. Any damage to the adjoining portion or to any other item shall be made good, as decided by the Engineer-in-Charge, the depths of vertical chases and horizontal chases shall not exceed one third and one sixth of the thickness of the masonry respectively.
- (b) When narrow stretches of masonry (or short lengths of walls) such as between doors and windows, cannot be avoided, they shall not be pierced with openings for soil pipes or waste pipes or timber joints, etc. Where there is a possibility of load concentration, such narrow lengths of walls shall be checked for stresses and high strength bricks mortar or concrete walls provided, if required.
- (c) Horizontal chases when unavoidable shall be located in the upper or lower one third of height of storey and not more than three chases shall be permitted in any stretch of a wall. No continuous horizontal chase shall exceed one metre in length. Where unavoidable, stresses in the affected area shall be checked and kept within the permissible limits.
- (d) Vertical chases shall not be closer than 2 m in any stretch of a wall. These shall be kept away from bearings of beams and lintels. If unavoidable, stresses in the affected area shall be checked and kept within permissible limits.
- (e) Masonry directly above a recess, if under than 30 cm (Horizontal dimension) shall be supported on lintel. Holes in masonry may be provided up to 30 cm width x 30 cm height without any lintel. In the case of circular holes in masonry, no lintel shall be provided up to 40 cm in diameter.
- (f) No chase shall be permitted in a half brick load bearing wall and as such no recessed conduits and concealed pipes shall be provided in half brick thick load bearing walls. In case of non-load bearing half brick walls services shall be planned with the help of vertical chases. Horizontal chases shall be provided only when unavoidable.
- (g) All chases shall be filled with cement concrete 1:3:6 (1 cement: 3 coarse sand: 6 graded stone aggregate 20 mm nominal size) or cement mortar 1:4 (1 cement: 4 coarse sand) as may be specified or otherwise directed by the Engineer-in-Charge and shall be made flush with the masonry surface.

41. FLOORING & FINISHES

41.1. LIST OF BUREAU OF INDIAN STANDARDS CODES

- IS 848 Specification for synthetic resin adhesives for plywood
- IS 1122 Method of test for determination of true specific gravity of natural building stones.

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- IS 1124 Method of test for determination of water absorption, apparent specific gravity and porosity of natural building stones.
- IS 1130 Marble (blocks, slabs and tiles).
- IS 1328 Specification for Veneered decorative plywood
- IS 1734 (Part-1) Methods of test for plywood
- IS 2380 Methods of test for wood particle boards and boards from other lignocellulosic materials
- IS 3316 Specifications for structural granite
- IS 3734 (Part-1) Rubber – Tolerance for products
- IS 4101 (Part 1) Code of practice for external facing and veneers: Stone facing.
- IS 7638 Wood/Lignocellulosic based panel products – Methods of sampling
- IS 12049 Dimensions and tolerances relating to wood based panel materials
- IS 12823 Wood products – Prelaminated particle boards - Specification
- IS 14223 (Part 1) Polished Building Stones (Part-1) Granite

41.2. FLOORING

i. VITRIFIED TILES

Vitrified Tiles of approved brand (size 600 mm X 600 mm, 300 mm x 300 mm or other sizes as indicated in drawings and as approved by the Engineer-in-Charge) shall be supplied for selection by the Engineer-in-Charge and only approved tiles shall be installed on floor, skirting etc. by laying them true to line and level. Tiles shall be set in 20 mm sand cement mortar (1:4). and with 2 mm thick cement slurry on back side of tiles using cement @ 2.91Kg./sq.m. Alternatively where directed by the Engineer-in-Charge, Vitrified tiles shall be installed by using 6 mm thick layer of polymerised adhesive applied directly over finished floor (without any backing course) laid after application of slurry using 1.75 Kg of cement per sq.m. below mortar. Normally all tiles shall be set without a spacer in between (i.e., paper joints) and all joints shall be grouted with admixture of white cement and approved colouring pigment to match with tiles or with approved epoxy grout materials to the direction of Engineer-in-Charge. Removal of wax coating of top surface of tiles shall be done with warm water. Flooring shall be completed by Polishing tiles using a soft and dry cloth up to a mirror finish.

ii. CERAMIC TILES

Ceramic tiles on floor shall be fixed with Sand Cement Mortar (1:4) 20 mm thick & 2 mm thick cement slurry at back side of tiles using cement @ 2.91 Kg/Sq.m & joint filling using white cement

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slurry @ 0.20 kg/Sq.m. Ceramic tiles on wall shall be fixed with Sand Cement Mortar (1:3) 15 mm thick & 2 mm thick cement slurry at back side of tiles using cement @ 2.91 Kg/Sq.m & joint filling using white cement slurry @ 0.20 kg/Sq.m.

Alternatively, Ceramic tiles shall be fixed with 4.5 mm thick polymerised adhesive of approved brand at the back of each tile and all joints shall be epoxy grouted as per the direction of the Engineer-in-Charge.

iii. GLASS MOSAIC TILES FOR SWIMMING POOL

Glass mosaic tiles of size 20 mm x 20 mm x 4 mm in all colours in customized design as approved by the Engineer-in-Charge, shall be fitted & fixed at finished plain wall & bed surface as per direction of the Engineer-in-Charge. The glass mosaic tiles shall be fixed on the wall surface & on bed by using approved quality adhesives, which shall be applied as specified in the manufacturer's recommendation otherwise shall be applied at the rate of 2.5 kg per sq.m.; all grouting shall be done with the same.

iv. MARBLE WORK

15 mm to 18 mm thick machine cut, mirror polished, Marble stone of both origins i.e. Indian [for example Chawk Dungri, Makrana white, Makrana plain pink / Adranga Pink / Garbh Gulabi/ Udaypur pink / Udaypur Green / Black Bhaslana etc. as approved by the Engineer-in-Charge] and Imported [for example Perlato, Bottichino, Crema, Antique Beige, Dark Emperadore, Red Verona, Black Marquino etc. as approved by the Engineer-in-Charge] on floor , in dado/wall as indicated in drawings shall be fixed in required pattern as per architectural drawings over 20 mm (average) thick base of cement mortar 1 : 2 (1 cement : 2 coarse sand) by applying white cement slurry @ 4.4 kg/sq.m on the back site of marble. Pointing shall be done with cement mortar (1:2)(1 Cement : 2 Marble dust) admixed with approved pigment to match the marble shade as directed by the Engineer-in-Charge. Finishing stonework shall include but not limited to grinding, rubbing, curing and polishing etc., and suitable arrangements to hold the stones properly by brass / copper hooks as required for vertical installations.

v. GRANITE WORK

15 mm to 18 mm thick Granite Slab/Tile on floor, lobby, stair, landing and treads etc. as indicated in drawings shall be fitted & fixed over 20 mm (average) thick base of cement mortar (1:2) laid with white cement slurry @ 4.40 Kg per square meter. Granite joints shall be grouted with white cement slurry @ 2.0 Kg per square meter with necessary pigments as approved and shall be completed as per direction of Engineer-in-Charge.

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15 mm to 18 mm thick Granite Slab/10 mm to 12 mm. thick Granite Tile on columns, wall, fascia, riser, skirting etc. as indicated in drawings shall be fitted & fixed with 15 mm (average) thick cement mortar (1:2) including making suitable arrangements to hold the stones properly by brass / copper hooks including pointing in cement mortar (1:2) (1 white cement: 2 marble dust) with admixture of pigment matching the stone shades as per direction of the Engineer-in-Charge.

vi. WOODEN FLOORING

8 mm thick Laminated Wooden Flooring fitting and fixing works above approved substrate shall conform to IS 5389, EN 13329. Plank size shall not be less than 1200 mm X 190 mm and planks shall be locked by Unilin/tongue-groove locking arrangement. Top abrasive layer shall be 0.2 mm thick over a decorative layer followed by a High-density fibreboard (HDF) having density more than 940 kg/m³ substrate core over a resin saturated backing layer. The wood species shall preferably be of non-refractory nature; installation shall be through Unilin/tongue- groove system having locking strength not less than 1000 kg/m. 2 mm thick polyurethane foam under layer shall be on 250-micron polythene sheet laid over a smooth, flat, hard subfloor (free from moisture < 8%, grease etc.). Wherever used for the installation all Nails shall conform to IS 723. Installation by a certified installer shall be complete in all respect with requisite accessories like end profile, transition profile, reducer 'T' profile etc. wherever required. Preparation of base including all other incidental works shall be as per direction & satisfaction of the Engineer-in-Charge.

vii. KOTA STONE/BLACKSTONE

18 mm. to 22 mm. thick, Kota stone/Blackstone slab/Tile shall be set in 20 mm thick cement mortar (1:4) on floor, stair & lobby as indicated in drawings. Pointing shall be done with cement slurry mixed with admixture of pigment matching the stone shades as per direction of Engineer - in - charge. Finishing stonework shall include but not limited to grinding, rubbing, curing and polishing etc., and suitable arrangements to hold the stones properly by brass / copper hooks as required for vertical installations.

viii. CEMENT CONCRETE FLOORING

Wherever floors are required to withstand heavy wear and tear, floor hardener shall be avoided as far as possible by using richer mixes of concrete. Where so directed by the Engineer-in-Charge The Metallic hardener compound shall be of approved quality consisting of uniformly graded iron particles, free from non-ferrous metal particles, oil, grease sand, soluble alkaline compounds. Topping shall be 12 mm thick layer of mix 1:2 (1 cement: 2 stone aggregate 6 mm nominal size) by volume or as otherwise specified with which metallic hardening compound is mixed in the ratio

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of 1: 4 (1metallic concrete hardener: 4 cement) by weight. Metallic hardener shall be dry mixed thoroughly with cement on a clean dry pacca platform. This dry mixture shall be mixed with stone aggregate 6 mm nominal size or as otherwise specified in the ratio of 1 : 2 (1 cement : 2 stone aggregate) and well turned over. Just enough water shall then be added to this dry mix as required for floor concrete.

41.3. FINISHES

i. GYPSUM PLASTER BOARD

Gypsum Plaster Board shall conform to IS 2095. Gypsum plaster shall conform to IS 2547 (Part 1). By product gypsum conforming to the requirements of IS 12679 shall also be used for the preparation of plaster. Requirements, tests, sampling, finishing etc. of Gypsum Plaster Board shall be as per IS 2095. Fixing the 12.5 mm thick gypsum plaster board with self-drilling / tapping screws / fasteners @ 60 cm c/c of approved make, Screws shall be of counter sunk rib head of 1.60 mm to 4 mm thick of 8 to 10 gauge of length varying from 25 to 45 mm. Proper taping and jointing to be done using fibre mesh tape and epoxy and acrylic based jointing compound for seamless finish.

Fill the groove (i.e. 2-3 mm gap between boards), taping and jointing 8 mm thick fibre cement board and 12.5 mm thick gypsum plaster boards with epoxy based sealing compound, Acrylic based sealing compound, Non-woven reinforcement Tape as per direction of Engineer-in-Charge. (Use a flexible knife so that no air bubble is entrapped. Allow 1-2 hrs gap. Once hard tacky or set, apply a coat of Acrylic based sealing compound paste to flash fill the bevelled area. After 2-4 hrs go on to repeat a skin coat with Acrylic based sealing compound to securely embed the 40 mm width (non-woven reinforcement Tape. Use only flexible steel knife, such as provided with packs, to avoid air entrapment within compound. After overnight drying shrinkage apply a coat of acrylic based sealing compound to compensate shrinkage. Finally cover the bevel portion with any suitable overall skin coat with a desired full surface-leveller material).

ii. CEMENT PLASTER

The cement plaster shall be 10 mm, 15 mm or 20 mm thick as specified in the item. 20 mm thick plaster on outer wall shall be – 1(cement):6(sand); 10 mm thick plaster on internal ceiling shall be – 1(cement):4 (sand); 15 mm thick plaster on internal wall shall be -1(cement) :6 (sand).

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For all exposed brick work or tile work double scaffolding independent of the work having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed. For all other work in buildings, single scaffolding shall be permitted. In such cases the inner end of the horizontal scaffolding pole shall rest in a hole provided only in the header course for the purpose. Only one header for each pole shall be left out. Such holes for scaffolding shall, however, not be allowed in pillars/columns less than one metre in width or immediately near the skew backs of arches. The holes left in masonry works for scaffolding purposes shall be filled and made good before plastering.

The joints shall be raked out properly. Dust and loose mortar shall be brushed out. Efflorescence if any shall be removed by brushing and scrapping. The surface shall then be thoroughly washed with water, cleaned and kept wet before plastering is commenced.

In case of concrete surface if a chemical retarder has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care shall be taken that none of the retarders is left on the surface.

Ceiling plaster shall be completed before commencement of wall plaster. Plastering shall be started from the top and worked down towards the floor. All putlog holes shall be properly filled in advance of the plastering as the scaffolding is being taken down. To ensure even thickness and a true surface, plaster about 15 × 15 cm shall be first applied, horizontally and vertically, at not more than 2 metres intervals over the entire surface to serve as gauges. The surfaces of these gauged areas shall be truly in the plane of the finished plaster surface. The mortar shall then be laid on the wall, between the gauges with trowel. The mortar shall be applied in a uniform surface slightly more than the specified thickness. This shall be brought to a true surface, by working a wooden straight edge reaching across the gauges, with small upward and sideways movements at a time. Finally, the surface shall be finished off true with trowel or wooden float according as a smooth or a sandy granular texture is required. Excessive trowelling or over working the float shall be avoided.

All corners, arrises, angles and junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished. Rounding or chamfering corners, arrises, provision of grooves at junctions etc. where required shall be done without any extra payment. Such rounding, chamfering or grooving shall be carried out with proper templates or battens to the sizes required.

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When suspending work at the end of the day, the plaster shall be left, cut clean to line both horizontally and vertically. When recommencing the plastering, the edge of the old work shall be scrapped cleaned and wetted with cement slurry before plaster is applied to the adjacent areas, to enable the two to properly join together. Plastering work shall be closed at the end of the day on the body of wall and not nearer than 15 cm to any corners or arrises. It shall not be closed on the body of the features such as plasters, bands and cornices, nor at the corners of arrises. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakages.

The plastering and finishing shall be completed within half an hour of adding water to the dry mortar. No portion of the surface shall be left out initially to be patched up later on. The plastering and finishing shall be completed within half an hour of adding water to the dry mortar.

Curing shall be started as soon as the plaster has hardened sufficiently not to be damaged when watered. The plaster shall be kept wet for a period of at least 7 days. During this period, it shall be suitably protected from all damages at the contractor's expense by such means as the Engineer-in-Charge may approve.

The plaster shall be finished to a true and plumb surface and to the proper degree of smoothness as required. The work shall be tested frequently as the work proceeds with a true straight edge not less than 2.5 m long and with plumb bobs. All horizontal lines and surfaces shall be tested with a level and all jambs and corners with a plumb bob as the work proceeds.

Any cracks which appear in the surface and all portions which sound hollow when tapped, or are found to be soft or otherwise defective, shall be cut out in rectangular shape and redone as directed by the Engineer-in-Charge.

Grooves of size 15 mm x 15 mm or as specified shall be provided as shown on the drawing or as required by the Engineer-in- Charge.

UPVC rainwater pipes shall be secured to the walls with clips at all joints and fixing in shall be with cement mortar 1:4 (1 cement: 4 coarse sand).

iii. PRIMING COAT ON WOOD, IRON OR PLASTERED SURFACES

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Primer for wood work (hard and soft wood) shall conform to IS 3536; Red Oxide Zinc Chromate Primer for Iron, Steel and Galvanized steel work shall conform to IS 2074; Cement primer for Cement/Concrete/RCC/brick work, plastered surfaces shall conform to IS 109.

The wood work to be painted shall be dry and free from moisture. The surface shall be thoroughly cleaned. All unevenness shall be rubbed down smooth with sand paper and shall be well dusted. Knots, if any shall be covered with preparation of red lead made by grinding red lead in water and mixing with strong glue sized and used hot. Appropriate filler material conforming to IS 345 with same shade as Paint shall be used where specified. The surface treated for knotting shall be dry before Paint is applied. After obtaining approval of Engineer-in-Charge for wood work, the priming coat shall be applied before the wood work is fixed in position. After the priming coat is applied, the holes and indentation on the surface shall be stopped with glazier's putty or wood putty. Stopping shall not be done before the priming coat is applied as the wood will absorb the oil in stopping and the latter is therefore liable to crack.

iv. EPOXY PAINT

Iron & Steel Surface to be painted shall be made free from rust and scales by scrapping or by brushing with steel wire brushes. Hard skin of oxide formed on the surface of wrought iron during rolling which becomes loose by rusting, shall be removed. All dust and dirt shall be thoroughly wiped away from the surface. If the surface is wet, it shall be dried before priming coat is undertaken.

Plastered Surface shall not be painted until it has dried completely, trial patches of primer shall be laid at intervals and where drying is satisfactory, painting shall then be taken in hand. Before primer is applied, holes and undulations, shall be filled up with plaster of Paris and rubbed smooth.

Surface must be dried, cleaned & made free from oil, grease, dirt, dust & all other contaminants that could interfere with adhesion of coating. The application of priming coat for relevant steel or cement surface shall be as per manufacturer's recommendation. The epoxy paint shall be consumed within the working pot life as specified by the manufacturers.

All equipment/apparatus shall be cleaned immediately after use with thinner especially the hose pipes, gun, all spray equipment etc. All surplus material shall be disposed of in compliance with environmental pollution rules etc. Contact of the product with skin specially with eyes shall be

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avoided. Proper ventilation is required and all safety procedures and precautions are to be adopted for executing epoxy painting process.

v. PAINTING

Paints, oils, varnishes etc. of approved brand and manufacture shall be used. Only ready mixed Paint as received from the manufacturer without any admixture shall be used. If for any reason, thinning is necessary in case of ready mixed Paint, the brand of thinner recommended by the manufacturer or as instructed by the Engineer-in-Charge shall be used. Approved Paints, oil or varnishes shall be brought to the site of work by the contractor in their original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight's work. The materials shall be kept in the joint custody of the contractor and the Engineer-in -Charge. The empties shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from the Engineer-in-Charge.

Painting shall not be started until the Engineer -in-Charge has inspected the items of work to be painted, satisfied himself about their proper quality and given his approval to commence the painting work.

The surface shall be thoroughly cleaned and dusted off. All rust, dirt, scales, smoke splashes, mortar droppings and grease shall be thoroughly removed before painting is started. The prepared surface shall have received the approval of the Engineer-in-Charge after inspection, before painting is commenced.

Where so stipulated, the painting shall be done by spraying. Spray machine used may be (a) high pressure (small air aperture) type, or (b) a low pressure (large air gap) type, depending on the nature and location of work to be carried out. Skilled and experienced workmen shall be employed for this class of work.

vi. SPRAY PAINTING

When the surface is dry, the spray painting with Paint in uniform and even layers will be done to the required number of coats as recommended by the manufacturer. Each coat shall be allowed to dry overnight and lightly rubbed with very fine grade of sand paper and loose particles brushed off before the next coat is sprayed.

Spraying shall be done only when dry condition prevails. During spraying the spray gun shall be held perpendicular to the surface to be coated and shall be passed over the surface in a uniform sweeping motion. Different air pressures and fan adjustment shall be tried so as to obtain the best

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application. The Air pressure shall not be kept too high as otherwise the Paint will fog up and will be wasted.

At the end of the job, the spray gun shall be cleaned thoroughly so as to be free from dirt. Incorrect adjustments shall be set right, as otherwise they will result in variable spray patterns, runs, sags and uneven coats.

If after the final coat of Paints, the surface doesn't attain up to the mark appearance and if considered necessary by the Engineer-in-Charge, further one or more coats as required shall be given after rubbing down the surface and dusting off all loose particles to obtain a smooth and even finish.

vii. EXTERIOR PAINTING ON WALL

The surface shall be thoroughly cleaned off all mortar dropping, dirt dust, algae, fungus or moth, grease and other foreign matter of brushing and washing, pitting in plaster shall make good, surface imperfections such as cracks, holes etc. shall be repaired using white cement. The prepared surface shall have received the approval of the Engineer-in-Charge after inspection before painting is commenced.

Base coat of water proofing cement paint shall be applied. The solution shall be applied on the clean and wetted surface with brushes or spraying machine. The solution shall be kept well stirred during the period of application. It shall be applied on the surface which is on the shady side of the building so that the direct heat of the sun on the surface is avoided. The method of application of cement Paint shall be as per manufacturer's specification.

All paints shall be brought to the site of work in its original containers in sealed condition. Paint shall be applied with a brush on the cleaned and smooth surface. Horizontal strokes shall be given first followed by vertical strokes applied immediately. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks. Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its container, when applying also the paint shall be continuously stirred in the smaller containers so that its consistency is kept uniform. Dilution ratio of paint with potable water can be altered taking into consideration the nature of surface climate and as per recommended dilution given by manufacturer. In all cases, the manufacturer's instructions & directions of the Engineer-in-charge shall be followed meticulously.

viii. FIRE RETARDANT PAINT

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Surface must be dry, free from dust, oil, wax, greases before applying Ready to use, intumescent coating which effectively retards the flame spread and penetration of heat through their intumescent sublimative-ablative and synergetic flame suppressing action. To achieve optimum performance of product fire retardant paint shall be applied as specified by manufacturers in multiple coats with brush etc. using conventional French polish process to achieve desired result.

ix. ALUMINIUM PAINT

All rust and scales shall be removed by scraping or brushing with steel wire brushes and then smoothened with sand paper. The surface shall be thoroughly cleaned of dust. The number of coats to be applied shall be as given in manufacturer's recommendation. As aluminium paste is likely to settle in the container, care shall be taken to frequently stir the Paint during used. Also the Paint shall be applied and laid off quickly, as surface is otherwise not easily finished.

x. LETTERING WITH PAINT

Ordinary Ready Mixed Paint (conforming to IS 341) as ordered by the Engineer-in-Charge shall be of approved brand and manufacture. Paint shall be of the shade required by the Engineer-in-Charge. letters and figures shall be to the heights and width as ordered by the Engineer in- Charge. These shall be stencilled or drawn in pencil and got approved before painting. They shall be of uniform size and finished neatly. The edges shall be straight or in pleasant smooth curves. The thickness of the lettering shall be as approved by the Engineer-in-Charge.

42. WOOD WORK, PVC AND STEEL WORK

42.1. WOOD PRESERVATIVE

Oil type wood preservative of specified quality and approved make, conforming to IS 218 shall be used. Generally, it shall be creosote oil TYPE-I or anthracene oil. Painting shall be done only when the surface is perfectly dry to permit of good absorption. All dirt, dust or other foreign matter shall be removed from the surface to be painted. All roughness shall be sand papered and cleaned. The preservative shall be applied liberally with a stout brush and not daubed with rags or cotton waste. It shall be applied with a pencil brush at the joints of the wood work. The first coat shall be allowed at least 24 hours to soak in before the second (the final) coat is applied. The second coat shall be applied in the same manner as the first coat. The excess of preservative which does not soak into the wood shall be wiped off with a clean dry piece of cloth.

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42.2. VARNISHING

Ordinary copal varnish or superior quality spray varnish shall be used. The work includes sizing of transparent wood filler. New wood work to be varnished shall have been finished smooth with a carpenter's plane. Knots shall be cut to a slight depth. Cracks and holes shall be cleaned of dust. The knots, cracks etc. shall then be filled in with wood putty made as follows: -

On a piece of wood say 20 x 15 cm face and on the side where cross grains appear, a small quantity of glue size shall be poured and the surface scraped with the edge of a fine carpenter's chisel. Very fine wood powder shall be mixed with the glue and the stiff paste thus formed shall be used for the filling.

The fillings when dry shall be rubbed down with a carpenter's file and then the entire surface shall be rubbed down perfectly smooth with medium grained and fine sand papers and wiped with dry clean cloth so that it presents uniform appearance. In no case shall sand papers be rubbed across the grains, as in this case even the finest marks will be visible when the varnishing is applied. The number of coats to be applied shall be as stipulated in the description of the item.

The undercoat shall be with a flatting varnish. This dries hard and brittle and when cut and rubbed down to produce a smooth surface enhances the gloss of the finishing varnish. The top coat shall be given with stipulated brand of finishing varnish.

The varnish shall be applied liberally with a full brush and spread evenly with short light strokes to avoid frothing. If the work is vertical the varnish shall be crossed and re-crossed and then laid off, latter being finished on the upstrokes so that varnish, as it sets, flows down and eliminates brush marks, the above process will constitute one coat. If the surface is horizontal, varnish shall be worked in every direction, with light quick strokes and finish in one definite direction so that it will set without showing brush marks, in handling and applying varnish care shall be taken to avoid forming froth or air bubbles. Brushes and containers shall be kept scrupulously clean. Rubbing down and flatting the surface shall be done after each coat except the final coat with fine sand paper.

The work shall be allowed to dry away from droughts and damp air. The finished surface shall then present a uniform appearance and fine glossy surface free from streaks, blister etc.

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Any varnish left over in the small container shall not be poured back into the stock tin, as it will render the latter unfit for use. Special fine haired varnishing brushes shall be used and not ordinary Paint brushes. Brushes shall be well worn and perfectly clean.

42.3. MELAMINE POLISH

The surface shall be thoroughly cleaned. All unevenness shall be rubbed down smooth with sand paper and shall be well dusted. Surface must be dry, free from dust, oil, wax, greases etc. Mix melamine (matt or gloss) base with the catalyst in the specified ratio as per manufacturers specification. Add melamine thinner up to 30% (as specified by the manufacturer) by volume of mixture. Stir it and allow it to mature for 2-3 minutes. The melamine is sprayed, using spray gun pressure of 45-55 psi, from a distance of 7"-10" from substrate.

42.4. FIXING DOOR, WINDOW

Length and breadth shall be measured correct; For embedding hold fasts of doors, windows the requisite number of holes at the correct positions shall be cut out in the masonry. Special care shall be taken when holes are made in load bearing pillars or wall portions separated by openings to ensure that beams etc. supported by them are properly propped up. In such portions cutting holes shall be done on one side at a time. The sides of the holes shall be truly parallel and perpendicular to the plane of the wall. Due care shall be taken, not to disturb the adjoining masonry and the masonry under the bearings of lintels and arches etc. spanning the opening. The holes shall then be cleaned of all dust, mortar and brick bats or stone pieces and thoroughly wetted.

The sides to be embedded in masonry shall be painted with two coats of coal tar before being placed in position. The frames shall then be inserted in position with their hold-fasts bolted tight. The frames shall then be adjusted to proper line and plumb and secured in position by temporary bracing which shall not be disturbed or removed until the hold fasts are embedded in the masonry and the concrete block has set. The concrete to be used for embedding hold- fasts shall be cement concrete 1:3:6 mix (1 cement: 3 coarse sand: 6 graded stone aggregate 20 mm nominal size). The minimum size of concrete block in which the hold-fasts will be embedded shall be 30 x 10 x 15 cm for 35 cm long holdfasts. The concrete of the block shall completely fill the hole made in the masonry for the purpose. The chase cut in the floor shall be cut square and construction joint shall be provided filled in with cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone

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aggregate 20 mm nominal size) and rendered smooth at the top and finished to match the existing type of floor. After the surface surrounding the hold-fasts has sufficiently dried it shall be cleaned of dust etc. and wetted. It shall then be plastered with cement mortar 1:4 (1 cement: 4 fine sand) flush and matching with the surrounding plaster work.

42.5. FIXING OF SHUTTERS

For side hung shutters, each leaf shall be hung on three hinges one at the centre and the other two at 200 mm from the top and bottom of the shutters. Top hung and bottom hung shutters shall be hung on two hinges fixed at quarter points of top rail or bottom rail. Centre hung shutter shall be suspended on a suitable pivot in the centre of the frame. Size and type of hinges and pivots be as per hardware schedule. Flap of hinges shall be neatly counter sunk into the recesses cut to the exact dimensions of flap. Screws for fixing the hinges shall be screwed in with screw driver and not hammered in. Unless otherwise specified, shutters of height more than 1.2 m shall be hung on butt hinges of size 100 mm and for all other shutters of lesser height butt hinges of size 75 mm shall be used. Continuous (piano) hinges shall be used for fixing cup-board shutters where specified in hardware schedule. Fittings shall be provided as per hardware schedule & as directed by the Engineer-in- Charge.

42.6. ROLLING SHUTTER

Rolling shutters shall conform to IS 6248 & the arrangement for fixing in different situations in the opening shall be as per IS 6248; Rolling grill shutter which are designed to provide visibility or ventilation or both shall be as indicated in drawings or as approved by the Engineer –in- Charge for internal/external locations where the degree protection and safety is less as compared to a rolling shutter. These locations where a certain amount of ventilation combined with safety is required rolling shutter-cum-grill shall be provided in which the rolling shutter shall have a rolling grill portion either at the top or at the bottom or at both places. In addition, the rolling grill portion shall also be provided in the middle of the shutter. The total height of the grill portion in all the segments of rolling shutter- cum-grill shall not exceed 1.0 m and the height of the grill portion in any individual segment shall not be more than 0.5 m. Brackets shall be fixed on the lintel or under the lintel as specified in manufacturer's shop drawings and as approved by the Engineer-in-Charge.

43. ROOFING

43.1. WATER PROOFING TREATMENT

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Before taking up the water proofing work the construction of parapet walls, including finishing shall be completed. Similarly, the ancillary items like haunches, khurras, grooves to tack the fibre cloth layer, fixing up of all down take pipes, water pipes and electric conduits etc. shall be completed and no such work shall be allowed on the area to be treated during the progress of water proofing treatment or even later.

The surface to be treated shall be cleaned including removing the mortar dropping from the surface. The procedure to prepare and apply the cement slurry shall be same as detailed in water proofing treatment in sunken portion except that over projected pipes etc. The slurry shall be applied up to the height of the groove on parapet walls where the fibre glass cloth is to be tucked. On completion of curing the grooves where the fibre glass cloth is tucked shall be closed neatly with cement mortar mixed with water proofing compound.

43.2. ELASTOMERIC LIQUID WATER PROOFING MEMBRANE

It is to be applied using a long-haired roller, brush or spray on any horizontal, sloping or vertical surfaces to form a string, flexible, tack-free dry surface, suitable for occasional light foot traffic. This can withstand normal expansion and contraction stresses caused by temperature variations due to its flexibility. This also helps lower the working temperature of roofs and guarantees good energy performance properties of all the layers of the roof.

Concrete and mineral substrates must be sound and dry with no rising damp, any loose parts must be removed with wire brushes. All wax, water-repellent treatments, etc. must be removed from the surface of ceramic substrates with a suitable detergent and/ or by sanding. Any hollows and gaps in the surface must be repaired properly with appropriate material as described and instructed by the manufacturer of this product.

All the area of operation shall be thoroughly cleaned. Mix the content in such a manner that they are perfectly blended into a homogenous state of liquid which can be applied by long haired roller or airless spray. The fibre reinforced elastomeric liquid water proofing membrane with resilient acrylic polymers shall be applied on top of concrete roof in coats more as recommended by manufacturer. First coat shall self-priming elastomeric water proofing liquid. The material shall be diluted with water in the ratio of 3:1 (3 parts of elastomeric water proofing liquid and 1 part of water). After the first coat has dried completely and has appeared as slightly darker in colour, second coat shall be applied with undiluted elastomeric water proofing liquid in a cross direction to the previous coat. After the drying of second coat completely apply the final coat of undiluted elastomeric water proofing liquid in a direction perpendicular to previous coat. The overall dry

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film thickness shall be as specified in manufacturer specification. The membrane shall be protected from rain unless it reaches completely dry state.

43.3. CRYSTALLINE WATER PROOFING MORTAR

Crystalline water proofing mortar shall consist of Portland cement, specially treated quartz sand and a compound of active chemicals. Total quantity of the water proofing Crystalline Mortar material confirming to IS 2645:2003, EN 1504-3 standard required at site shall be arranged only after obtaining the prior approval of the Engineer-in-Charge in writing. The proper account of water proofing compound used in the work shall be maintained. It shall be ensured that the consumption of the compound is as per specified requirements. Contractor shall associate himself with anyone of the specialist firms mentioned in approved list of applicator of water proofing compound only approved by Engineer-in-Charge before start of work.

The manufacturer shall submit guarantee in respect of crystalline water proofing mortar performance for 10 years against any leakage.

43.4. GRADING WITH CEMENT CONCRETE

Before laying cement concrete (1:2:4) for grading, the level markings to the required slope/gradient shall be made only with cement concrete on the surface of the slab at suitable spacing with the help of string and steel tape (Measuring tape) so that the mason can lay the concrete to the required thickness, slope / gradient easily in between the two level markings. On getting the level marking approved by the Engineer-in-Charge the surface shall be sprinkled with thick cement slurry and the concrete shall be laid carefully, without throwing from height, in predetermined strips.

The concrete shall be consolidated by specially made wooden tamping. After the tamping is done the surface shall be finished to required slope/gradient with wooden trowels without leaving any spots of loose aggregates etc.

The mixed cement concrete must be laid in position, within half an hour of its mixing. In case any quantity of concrete remains unused for more than half an hour the same shall be rejected and removed from the site. The slope of finished terrace shall not be more than 1 in 120 unless a steeper slope is desired by the Engineer-in-Charge. The minimum thickness of the concrete at its junction with Khurra or parapets shall be 50 mm. The concrete shall be rounded at the junction of roof slab and parapet. It is desirable to provide a haunch/gola/filler at the junction of the parapet wall and the roof slab.

Curing shall be done either by spreading straw/Hessian cloth over the graded surface, keeping the same wet for full 10 days or flooding the graded area with water by making kiaries with weak

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cement mortar, for 10 days as per the direction of the Engineer-in-Charge. Occasional curing by simply spraying water now and then shall not be permitted under any circumstances.

43.5. GRADING WITH CEMENT MORTAR

Grading shall be done with cement mortar 1:3 (1 cement: 3 coarse sand) / 1:4 (1 cement: 4 coarse sand) as directed by the Engineer-in-Charge. The surface shall be cleaned properly with brooms brush, cloth to remove all dirt, dust, mortar droppings. The minimum thickness of cement mortar grading at any pipe junctions shall be no less than 20 mm. The cement mortar shall be rounded at the junction of roof slab and parapet. It is desirable to provide a haunch/gola/filler at the junction of parapet wall and the roof slab. The maximum thickness that shall be adopted for grading with cement mortar shall be no more than 50 mm.

44. WATERPROOFING

44.1. WATER PROOFING STP, SWIMMING POOLS AND WATER RESERVOIRS

Apart from the regular workability admixtures, Integral Crystalline durability admixtures (i.e. one-part cementitious powder added to the concrete mix at the time of batching) shall be added to all concrete, structural and otherwise, to waterproof & enhance the Concrete Durability. The self-healing, non-toxic Crystalline Admixture shall be added either at the time of batching at the batching plant or as directed by the Engineer-in-Charge in the drum of the transit mixer, when the concrete arrives the point of pouring.

The water proofing compound used in integral crystalline water proofing treatment shall satisfy all the requirements indicated in relevant IS standards and the same shall be tested to from reputed National/International laboratories as per relevant codes to get approval from the Engineer-in-Charge before its use at site.

Mixing shall be as recommended in the manufacturer's specification. The manufacturer shall submit guarantee in respect of performance for 10 years against any leakage.

44.2. WATER PROOFING TREATMENT IN SUNKEN PORTION

Only extra mortar sticking to the surface shall be removed and the surface shall be cleaned thoroughly. The consistency of the slurry shall be such as to cover the desired area by using 0.488 kg of blended cement per sq.m. of area to the satisfaction of Engineer-in-Charge. On deciding the correct quantity of water required per sq.m. area the required quantity of slurry shall be prepared for applying over the desired surface as per manufacturer specifications.

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All layers shall be applied as per manufacturer's specification over the desired area by carefully including all corners, holes on the surfaces and joints of pipes in concrete etc. and the application shall continue at least up to minimum 150 mm height of fixtures of pipes from the surface up to the satisfaction of Engineer-in -Charge. The surface on application shall be cured.

If included in approved brand/ manufacturer's waterproofing system, the fibre glass cloth shall be thin, flexible uniformly bonded mat composed of chemically resistant borosilicate glass fibre distributed in random open porous structure bonded together with a thermosetting resin. Following application of slurry on a sufficiently workable area, when the applied slurry is still green, the specified fibre glass shall be spread evenly on the surface without any kink and shall be pressed in such a way that no air spaces exist. The fibre glass cloth shall be taken up to a height of the groove on wall where it shall be tucked in. On completion of curing the grooves where the fibre glass cloth is tucked shall be closed neatly with cement mortar mixed with water proofing compound. A minimum overlap of 100 mm width shall be provided when the fibre cloth has to be joined. The joining of 100 mm overlap shall be done with the same slurry used for the application on surface as first layer. The fibre cloth shall also be extended up to a height of 100 mm over pipes projecting from the surface. The consistency of slurry shall be such that in one application with a brush, a layer of 1.50 mm thick slurry can be applied evenly on the entire surface covered with fibre glass cloth.

44.3. WATERPROOFING VERTICAL JOINTS

Water proofing treatment of Vertical joints (of external side and internal side) between door frame, window & ventilator frames (on all four sides) of outer wall over the Zycosil/equivalent & Zycoprime/equivalent solution already applied (before the installation of door / window / ventilator frames in position) and fine finish with Grout RW/equivalent.

45. DRAINAGE

45.1. BRICK MASONRY GULLY TRAP

The excavation for gully traps shall be done true to dimensions and levels as indicated on plans or as directed by the Engineer-in-Charge. The chamber shall be of brick masonry of specified class and shall have a C.I. grating with frame fixed in 15 cm thick cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) at the top. If trap sizes are not shown in services drawings the internal size of the trap shall be minimum 80 × 40 × 46 cm. The depth shall be measured from the top of the floor to the top of the cover. 40 mm thick stone baffles shall

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be fixed 50 mm deep in masonry with cement mortar 1:4 (1 cement: 4 fine sand). These chambers shall be built at various locations at site as shown in drawings and as directed by the Engineer-in-Charge.

45.2. MANHOLES

Manholes of different types and sizes as shown in drawing shall be constructed in the sewer line at such places and to such levels and dimensions as shown in the drawings or as directed by the Engineer -in-Charge. The size specified shall indicate the inside dimensions between brick faces of the manholes. The manhole shall be built on a bed of cement concrete 1:4:8 (1 cement: 4 coarse sand: 8 graded stone aggregate 40 mm nominal size) unless required by local authorities. The brick work shall be done in cement mortar 1:4 (1 cement: 4 coarse sand). The walls of the manholes shall be plastered inside with 12 mm thick cement plaster 1:3 (1 cement: 3 coarse sand) finished smooth.

Unless specified otherwise, the frame of the manhole shall be firmly embedded to correct alignment and level in RCC slab or plain concrete as the case may be on the top of masonry for fixing Circular, Square or Rectangular shaped LD-2.5/MD-10/HD-20/EHD-35 grade cover in it.

45.3. INSPECTION CHAMBERS

The inspection chambers shall be built on a bed of cement concrete 1:5:10 (1 cement: 5 coarse sand: 10 graded stone aggregate 40 mm nominal size) unless required by local authorities. The thickness of the bed concrete shall be 15 cm unless otherwise specified or directed by the Engineer-in-Charge and 40 mm thick cement concrete 1:2:4 (1 cement: 4 coarse sand: 4 grade stone aggregate 40 mm nominal size). The brick work shall be done in cement mortar 1:4 (1 cement: 4 coarse sand). The external joints of the brick masonry shall be finished smooth, and the joints of the pipes with the masonry shall be made perfectly leak proof. The walls of the inspection chambers shall be plastered inside including bed with 12 mm thick cement plaster 1:3 (1 cement: 3 coarse sand) finished smooth.

The frame of inspection chambers shall be firmly embedded to correct alignment and levels in RCC slab or plain concrete as the case may be on the top of the masonry. After completion of the work, inspection chambers covers shall be sealed by means of thick grease.

46. ROAD WORKS

46.1. EARTHWORK IN ROAD CONSTRUCTION

These shall broadly conform to: -

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- (a) IRC: 36 Recommended practice for construction of earth embankments for road works.
- (b) IRC: 10 Recommended practice for borrow pits for road embankments by manual operations. Excavation from borrow pits shall conform to provisions in para 3 of IRC: 10 and the road embankment shall generally conform to section, slopes and location of borrow pits as per the direction of the Engineer-in-Charge. Earth from cutting shall be utilized for filling areas as directed by the Engineer-in-Charge, Earth not required for filling shall be disposed off as directed by the Engineer-in-Charge.

46.2. PRECAST KERB STONE

Trenches shall first be made along the edge of the wearing course of the road to receive the kerb stones of cement concrete. The bed of the trenches shall be compacted manually with steel rammers to a firm and even surface and then the stones shall be set in cement mortar. Where shown in drawings, the kerb stones with 20 cm. wide top shall be laid with their length running parallel to the road edge, true in line and gradient at a distance of 30 cm. from the road edge to allow for the channel and shall project about 12.5 cm. above the latter. The channel stones with top 30 cm. wide shall be laid in position in chamber with finished road surface and with sufficient slope towards the road gully chamber. The joints of kerb and channel stones shall be staggered and shall be not more than 10 mm. Wherever specified all joints shall be filled with mortar 1:3 (1 cement: 3 coarse sand) and pointed with mortar 1:2 (1 cement: 2 fine sand) which shall be cured for 7 days. The necessary drainage openings of specified sizes shall be made through the kerb as per drawings and as directed by the Engineer-in-Charge for connecting to storm water drains.

46.3. INTERLOCKING PAVER BLOCK

Factory made precast Interlocking paver block of M-30 grade procured from an approved brand and manufacturer shall be fixed on minimum 50 mm thick sand bed or as specified otherwise thickness of coarse sand and filling, all as directed by Engineer-in-Charge.

46.4. LAYING AND JOINTING CEMENT CONCRETE PIPES

NP-3 class (medium duty)/ NP-4 class (heavy duty) RCC pipes of internal diameter 80 mm to 250 mm shall be with reinforcement as required and shall conform to IS 458, capable of withstanding a test pressure of 0.07 MPa (7 m head).

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In case where foundation conditions are unusual such as in the proximity of trees or holes, under existing or proposed tracks manholes etc. the pipe shall be encased all-around in 15 cm thick cement concrete 1:5:10 (1 cement: 5 fine sand: 10 graded stone aggregate 40 mm nominal size) or compacted sand or gravel. Joints are generally of rigid type; the jointing space shall be filled with cement mortar 1:2 (1 cement: 2 fine sand).

46.5. SPECIFICATION FOR 7 METRES (22 FT.) METALLED WIDTH

- 225 mm (9") wide brick on edge- edging on either side
- 100 mm (4") thick stone aggregate base-course of W.B.M. as per IRC specifications.
- 200 mm (8") thick stone aggregate base-course of W.B.M. as per IRC specifications shall be to be laid in two layers.
- 20 mm (3/4") thick pre mix carpet with seal coat of premixed stone dust.
- Slab of the culvert shall be of R.C. C. M-150 with suitable reinforcement

46.6. GRANULAR SUB-BASE

IS Sieve Designation	Percent by Weight Passing the IS Sieve			
	Grading III	Grading IV	Grading V	Grading VI
75.0 mm	--	--	100	--
53.0 mm	100	100	80-100	100
26.5 mm	55-75	50-80	55-90	75-100
9.50 mm	--	--	35-65	55-75
4.75 mm	10-30	15-35	25-50	30-55

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2.36 mm	--	--	10-20	10-25
0.85 mm	--	--	2-10	--
0.425 mm	--	--	0-5	0-8
0.075 mm	<5	<5	--	0-3

This work shall consist of laying and compacting well-graded material on prepared subgrade in accordance with the requirements of these Specifications. The material shall be laid in one or more layers as sub-base or lower sub-base and upper sub-base (termed as sub-base hereinafter) as necessary according to lines, grades and cross-sections shown on the drawings or as directed by the Engineer-in-Charge. The material to be used for the work shall be natural sand, crushed gravel, crushed stone, crushed slag or combination thereof. Use of materials like brick metal, Kankar (compliant with IS: 5640). and crushed concrete shall be permitted in the lower sub-base. The material shall be free from organic or other deleterious constituents. Gradings III and IV shall be used in lower sub-base, Grading V and VI shall be used as a sub-base-cum-drainage layer. For a two-layer sub-base, minimum thickness of each layer shall not be less than 150 mm.

The surface of the sub grade to receive the Granular Sub-base shall be prepared to the specified lines and cross fall (Camber) as necessary and made free of dust and other extraneous materials. Any ruts or soft yielding places shall be corrected in an approved manner and rolled with 80 – 100 kN smooth wheeled roller until firm surface is obtained if necessary by sprinkling water. Weak

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places shall be strengthened, corrugations removed and depressions and pot holes made good with suitable materials, before spreading the aggregate for GSB.

The sub-base material of grading and water shall be mixed mechanically by a suitable mixer equipped with provision for controlled addition of water and mechanical mixing to ensure a homogenous and uniform mix. The required water content shall be determined in accordance with IS 2720 (Part 8). Moisture content of the mix shall be checked in accordance with IS 2720 (Part 2). The mix shall be spread on the prepared sub-grade with the help of a motor grader of adequate capacity, its blade having hydraulic controls suitable for initial adjustment and for maintaining the required slope and grade during the operation, or other means shall be as approved by the Engineer-in-Charge. Immediately after spreading the mix, rolling shall be done by an approved roller.

46.7. WATER BOUND MACADAM WITH STONE AGGREGATE

Before starting with W.B.M. construction, necessary arrangements shall be made for lateral confinement of aggregates. One method is to construct side shallers in advance to a compacted layer of the W.B.M. coarse. Inside edges may be trimmed vertical and the included area cleaned off all spilled materials thereby setting the stage for spreading the coarse aggregate. The practice of laying W.B.M. after excavating a trench section in the finished formation must be completely avoided.

The coarse aggregate shall be spread uniformly and evenly upon the prepared base in required quantities with a twisting motion to avoid segregation. In no case shall these be dumped in heaps directly on the area where these are to be laid nor shall their hauling over a partly completed base be permitted. The aggregates shall be spread uniformly to proper profile by using templates placed across the road six metres apart. Where specified, approved mechanical devices may be used to spread the aggregates uniformly. The levels along the longitudinal direction up to which the metal shall be laid, shall be first obtained at site to the satisfaction of Engineer-in-Charge, and these shall be adhered to. The surface of the aggregate spread shall be carefully trued up and all high or low spots remedied by removing or adding aggregate as may be required. The W.B.M. sub-base shall be normally constructed in layer of 100 mm compacted thickness and W.B.M. base shall be normally constructed in layers of 75 mm compacted thickness. No segregation of large or fine particles shall be allowed and the coarse aggregate as spread shall be of uniform gradation with no pockets of fine material. The coarse aggregate shall normally not be spread in lengths exceeding three days average work ahead of the rolling and blending of the proceeding section.

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Immediately following at spreading of the coarse aggregate, it shall be compacted to the full width by rolling with either the three- wheel- power -roller of 8 to 10 tonnes capacity or an equivalent vibratory roller.

After the coarse aggregate has been lightly rolled to the required true surface, screenings shall be applied gradually over the surface to completely fill the interstices. Dry rolling shall be continued while the screenings are being spread. The screenings shall be applied at a slow rate. After spreading the screening and rolling the surface shall be copiously sprinkled with water, swept and rolled until a grout has been formed. After the application of screenings and rolling, a suitable binding material shall be applied at a uniform and slow rate in two or more successive thin layers. The surface shall be rolled by an 8-10 tonne roller.

46.8. ROAD MARKING

The colour width and layout of road makings shall be in accordance with the Code of Practice for Road Markings with paints, IRC: 35, and as directed by the Engineer- in-Charge.

The thermoplastic material shall conform to IS 164:1981/ASTM D36/BS-3262- (Part I) & shall be homogenously composed of aggregate, pigment, resins and glass reflectorizing beads. The material shall be melted in accordance with the manufacturer's instructions in a heater fitted with a mechanical stirrer to give a smooth consistency to the thermoplastic material to avoid local overheating.

The colour of yellow marking shall conform to IS Colour No. 356 as given in IS 164. Marking shall be done by fully /semi-automatic paint applicator machine fitted with profile shoe, glass beads dispenser, propane tank heater and profile shoe heater, driven by experienced operator as specified in item. For locations where painting cannot be done by machine, approved manual methods shall be used with prior approval of the Engineer-in-Charge. The Contractor shall maintain control over traffic while painting operations are in progress so as to cause minimum inconvenience to traffic compatible with protecting the workmen. The thermoplastic material shall be applied hot either by screeding or extrusion process. After transfer to the laying apparatus, the material shall be laid at a temperature within the range specified by the manufacturer or otherwise directed by the Engineer-in-Charge for the particular method of laying being used. The paint shall be applied using a screed or extrusion machine. All surfaces to be marked shall be thoroughly cleaned of all dust, dirt, grease, oil and all other foreign matter before application of the paint. Thermoplastic paint shall be applied in intermittent or continuous lines

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of uniform thickness of at least 2.5 mm unless specified otherwise. Where arrows or letters are to be provided, thermoplastic compound may be hand-sprayed with prior approval of the Engineer-in-Charge. The minimum thickness specified is exclusive of surface applied glass beads. The finished lines shall be free from ruggedness on sides and ends and be parallel to the general alignment of the carriageway. The upper surface of the lines shall be level, uniform and free from streaks.

46.9. REGULATORY SIGN BOARD

The colour, configuration, size and location of all the traffic signs shall be in accordance with the code of practice for road signs, IRC 67. Concrete shall be of M-25 grade, reinforcing steel shall confirm to the requirement of IS 1786, high strength bolts shall confirm to IS 1367 whereas precision bolts, nuts etc. shall confirm to IS 1364, plates and support sections for the sign posts shall confirm to IS 226 and IS 2062, Aluminium sheets for sign boards shall be of smooth, hard and corrosion resistant aluminium alloy confirming to IS 736 material designation 24345 or 1900 as approved by the Engineer-in-Charge. On the back surface, it shall have a polyester based service coating preferably grey in colour to protect against possible corrosion.

PLUMBING SYSTEM

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PLUMBING WORKS

SPECIAL CONDITIONS

1. GENERAL

- 1.1.** Special conditions of contract shall be read in conjunction with General Conditions of contract and both shall form an integral part of contract. Where the two are at variance, the conditions stipulated in this, as Special Conditions shall supersede relevant General Conditions.
- 1.2.** Work under this contract shall be executed as shown on the drawings and given in the specifications and required at site whether specifically shown or not.
- 1.3.** Special Conditions of Contract shall be read in conjunction with the General Conditions of the Contract, specifications of the work, drawings, bill of quantity and any other document forming part of this contract, wherever the contract so requires.
- 1.4.** 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 in to the contract so far as it may be practicable to do so.
- 1.5.** Where mentioned in the specifications that the contractor shall perform certain work or provide certain facilities; it is understood that the contractor shall do so at his own cost.
- 1.6.** The materials, design and workmanship shall satisfy the relevant Indian Standard, the job specifications contained herein and codes referred to where the job specifications and fire authority requirements stipulate in addition to these contained in the standard codes and specifications, these additional requirements shall be satisfied.

2. SCOPE OF WORK

- 2.1.** Work under this contract shall consist of furnishing labor, materials, equipment and appliances necessary and required. The contractor is required to completely furnish all the plumbing and drainage system and other specialized services as described here-in-after and as specified in the specification/drawing and/or shown on the plumbing drawings.
- 2.2.** Without restricting to the generality of the foregoing, plumbing and drainage works shall include the following: -
 - i. Sanitary ware, Fittings and Accessories.
 - ii. Soil, Waste, Vent and Rain water piping.
 - iii. Cold and hot water supply piping including all accessories.

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- iv. Underground & roof tanks including all sleeve.
- v. Water Supply Pumps
- vi. Making connection to municipal water supply systems, rain water drainage system with existing storm drain and S.T.P. effluent with existing sewer line.
- vii. S.T.P. (Sewage Treatment Plant)

2.3. Services rendered under this section shall be done without any extra cost.

3. INTERPRETATION

3.1. In interpretation of specifications, the following order of decreasing importance shall be followed:

- i. Specification/drawing.
- ii. Additional specifications.
- iii. List of approved make of materials.

4. SPECIFICATIONS

4.1. Work shall be carried out strictly in accordance with the specifications attached to the tender.

4.2. Works not covered in the specifications shall be carried out as per relevant Indian Standard Code of practice specifications of materials.

5. DRAWINGS

5.1. Plumbing drawings are diagrammatic but shall be followed as closely as actual construction permits. Any deviations made shall be conformity with the architectural and other services drawings.

5.2. Architectural drawings shall take precedence over plumbing or other services drawings as to all dimensions.

5.3. Contractor shall verify all dimensions at site and bring to the notice of the Engineer all discrepancies or deviations noticed. Engineer-in-charge decision shall be final.

5.4. All equipment/materials dimensions to be incorporated and shall take precedence over small scale drawings.

5.5. All drawings issued by the consultants for the work are the property of the consultants and shall not be lent, reproduced or used on any other works than intended, without the written permission of the consultants.

5.6. Any drawings supplied with the tender shall be returned in good conditions along with the tender.

6. INSPECTION AND TESTING OF MATERIALS

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- 6.1.** Contractor shall be required, if requested, to produce manufacturers test certificate for the particular batch of equipment/materials supplied to owner. The tests carried out shall be as per the relevant Indian standards.
- 6.2.** For examination and testing of equipment/materials and works at the site contractor shall provide all testing and gauging equipment necessary but not limited to the followings:
- i. Theodolite
 - ii. Dumpy level
 - iii. Weighing machine
 - iv. Plumb bobs, spirit levels, Hammers
 - v. Steel tapes
 - vi. Micrometers / Vernier Calipa
 - vii. Thermometers, stoves
 - viii. Hydraulic test machine
 - ix. Smoke test machine
- 6.3.** All such equipment/measuring instrument shall be tested for calibration at any approved laboratory, if required by the Engineer-in-charge.
- 6.4.** All testing equipment shall be preferably located in special room meant for the purpose.
- 6.5.** The contractor shall carry out the various tests as enumerated in the technical specifications of tender documents that will be furnished to him during the performance of the work.
- 6.6.** All tests whether on the field or outside concerning the execution of the work and supply materials by the contractor shall be carried out by the contractor at his own cost.
- 6.7.** The work is subjected to inspection at all times by the Engineer-in-charge. 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. The technical documents will be furnished to him during the performance of the work and relevant codes of practice.
- 6.8.** The contractor shall provide for purpose of inspection access ladders, lighting and necessary instruments at his own cost.
- 6.9.** All results of inspection and tests will be recorded in the inspection reports, pro forma of which will be approved the project engineer. These reports shall be form part of the completion documents.
- 6.10.** Any work not conforming to the execution drawings, specifications or codes shall be rejected forth with and the contractor shall carry out as per the specification at his own cost.

7. FACTORY INSPECTION

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- 7.1.** All factory manufactured equipment e.g. pumps, motor, filters, softeners, dosing units, Installation control valves, flow switches etc., shall be factory tested with respect to materials and performance by the manufacturer in accordance with the relevant standards to which the equipment will be made. The contractor shall furnish manufacturer certificates of these tests.
- 7.2.** The contractor in consultation with the manufacturer/supplier of above equipment shall give sufficient prior notice to Project Engineer regarding testing of equipment at factory premises, who shall either depute his representative to witness the testing or allow to carryout tests of their own.
- 7.3.** Project Engineer shall reserve the right to get any material or equipment tested from any approved testing laboratory or institution to ensure that the material conforms to the specification. If the material or equipment fails such tests, the material or equipment shall not be acceptable for the work and replaced by the Contractor.
- 7.4.** Contractor shall provide necessary facilities for conducting such tests. All expenses required to conduct such tests including to and fro postage, transportation, testing fees, travel, boarding & lodging of Project Engineer or his representative shall be borne by the owner. The cost of samples shall however be borne by the Contractor.
- 7.5.** The Project Engineer shall have the authority to waive off inspection and testing of any item in case of MTC/other approved laboratory test certificates furnished are acceptable to him.

8. REFERENCE POINTS

- 8.1.** Contractor shall provide permanent bench marks, flag tops and other reference points for the proper execution of work and those shall be preserved till the end of the work.
- 8.2.** All such reference points shall be in relation to the levels and locations, given in the architectural & plumbing drawings.

9. SHOP DRAWINGS

- 9.1.** Contractor shall provide shop drawings of plumbing & fire protection water tanks with pump room including all equipment.
- 9.2.** Shop drawings are detailed working drawings which incorporate the contractor's details for execution of the work and incorporate equipment manufacturer's details and dimensions to ensure that the same can be installed in the space provided. Shop drawings shall be submitted by contractor for approval to consultant.
- 9.3.** All shop drawings shall have detail pipe routing and levels, showing restriction and location of other services (if any) at crossings etc., Engineer-in-charge will arrange the issue of one set of Architectural, Plumbing and other drawings, other agencies drawings to the contractor.

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Additional copies of such drawings may be had from the respective agencies on payment of actual cost.

- 9.4.** Shop drawings shall also be furnished for detail layout of all equipment, foundation, bolting and vibration elimination details along with information on dead and dynamic load, vibration etc.
- 9.5.** Shop drawings shall furnish all details of MCC panels, cable routes, wiring diagrams and connection details with limit of scope.
- 9.6.** Three copies of each set of shop drawings shall be submitted for initial scrutiny discussion and approval.
- 9.7.** Each submission shall be accompanied by contractor's certificate stating that the shop drawings meet all requirements and that the piping and equipment can be satisfactorily installed without any obstructions in space available.
- 9.8.** On approval of the above the contractor shall furnish six sets of the approved shop drawings for execution of the work.

10. TESTING

- 10.1.** Piping and drainage works shall be tested as specified under the relevant clauses of the specifications/IS Code.
- 10.2.** Tests shall be performed in the presence of the Engineer-in-charge.
- 10.3.** All equipment and materials found defective shall be replaced and the whole work tested to meet the specifications required in presence of owner/owner's representative.
- 10.4.** 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.
- 10.5.** Contractor shall provide all labour, equipment/instruments and materials for the performance of the tests.

10.6. CUTTING OF WATER PROOFING MEMBRANE

- i. No wall / terrace shall be cut for making opening after water proofing has been done, without written approval of Engineer-in-Charge. Cutting of water proofing membrane shall be done very carefully so as other portion of water proofing is 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 Engineer-in-Charge.

10.7. CUTTING OF WATER STRUCTURAL MEMBER

- i. No structural member shall be chased or cut without written permission of Engineer-in-Charge. Cutting of water proofing membrane shall be done very carefully so as other

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portion of water proofing is 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 Engineer-in-Charge.

11. LICENSE AND PERMITS

- i. Contractor must hold a valid plumbing license issued by the Municipal authority or other competent authority under whose jurisdiction the work falls.
- ii. Contractor shall obtain, from the municipal authority, completion certificate with respect to his work as required for occupation of the building without any extra cost.

11.2. Site Order Book

- i. The Engineer and the Architect shall communicate or confirm their instructions to the Contractor in respect of the execution of work during their Site inspections in a "Work Site Order Book" maintained at the Site Office of the Engineer. The Contractor or his authorized representative shall confirm receipt of such instructions by signing against the relevant orders in the book.

11.3. Site Records

- i. The Contractor shall keep books, accounts and Site documents and records showing the number of men employed each day, wage bills, delivery notes, priced invoices for all materials ordered or delivered, visitors to the Site, weather conditions, temperature and other events influencing the progress and quality of Works concerned. The Contractor shall furnish such documents and records to the Architect and Engineer, when required.

12. Coordination of Works:

12.1. At the commencement of work, and from time to time, the Contractor shall confer with other contractors, sub-contractors, persons engaged on separate contracts in connection with the Works, and with the Architect and Engineer for the purpose of coordination and execution of the various phases of work. The Contractor shall ascertain from the other contractors, sub-contractors and persons engaged in separate contracts, in connection with the works, the extent of all chasing, cutting and forming of all opening, holes, grooves etc. as may be required to accommodate the various services.

12.2. The Contractor shall ascertain the routes of all services and the position of all floor and wall outlets, traps etc. in connection with the installation of plant, services and arrange for the construction of work accordingly. The breaking and cutting of the completed work must not be done unless specifically authorized in writing by the Architect. Generally, all breaking shall be by

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the Contractor for civil work and no work shall be done over broken or patched work without first ascertaining that the broken surface is adequately prepared and reinforced to receive and hold further work.

13. Guarantee Certificates:

- i. The Contract shall not be considered as completed until the Guarantee Period shall have expired. The Guarantee Certificate stating that the Works have been completed and maintained to his satisfaction and that all the defects notified had been rectified, shall be given by the Architect, subject to the Architect being so satisfied, within three months of the expiry of the Guarantee Period or, if different Guarantee periods shall become applicable to different parts of the Works, the expiry of the last such period; or as soon thereafter as any work ordered to be rectified during such period shall have been completed to the satisfaction of the Architect.
- ii. Provided that in the case of fraud, concealment or fraudulent concealment relating to the works or materials or to any matter dealt with in any certificate, the Guarantee Period or, if different Guarantee periods shall become applicable to different parts of the Works, the expiry of the last such period; or as soon thereafter as any work ordered to be rectified during such period shall have been completed to the satisfaction of the Architect.

14. LIST OF STANDARD CODES

S.No.	IS Code No.	Description
1.	IS:13592:1992 Reaffirmed 2002	Specification for UPVC (SWR) soil, waste, rain water and ventilating pipes.
2.	IS: 13592: 1992 Reaffirmed 2002	Specification for UPVC (SWR) fittings for soil, waste, rain water and ventilating pipes.
3.	IS: 5382: 1985 Reaffirmed 2003	Specification for rubber sealing for UPVS (SWR) pipes.
4.	IS: 7634: 2003 (Pt. III)	Specification for Laying and jointing UPVC (SWR) pipes.
5.	IS:651:1992 Reaffirmed 2003	Specification for salt glazed stoneware pipes and fittings (5th rev.) (Amendment 1)
6.	IS:4127:1983 Reaffirmed 2001	Code of practice for laying of glazed stoneware pipes (1st rev.)
7.	IS:783:1985 Reaffirmed 2001	Code of practice for laying of concrete pipes .
8.	IS:1172:1993 Reaffirmed 2002	Code of basic requirements for water supply, drainage & sanitation (4th rev.)
9.	IS:1200 (Part-16):1979	Code of practice for methods of measurements of building and civil engineering works: Part 16 laying of water and sewer lines

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S.No.	IS Code No.	Description
	Reaffirmed 2002	including appurtenant items (3rd rev.)
10.	IS:1200(PART-19):1981 Reaffirmed 2002	Code of practice for methods of measurements of building and civil engineering works: part 19 water supply, plumbing and drains (3 rd rev.)
11.	IS:1742:1983 Reaffirmed 2002	Code of practice for building drainage (2nd rev.)
12.	IS:2065:1983 Reaffirmed 2001	Code of practice for water supply in buildings
13.	IS:13095:1991 Reaffirmed 2003	Butterfly valves for general purposes
14.	IS:5312 (part 1):1984 Reaffirmed 2000	Swing heck type reflux valves (non-return valve): part 1 single door pattern (1 st rev.)(amendment 1)
15.	IS:1726:1991 Reaffirmed 2003	CI manhole covers & frames (3rd rev.)
16.	IS:780:1984	Specification for sluice valve for water works purposes (6th rev.) (50 to 300 mm size) (amendment 3)
17.	IS: 1239(Part 1): 2004	Specification for G.I. pipes & fittings for water supply purpose.
18.	IS : 15778	Specification for CPVC pipes & fittings for water supply purpose
19.	IS: 4984: 1995 Reaffirmed 2002	Specification for HDPE pipes and fittings for water supply purpose.
20.	IS: 2556: 1994(Part 1 to 8)	Specification for (Vitreous China) sanitary appliances.
21.	IS: 2326: 1987 Reaffirmed 2003	Specification for Automatic flushing cistern for urinals.
22.	IS: 2470 (Part 1 to II)	Code of practice for installation of septic tanks.
23.	NBC-SP-7-1983 Part IV	National building code of India 1983, amendment No. 3
24.	SP:35 (s&t)-1987	Hand book on water supply & drainage by bureau of Indian standards
25.		National Building code (sec-ix)
26.	IS:2065:1983 Reaffirmed 2001	Code of practice for water supply in buildings
27.	IS: 4111-1986 (Pt.I) Reaffirmrd	Manholes
28.	IS:456:197828.	Code of practice for plain and reinforced concrete (3rd rev.) (Amendment 2)
29.	IS:7740: 1985 Reaffirmed 2001	Code of practice for road gullies.

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TECHNICAL SPECIFICATION

SECTION - I

15. SANITARY WARE & FITTINGS

15.1. GENERAL

- 15.1.1. All sanitary appliances including sanitary fittings, fixtures, toilet requisites, shall be of size, make and design as specified in the item of work as per sample approved by the Engineer-in-Charge / Owner.
- 15.1.2. All exposed G.I. & UPVC. pipes and fittings shall be painted with approved quality of paint and shade as specified.
- 15.1.3. All sanitary and plumbing work shall be carried out through licensed plumbers.
- 15.1.4. On completion of work, the site shall be cleaned and rubbish disposed off as directed by the engineer-in-charge.
- 15.1.5. All sanitary fittings such as water closet pans, urinals, partitions for closets and urinals, flush pipes, brackets, lavatory basins, sinks, soil and vent pipes etc. and fittings holders for toilet paper, glass shelves and other fittings together with the fixing of the same shall be enumerated separately or in combination under relevant items of work as described in specification/drawing.
- 15.1.6. All damage done on floors, walls and RCC. work etc. during process of execution, fixing or installation of sanitary fittings, pipes, internal water supply and house drainage etc., shall be restored to its original condition and cost of the same is included in the rates, unless otherwise specially specified.

15.2. SANITARY FIXTURES AND FITTINGS

- 15.2.1. Scope of work covers supply, installation, testing and commissioning of:

- i. Sanitary ware
- ii. Chromium plated (CP) fittings
- iii. Any other work to complete the systems

- 15.2.2. The contractor shall get the installation along with associated water supply distribution system and drainage system approved by the Kolkata municipal corporation or other licensing authorities/owner.

15.3. Standards

All sanitary ware shall generally conform to IS 2556 part I to VIII unless stated otherwise.

15.4. Materials

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15.4.1. General

15.4.2. All sanitary ware and CP fittings shall be new, best of quality and of approved make, type, size and colour as specified in the schedule. All samples of materials with specifications/catalogues, performance data, shall be submitted and got approved before use on the work by the authorized representative. Approved samples along with other approved equipment/materials shall be neatly displayed on a board and such a display board of samples shall always be in exhibition in the construction office of the engineer-in-charge. Such display shall be used for the day-to-day checking of the materials on site.

15.4.3. Wherever multiple choices of fixtures are offered, the Owner shall have the final choice.

15.4.4. All fixtures shall be complete with all accessories as required for the working of the said fixture as specified.

15.4.5. European WC

European WC shall be wash down pattern unless otherwise specified. Closet shall have an integral flushing rims of self-draining type. Water closet shall be floor / wall mounted in white glazed vitreous chinaware with integral P or S trap as required. Wash down WC shall be supported on floor. Flush shall be concealed in wall and flush pipe shall be copper or GI except the exposed part as specified. Each WC shall be provided with a black or as specified solid plastic seat conformed to IS 2548. The seat shall be fixed to the WC with CP brass pillar bar hinges. Rubber buffers shall be provided for the cover.

15.4.6. Urinals

Urinals shall be large flat back wall hung urinal in white glazed vitreous chinaware of size mentioned in the schedule of work.

Urinals shall be provided with:

- i. 15 dia spreader
- ii. dia CP dome waste
- iii. dia CP P-trap with unions
- iv. CP wall flange and pipe

All exposed pipes and fittings shall be of CP. The urinals shall be fixed with CP brass screws. Urinal flushing shall be through an auto flush valve with electrically operated solenoid valve activated by

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infra-red sensor. Auto flush shall be concealed in wall and flush pipe shall be of copper or GI except the exposed part as specified. Waste pipes, heavy quality as per IS 4985 as specified in the schedule of work or shown on drawings. Urinal partitions shall be white Rajgarh Marble 25 mm thick, 1050 x 600 mm size fixed in wall by cutting chase and making good in cement mortar (1:2) finished to match the surroundings

15.4.7. Wash Basin

Wash basins shall be white glazed vitreous chinaware of size, shape and type specified in the schedule of work.

Each basin shall be complete with:

- i. CI or galvanised steel supporting brackets & clips as required.
- ii. 32 mm dia CP waste and overflow
- iii. Waste with rubber plug and CP chain as specified
- iv. Single Lever Mixer (for hot & cold)
- v. Bottle Trap - CP Brass Bottle Trap
- vi. Two nos. 15 mm CP brass angle cock 15 mm size with CP brass flexible connection from angle valve to mixer.

15.4.8. Sink and Draining Board

Stainless steel sinks and draining board shall be pressed stainless steel 2 mm thick sheets of size, shape and type specified in the schedule of work or white glazed fine clay or vitreous china.

Each sink shall be complete with:

- i. CI or galvanized steel supporting brackets & clips as required.
- ii. 32 dia CP waste and overflow
- iii. Waste with rubber plug and CP chain as specified
- iv. One Sink mixer (for hot & cold).

15.5. Installation

15.5.1. All sanitary ware and CP fittings shall be installed in accordance with the interior requirements. Neat workmanship and maintaining exact position and level of each fixture shall be the sole objective of the installation. Care shall be taken to fix inlet and outlet pipes at correct positions. Faulty positioning shall be made good without any damage to the finished floor or

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wall tiling and any damage to the finished surfaces shall be made good at the tenderer / contractor's cost.

- 15.5.2.** In order to ensure quality of workmanship and compliance with interior requirements, one or two mock-up installations shall be done and got approved. Fixtures used in the mock-up may be reused with the approval of the Engineer-in-charge.
- 15.5.3.** All fixing accessories like bolts, nuts, brackets etc. as required shall form part of the installation. all such accessories shall be CP brass or galvanized or stainless steel as approved by the engineer-in-charge. All exposed pipes and bends shall be of CP brass.
- 15.5.4.** Wall-hung European WC shall be mounted on CI chairs which are fixed to the wall and floor using Anchor fasteners. The bolts and nuts used for fixing the chairs shall be stainless steel and the fixing bolts for the WC and chairs could be CP brass or stainless steel. Floor-mounted WC shall be fixed with Anchor fasteners using stainless steel bolts and nuts. The gap between the WC and floor or wall shall be neatly sealed with water proof non-hardening sealant of approved Colour. The sealant shall not extrude beyond the foot print or WC outline.
- 15.5.5.** All WC's shall be aligned and leveled with the floor and wall tiles so as to present an integrated look. Utmost care and skill shall be exercised to achieve a good installation in keeping with the interior designs.
- 15.5.6.** Urinals shall be fixed to the wall using anchor fasteners and stainless steel bolts and nuts. The urinals shall be held in line and level according to the interior designs and tile modules. Partitions, wherever required to be provided, shall also maintain line and level as shown on drawings and as required. Supply spreader and drain piping and P-trap shall be of CP brass and installed in a neat and workman like manner. No unseemly bends or wooden support pieces shall be permitted.
- 15.5.7.** Wall-mounted wash basins shall maintain line and level as specified by the interior drawings and also with the tile modules. The supply connections shall be of CP brass from the angle stop valves to the pillar taps or single level fixture and shall display good workmanship. Drain connections shall have a CP trap with unions and exposed CP drain pipe and a wall flange or escueheon. In the case of counter mounted basins extreme care shall be taken to independently and adequately supporting the basin and aligning with the opening in the counter slab. Supply and drain connections shall be same as for wall mounted basins. The gaps between basin and wall or counter shall be neatly sealed with a non-hardening sealant of approved Colour.

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15.5.8. All accessories like the mirror, soap dish, soap dispenser, hand dryer, paper holder, ablution hose, etc. shall be neatly fixed as per interior designs. Good workmanship is the essence of all sanitary installation for achieving the interior design objectives.

15.5.9. During the construction period, the contractor shall protect all the sanitary fixtures from damage due to accidental or even intentional mechanical impact with hard objects and also misuse and vandalism.

15.6. Testing and Acceptance

15.6.1. The sanitary fixtures form the final terminal units of the water supply and drainage system and shall meet the performance needs as a terminal unit. Each fixture shall be inspected for scratches or chippings and alignment before acceptance.

15.6.2. The following design flows shall be verified and validated for acceptance.

WC Flush Valve	8 ltrs to 10 ltrs per flush	Provide test 32 dia valved connection at the lowest floor and highest floor
Flushing cistern	3 to 6 ltrs per flush	Fill time between two consecutive flushes
Pillar taps	15 lpm max.	6 lpm min
Wash Basin	Full basin drain time 3 min	To be measured and validated
Urinal Flush Valve	2 lpm max.	1 lpm minimum

All tests shall be conducted at each and every fixture except for flush valves shall be at the lowest and

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highest test connections to be made on each riser/down take. The contractor shall make the temporary valve connections shall be plugged with a brass after validation in according with BS 5572.

16. MOCK UP

The contractor shall install all pipes, fixtures, clamps and accessories and fixing devices in mock-up shaft and room so constructed as directed by Engineer without any cost. The materials used in the mock-up may be reused in the works if found undamaged.

Any tiles or finished surfaces or floors damaged by the contractor while doing his work shall be made good with new tiles or other finishing material. No payment shall be admissible for such repairs. The engineer may, at his discretion get the damaged work repaired by other agencies and debit the cost of such repairs to the contractor.

SECTION II

17.SOIL, WASTE, VENT AND RAIN WATER PIPES

17.1. SCOPE OF WORK

- 17.1.1.** Work under this section shall consist of furnishing all labour, materials, equipment and application, necessary and required to completely install all soil, waste, vent and rain water pipes as required by the drawings, specified hereinafter and given in the specification/drawing.
- 17.1.2.** Without restricting to the generality of the foregoing, the soil waste and vent pipes system shall include the following.
- 17.1.3.** Vertical and horizontal soil, waste and vent pipes rain water pipes and fittings joints, clamps and supports (MS) connections to fixtures.
- 17.1.4.** Connections of all pipes to sewer and storm water lines as shown on the drawings at ground floor levels.
- 17.1.5.** Floor and urinal traps, cleanout plugs and inlet fittings.
- 17.1.6.** Waste pipe connections from all fixtures e.g., wash basins, sinks, urinals, pantry, equipment and plant room equipment.

17.2. GENERAL REQUIREMENTS

- 17.2.1.** All materials shall be new of the best quality conforming ISI code and specifications and subject to the approval of engineer-in-charge.
- 17.2.2.** Pipes and fittings shall be fixed truly vertical, horizontal or slopes as required in neat workman like manner.
- 17.2.3.** Pipes shall be fixed in a manner as to provide best accessibility for repair and maintenance and shall not cause obstruction in shafts, passages, etc.
- 17.2.4.** Pipes shall be securely fixed to walls by suitable clamps at intervals as per manufactures specification or as specified.
- 17.2.5.** Access door for fittings and cleanouts shall be so located that they are easily accessible for repair and maintenance.
- 17.2.6.** All work shall be executed as directed by the engineer-in-charge.

17.3. PIPE & FITTINGS

17.3.1.UPVC(SWR) PIPES AND FITTING

Soil, waste, vent, and rain water pipes shall be UPVC (SWR) pipes.All pipes shall be straight and smooth and inside free from irregular bore, blow holes cracks and other manufacturing defects. The Pipes shall conforming to IS 13592,UPVC-SWR (Type "A" or "B" as specified).

17.3.2. Fittings

Fitting shall conform to IS 13592 shall be free from cracks the Indian Standard as for pipes. Contractor shall use pipes and fittings of matching specifications. Fittings shall be of the required degree of curvature with or without access door.

17.3.3. Floor Traps & Urinal Traps

Floor traps shall be UPVC (SWR), deep seal with an effective seal of 50 mm. The jointing of trap and waste pipes shall be done with approved make cement solvent including making surface rough or Rubber sealing rings with lubricant for sliding socket joints.

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17.3.4. CLEANOUT PLUGS

Contractor shall provide UPVC (SWR) cleanout plugs as required. Cleanout plugs shall be thread and provided with key holes for openings. Cleanout plugs shall be fixed the pipes by a UPVC (SWR) socket drip seal caulked as per detail drawing.

17.4. WASTE PIPE FROM APPLIANCES

17.4.1. PVC PIPES & FITTINGS

Waste pipes from appliances e.g. wash basins, sinks, urinals & water cooler shall be of PVC pipes and fittings conforming to ASTM D-1785(Schedule 80). Pipes shall be provided with all required fittings, e.g. Tees, couplings, bends, elbows, unions, reducers, nipples etc. All PVC waste pipes shall be terminated at the point of connection with the appliance with an outlet of suitable diameter. Access shall be fixed in gradient towards the out falls of drain. Pipes inside a washroom shall be in chase unless otherwise shown on drawings. Where required pipes may be run at ceiling level in suitable gradient and supported on structural clamps, spacing for clamps for such pipes shall be: - Vertical - 1.5 meter; Horizontal 1.0 meter.

17.5. PAINTING

All UPVC Soil, waste and vent pipes in exposed location, in shafts and pipes spaces shall be painted with two or more coats of ready mix oil paint to give an even shade. Painting shall be approved quality and shade. Where directed pipes shall be painted in accordance with approved pipe colour code. UPVC. soil and waste pipes below ground and covered in cement concrete or lead pipes shall not painted.

17.6. CUTTING AND MAKING GOOD

Pipes shall be fixed and tested as building proceeds. Contractor shall provide all necessary holes cut out and case in structural members as building work proceeds. Wherever holes are cut or left originally they shall be de good with cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 stone aggregate 20 mm thick nominal size) or cement mortar 1:2 (1 cement: 2 coarse sand) and the surface restored to original condition.

17.7. TESTING

17.7.1. Before use at site all UPVC soil and waste pipes shall be tested by filing up with water for at least 10 minutes. After filling pipes shall be struck with a hammer and inspected for blow holes and cracks. All defective pipes shall be rejected and removed from the site within 48 hours. Pipes with minor seating shall be accepted at the discretion of the engineer-in-charge.

17.7.2. Pipes shall be tested, after installation by filling up the stack with water. All opening and connections shall be suitably plugged. The total head in the stack shall however not exceed 4.5 m.

17.7.3. Alternately contractor may test all soil and waste stack by a smoke testing machine. Smoke shall be pumped into the stack after plugging all inlets and connections. The top end shall however be left open. The stack shall then be observed from leakages and all defective pipes and fittings removed or repaired as directed by the engineer-in-charge.

17.7.4. A test register shall be maintained and all entries shall be signed and dated by contractor engineer-in-charge.

SECTION III

18. WATER SUPPLY

18.1. SCOPE OF WORK

18.1.1. 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 specification/drawing.

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

18.1.3. Water Heaters including all accessories.

18.1.4. Water supply pipes including fittings.

18.1.5. Control valve, masonry chambers and other appurtenances.

18.1.6. Connections to all plumbing fixtures, pantries and overhead tanks.

18.1.7. Excavation and refilling of pipe trenches.

18.1.8. Pipe protection and painting.

18.2. GENERAL REQUIREMENTS

18.2.1. All materials shall be new of the best quality conforming to specifications. All works executed shall be to the satisfaction of the engineer-in-charge.

18.2.2. Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workman like manner.

18.2.3. Short or long bends shall be used on all main pipelines as far as possible. Use of elbows shall be restricted for short connections. As far as possible all bends shall be formed by means of hydraulic pipe bending machine for pipes up to 65 MM diameter.

18.2.4. 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.

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

18.2.6. Valves and other appurtenances shall be located to provide easy accessibility for operation, maintenance and repairs.

18.3. PROVISION OF HOT WATER HEATERS

18.3.1. Hot water heaters shall be high pressure type and operate at 6 bar water pressure.

18.3.2. The water heaters shall be work on minimum six bar pressure. The cylinder of water heater shall be tested on 12 bars.

18.3.3. Hot water heaters shall be sand blasted thick steel type.

18.3.4. The hot water heaters shall be 100% control of the regulating temperature of the thermostats and dielectric control of the appliances guarantees their absolute safety.

18.3.5. The hot water heaters shall be 100% control of the outside appearance of the painted (high temp. resistant) jacket and paint thickness ensures the constant quality of the finish.

18.3.6. The hot water heaters shall be work on single phase electric supply.

18.3.7. The water heaters shall be injection of polyurethane foam without CFC's, in temperature The water heaters shall be equipped with immersion heaters. The KW rating of heaters chamber, the perfect centering the tank within covering. The tank filling shall be tested at 100%.

18.3.8. As per future location of water heater cold water incoming point and hot water outgoing point for future water heater connection shall be plugged off with concealed hot and cold water supply line.

18.4. WATER SUPPLY PIPES & FITTINGS

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All pipes of hot water supply line shall be concealed CPVC pipes with fittings and all cold water supply pipes with fittings as concealed and exposed in the shaft and on the roof shall be PVC schedule 80 pipes. M.S. medium class pipe with puddle flange shall be used inlet outlet, drain and vent pipe of U.G. & roof top water reservoirs.

18.5. CPVC PIPES, FITTINGS

All hot water pipes inside the building up to 25 mm diameter as concealed shall be used CPVC pipes and fittings Class -1, SDR-11 conforming to I.S.-15778: 2007.

18.6. PVC PIPES, FITTINGS

All cold water pipes and fittings shall be used as PVC schedule 80 (medium duty) conforming to ASTM D – 1785.

18.7. INSTALLATIONS

- 18.7.1.** Install product according to Manufactures installation instruction and manual and follow recommended safe work practices.
- 18.7.2.** Keep pipe and fitting in original packaging until needed and store pipes in covered areas.
- 18.7.3.** Use tools designed for use with plastic pipe and fitting.
- 18.7.4.** Cut of minimum 25 mm beyond the edge of the crack in case any crack is discovered in the pipe.
- 18.7.5.** Cut the pipe as square (perpendicular) as possible before making joint. Always use sharp edge cutting tools. Sharpen holder tools periodically.
- 18.7.6.** Always apply a heavy & even coat of CPVC solvent cement on pipe and a light cost inside fittings.
- 18.7.7.** Use CPVC fusion compound conforming with ASTM F 493.
- 18.7.8.** Always hold the fresh fusion compounded joint in place for 20-30 second.
- 18.7.9.** Use brass threaded MTA's and FTA's for hot water & for transition to or from Metal.
- 18.7.10.** Always conduct hydraulic pressure testing after installation to detect any leaks and faults. Wait for appropriate cure time before pressure testing. Fill lines slowly and bleed air from the system prior to pressure testing.
- 18.7.11.** Debar, bevel and clean mating surface of pipe and fittings before joining.
- 18.7.12.** Rotate the pipe 80 degree to 190 degrees to spread the CPVC solvent cement evenly in the while pushing the pipe into fitting.
- 18.7.13.** Use Teflon tapes with threaded fitting, good quality champion make only.
- 18.7.14.** Ensure that there no sharp edge in contact with the pipe while embedding the pipes on the wall or in the floors.
- 18.7.15.** Provide vertical and horizontal supports as recommended using the plastic straps only.
- 18.7.16.** Apply only water- based paint on exposed pipes and fitting.
- 18.7.17.** Provide sleeves (pipe cover) at entry & exit it under slab installations & while crossing walls.
- 18.7.18.** Visually inspect all joints for proper cemented at the end of shift or day. A visual inspection of the complete system is also recommended during pressure testing.

18.8. Clamps

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PVC & CPVC pipes in shafts and other locations shall be supported by G.I clamps of design approved by the Resident Engineer. Pipes at ceiling level shall be supported / suspended on structural clamps fabricated from MS structure. Pipes in shafts shall be supported on slotted angles/ channels as specified/ as directed.

18.9. Unions

The Agency 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 for easy dismantling and/ or as directed by Resident Engineer.

18.10. Flanges

Flanged connections shall be provided on pipes as required for maintenance/ ease in dismantling or where shown on the drawings, all equipment connections as necessary and required or as directed by the Resident Engineer. Connections shall be made by the correct number and size of the GI nuts/ bolts, as per relevant IS Standards and made with 3mm thick insertion rubber washer/ gasket. All PVC pipes below ground shall be laid in trenches with a minimum cover of 600 mm. The width and depth of the trenches shall be as follows: -

Dia of pipe	Width of trench	Depth of trench
15 mm to 50 mm	300 mm	600 mm
65 mm to 100 mm	450	750 mm

18.11. Sand Filling

PVC pipes in trenches shall be protected with fine sand 150 mm all around before filling in the trenches.

18.12. Painting

All PVC pipes above ground shall be painted with one coat of approved primer and two coats of paint of approved shade and quality to give an even shade. Pipes shall be painted to standard colour code specified by the Resident Engineer.

18.13. Piping Installation:

18.13.1. Piping shall be properly supported on or suspended from clamps, hangers as specified and as required. The Agency shall adequately design all the brackets, saddles, anchors, clamps and hangers and be responsible for their structural sufficiency.

18.13.2. Pipe supports shall be of steel, adjustable for height and painted with one coat of red oxide primer and two coats of synthetic enamel paint of approved shade and quality to give an even shade. Where pipe and clamps are of dissimilar materials, a gasket shall be provided in between. Spacing of pipe supports shall not exceed the following:

	Spacing between Supports	
	Horizontal	Vertical
Upto 12 mm	1500 mm	1500 mm

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15 to 150 mm	2000 mm	1000 mm
150 mm & over	2500 mm	10

18.13.3. Vertical pipe risers shall be parallel to walls and column lines and shall be straight and plumb. Piping passing from floor to floor shall be supported at each floor by clamps or collars steel structural supports attached to pipe and with a 15 mm thick rubber pad or any resilient material. Where pipes pass through the terrace floor, suitable flushing shall be provided to prevent water leakage. Risers shall have a suitable clean out at the lowest point and air vent at the highest point.

18.13.4. All pipe work shall be carried out in workmen like manner, causing minimum disturbance to the existing services, buildings, roads and structure.

18.13.5. The Agency shall make sure that the clamps, steel structural supports, brackets, clamp saddles and hangers provided for pipe supports are adequate. Piping layout shall take due care for expansion and contraction in pipes, and include expansion joints where required.

18.13.6. All pipes shall be accurately cut to the required sizes in accordance with relevant codes and burrs removed before laying. Open ends of the pipes shall be closed as the pipe is installed to avoid entrance of foreign matter. Where reducers are to be made in horizontal runs, eccentric reducers shall be used for the piping to drain freely. In other locations, concentric reducers may be used.

19. VALVES

Valves up to 50 MM dia. shall be ball valves with cast iron body and stainless steel ball or as described in the BOQ. Valves 50 MM dia. and above shall be cast iron butterfly valves with epoxy coated disc carbon steel shaft and lever actuator or as described in the BOQ. Valves shall be tested at manufacturers and their name stamped on it.

All valves shall be approved by the engineer-in-charge before they allowed to be used on works. However, the final responsibility of the quality of material lies with the contractor.

20. AIR VALVES

Air valves 15 mm or required dia. shall be provided in all high points in the system to prevent air locks, as shown on the drawings or directed by engineer-in-charge. Air valves shall be of single acting heavy duty brass spring type as specified in the specification/drawing.

21. SCOUR VALVES

Scour valves shall be provided at all low points in the system as shown on the drawings or directed by engineer-in-charge. Valves shall be gunmetal full way valves for sizes 50 mm dia. and below and butterfly valve 65 mm dia and above.

22. MANHOLE FRAMES AND COVER FOR WATER TANKS

Each tank shall be provided with adequate number of lockable type manhole frames and covers fabricated from M.S. sheet or standard cast iron tank covers as specified in specification/drawing. Manhole covers shall be of sizes shown in the drawings.

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23.INSULATION

- 23.1.** As required all Cold water supply pipes in the exposed areas & all hot water pipes shall be insulated with elastomeric closed shells circular pipes.
- 23.2.** All insulation material shall be elastomeric closed shells foam has a high diffusion resistance factor that prevent excessive water diffusion that gives longer lifetime of material.
- 23.3.** The insulation material having the property of resistance of fire i.e in case of fire these material do not drop and do not spread flames.
- 23.4.** All insulation material as per din 1988/7 (standard for drinking water pipe installation and for avoiding corrosion damage and scale formation).
- 23.5.** The thermal conductivity of material at 0 deg. C = 0.035 w/(m.K).
- 23.6.** The temperature resistance of material between -45 deg. C to +116 deg. C. The Thickness of insulation pipes as follows: The thickness of insulation shall applicable for CPVC pipes concealed and PVC pipes exposed to roof level.

Size of pipes	Application of pipes	Location	Thickness of Material (mm)	Type of Section
15 mm to 100mm	Cold Water Supply	Exposed	19mm	Tube Section
15 mm to 32mm	Hot water supply	Concealed	9 mm	Tube Section
15mm to 25 mm	Hot water supply	Exposed	13 mm	Tube Section
32 mm to 50 mm	Hot water supply	Exposed	19 mm	Tube Section
65 mm to 80 mm	Hot water supply	Exposed	25 mm	Tube Section
100mm	Hot water supply	Exposed	32 mm	Tube Section

24. TESTING PROCEDURE GUIDELINE

24.1. GENERAL

- 24.1.1.** After laying and jointing, the pipeline must be pressure tested to ensure that pipes and joints are sound enough to withstand the maximum pressure likely to be developed under working conditions.

24.1.2. TESTING OF PRESSURE PIPES

The field test pressure to be imposed shall be not less than the maximum of the following.

- (a) 1 1 / 2 times the maximum sustained operating pressure.
- (b) 1 1 / 2 times the maximum pipeline static pressure.
- (c) Sum of maximum sustained operating pressure and the maximum surge pressure.
- (d) Sum of the maximum pipeline static pressure and the maximum equal to the work test pressure for any pipe fittings incorporate.

The field test pressure shall wherever possible be not less than 2/3 the work test pressure appropriate to the class of pipe accept in the class of pipe accept in the case of spun iron pipes and shall be applied and maintained for at least four hours. If the visual

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inspection satisfied that there is no leakage, the test can be passed.

Where the field test pressure less than 2 / 3 work test pressure, the period of test shall be increased to at least 24 hours. The test pressure shall be gradually raised at the rate of 1 kg / cm² / min. If the pressure measurements are not made at the lowest point of the section, an allowance shall be made for the difference in static head between the lowest point and the point of measurement to ensure that the maximum pressure is not exceeded at the lowest point. If a drop in pressure shall be carefully measure. This shall not exceed 0.1 Liter per mm of pipe diameter per KM of pipeline per day for each 30 meter head of pressure applied.

IN case of gravity pipes, maximum working pressure shall be 2/3-work test pressure.

The hydrostatic test pressure at works and at field after installation and the working pressure for different classes of pipes are given.

The allowable leakage during the maintenance stage of pipes carefully laid and well tested during construction, however shall not exceed;

$$qL = \frac{ND \diamond P}{115}$$

Where,

- QL = Allowable leakage in cm³ / hour
- N = No of joints in the length of pipe line
- D = Diameter in mm
- P = The average test pressure during the leakage test in kg/ cm²

Where any test of pipe laid indicates leakage greater than that specified as per the above formula, the defective pipe(s) or joint(s) shall be repaired / replace until the leakage in with in the specified allowance.

The above is applicable to spigot and socket cast iron pipes and A.C pressure pipes, whereas, twice this figure may be taken for steel and pre-stressed concrete pipes.

25. STERILIZATION OF INSTALLATION FOR WATER PIPING

- 25.1.** After completion of all hot & cold water supplying piping work. The contractor shall be responsible for sterilization of all cold and hot water piping line.
- 25.2.** The contractor shall be required do the flushing of all hot and cold water supply lines with clear water to remove all dirt's and debris in pipe line.
- 25.3.** After flushing of all hot and cold water supply lines provide chlorine treatment of the domestic hot and cold water supply lines.
- 25.4.** Disinfect the hot & cold water supply line including water service connections, with chorine.
- 25.5.** Chlorine dosage: Not less than 50 parts per million.
- 25.6.** Following a contact period of not less than 24 hours, flush the chlorinated water from the system with greater than 0.2 parts per million.
- 25.7.** Open and closed valves being disinfected several times during the 24 hour period.
- 25.8.** Repeat disinfection until piping meets the following bacteriological test:

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25.9. Take two (2) samples of water from different risers on each floor.

25.10. Test two 10-ml portions of each sample for coliform present.

25.11. Repeat until all tests are negative.

25.12. Repeat the sterilization of complete system.

26. MAKING CONNECTION WITH MUNICIPAL WATER MAIN

26.1. GENERAL

The item includes connection with the existing C.I. or G.I. water supply line including fittings and fixtures.

26.2. MATERIAL

C.I. or G.I. specials/PVC shall be conforming to relevant IS code and flange joint or lead joint shall be as per IS specification.

26.3. MUNICIPAL CHARGES

If the connection shall be made with the water supply line of NKDA the contractor shall obtain necessary permission from the concerned municipal authorities. He shall pay all the necessary charges towards the connection being permitted by the NKDA.

26.4. MAKING CONNECTION

The connection shall be made with existing C.I. or G.I. water pipe line of specified diameter. The existing water supply pipe line shall be cut or disjointed carefully where the connection is not made. The connection shall be made with providing C.I. or G.I. specials / PVC as per site requirement including making flanged joint or lead joint.

26.5. DEWATERING

The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or other cause.

26.6. TESTING

The connection shall be tested under the testing clause of pipe line. The testing shall be done along with the testing of pipe line.

SECTION-IV

27. DRAINAGE (SEWERS & STORM WATER)

27.1. SCOPE OF WORK

27.1.1. Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install the drainage system as required by the drawings and specified hereinafter or given in the specification/drawing.

27.1.2. Without restricting to the generality of the foregoing, the drainage system shall include:

27.1.3. Sewer lines including excavations, pipe line, manholes, underground storm water drains, including pipes, manholes with catch basins.

27.2. GENERAL REQUIREMENTS

27.2.1. All materials shall be new of the best quality conforming to specifications and subject to the approval of the engineer -in -charge.

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

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

27.2.4. Contractor shall obtain necessary approval and permission for the drainage system from the municipal or any other competent authority.

27.2.5. Location of all man holes, catch basins, etc, shall be got confirmed by the engineer-in -charge before the actual execution of work at site.

27.2.6. All works shall be executed as directed by the engineer-in -charge.

27.3. ALIGNMENT AND GRADE

The sewers and storm water lines shall be laid to alignment and gradient shown on the drawings with A class Bedding but subject to such modifications as shall be ordered by the engineer in charge from time to time to meet the requirements of the works. No deviations from the lines, depths of cutting or gradients of sewers shown on the plans and sections shall be permitted except to the direction in the engineer-in-charge.

27.4. EXCAVATION

The excavation for sewers and storm water drains shall be in open cutting unless the permission of the engineer-in-charge is obtains in writing. Where sewers have to be constructed along narrow passages, the engineer in charge may order the excavation to be made partly in tunnel and in such cases the excavated soil shall be brought back later on for refilling the trenches or tunnel.

27.5. HIGH DENSITY POLYETHYLENE PIPES

All underground sewer lines where specified shall be High Density Polyethelene pipes. All pipes shall be conforming to IS 16098 (Part-II0: 2013 having Stiffness Class of SN 8 with ring Stiffness not less than 8.00 KN/Sqm and as described in the B.O.Q. All pipes shall have the manufacturer's name marked on it

28. LAYING AND JOINTING OF HIGH DENSITY POLYETHYLENE PIPES

The pipes shall be carefully laid straight to the correct alignment in gradients as indicated in the drawing. All the pipe shall be used in standard length as far as possible. Cut length may be used only where it is necessary to make up exact length. All pipes laying on suitable A class bedding as shown in the drawing Pipes shall be jointed with ring fit joint or as manufacture's instruction or as instruction of Engineer- in- charge.

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29. TESTING

- 29.1.** All lengths of the sewer and drain shall be fully tested for water tightness by means of water pressure maintained for not less than 30 minutes. Testing shall be carried out from manhole to manhole. All pipes shall be subjected to a test pressure of at least 1.5 mtrs head of water. The test pressure shall, however, not exceeds 6 meters at any point. The pipes shall be plugged preferably with standard design plugs with rubber plugs on both sides. The upper end shall however, be connected to a pipe for filling with water and getting the required head poured at one time permit.
- 29.2.** Sewer lines shall be tested for a straightness by:
- 29.3.** Inserting a smooth ball 12 mm less than the internal diameter of the pipe. In the absence of obstruction such as yarn or mortar projecting at the joint the ball shall roll down the invert of the pipe and emerge at the lower end.
- 29.4.** Means of a mirror at one end and a lamp at the other end. If the pipe line is straight the full circle of light will be seen otherwise obstructions or deviation will be apparent.
- 29.5.** The contractor shall give a smoke test to the drain and sewer at his own expense and charges, if directed by Engineer-in-Charge / consultants.
- 29.6.** A test register shall be maintained which shall be signed and dated by contractor, Architect and representative of consultants.

30. GULLY TRAPS

Gully traps shall be fixed in cement concrete 1:5:10 mix (1 cement 5 coarse sand 10 stone aggregate 40mm nominal size) and a brick masonry chamber 30 x 30 cms C.I. sealed cover and frame weighing not less than 7.3 kg. to be constructed as per standard drawings. Where necessary, sealed cover shall be replaced with C.I. grating of the same size.

31. CEMENT CONCRETE AND MASONRY WORKS (FOR MANHOLES AND CHAMBERS, ETC.)

31.1. WATER:

Water used for all the constructional purposes shall be clear and free from oil, acid, alkali, organic and other harmful matters deteriorate the strength and /or Durability of the structure. In general, the water suitable for drinking purposes shall be considered good enough for constructional purposes.

31.2. AGGREGATE FOR CONCRETE:

The aggregate for concrete shall be in accordance with I.S.3 8 3 and I.S. 5 1 5. In General, these shall be free from all impurities that may cause corrosion of the reinforcement. Before actual use these shall be washed in water, if required as per the direction of engineer-in-charge. The size of the coarse aggregate shall be as given in the specification/drawing.

31.3. MANHOLE AND CHAMBERS

- 31.3.1.** All manholes, chambers and other such works as specified shall be constructed in brick masonry in cement 1: 5 (1 cement: 5 coarse sand) or as specified in the specification/drawing.
- 31.3.2.** All manholes, chambers, etc., shall be supported on base of cement concrete of such thickness mix as given in shown on the drawings. Where specified, manholes shall be constructed as follows:

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31.3.3.

(All dimensions internal clear in CMS.)

Size of Manhole	900 × 800	1200 × 900	1200 dia	1500 dia
Manhole Type	Rect.	Rect.	Circular	Circular
Maximum depth	900 mm	2500 mm	2300 mm	9000 mm
Average wall thickness	250 mm (one brick)	250 mm (One brick)	375 mm (One & Half brick)	500 mm (Two & Half brick)
Size of Cover & frame(M duty)	500 mm dia	500 mm dia	500 mm dia	500 mm dia
Size of cover & frame (H duty)	560 mm dia	560 mm dia	560 mm dia	560 mm dia
Weight of cover (M duty)	58 kg	58 kg	58 kg	58 kg
Weight of cover (H duty)	108 kg	108 kg	108 kg	108 kg
Weight for Frame (M duty)	58 kg	58 kg	58 kg	58 kg
Weight for Frame (M duty)	100 kg	100 kg	100 kg	100

31.3.4. All manholes shall be provided with cement concrete benching in 1: 2 : 4 mix (1 cement 2 coarse sand 4 stone aggregate 20 mm nominal size).The benching shall have a slope of 10 cms towards the channel. The depth of the channel shall be full diameter of pipe. Benching shall be finished with a floating coat of neat cement.

31.3.5. All manholes shall be plastered with 12/15 mm thick cement mortar 1:3 (1 cement: 3 coarse sand) and finished with a floating coat of neat cement inside. Manholes shall be plastered outside as above but with rough plaster.

31.3.6. All manholes with depths greater than 1 m shall be provided with 20mm square or as shown in the drawing in cement concrete blocks 25 x 110 cms in 1:2:4 mix 30 cms vertically and staggered. Footrest shall be coated with coat tar before embedding.

31.3.7. All manholes shall be provides with Reinforcement Cement Polymer Concrete (R.C.P.C.) covers and frames or as described in the B.O.Q.are embedded in reinforced cement concrete slab. Load bearing capacity, Weight of cover and frame shall be specified in the schedule of quantities.

31.4. DROP CONNECTIONS

31.4.1. Drop connections shall be provided between branch sewer and main sewer or in the main sewer itself in steep ground when the difference in invert level of the two exceeds 45 cms of the required sizes.

31.4.2. Drop connections from gully traps to main sewer or rectangular manholes shall be made inside the manholes and shall have H.C.I. special type door bend on top and heel rest bend at bottom connected by a H.C.I. pipe. This pipe shall be supported by holder

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bat clamps at 180 cms intervals with at least one clamp for each drop connection. All joints shall be lead caulked 25 mm deep.

31.4.3. Drop connections from branch sewer to main sewer shall be made outside the manhole wall with glazed stoneware pipe tee connections, vertical pipe and bend at the bottoms. The top of the tee shall be finished up to the surface level and provided with a C.I. hinged type frame and cover 30 x 30 cms. The connection shall be embedded in cement concrete 1:2:4 mix 15 cms all round the pipes and tee up to the surface camber of the tee.

31.4.4. Drop connection made from vertical stacks directly into man holes shall be not be considered as drop connections. They shall be paid for under the relevant soil ad waste pipes.

31.5. BRICK MASONRY

Brick masonry shall be of a minimum width of 30 cm for a maximum width of drains shall be 45 cm for depths beyond 45 cm. Brick masonry drains shall be constructed in brick masonry in cement mortar in cement concrete foundations as specified in specification/drawing. Masonry and concrete work shall be carried out as given in para 9 of this section. Wherever specified, masonry drains shall be plastered with cement mortar inside. The outer surface shall be flush pointed without additional charge. Wherever specified, all brick masonry covered drains shall be provided with cast in suit or precast RCC. slabs.

31.6. TESTING PROCEDURE GUIDELINES

31.6.1.GENERAL

Contractor shall be follow testing procedure lines for sewer / drain / pipeline etc. for SW, RCC pipes, HDPE pipes, Manholes and Chambers etc. as per IS: 1172 to IS: 5329. After laying and jointing, the pipeline must be pressure tested to ensure that pipes and joints are sound enough to withstand the maximum pressure likely to be developed under working conditions.

31.6.2.TESTING OF PRESSURE PIPES

The field test pressure to be imposed shall be as per the direction of Engineer-in-Charge.

The field test pressure shall wherever possible be not less than 2/3 the work test pressure appropriate to the class of pipe accept in the class of pipe accept in the case of spun iron pipes and shall be applied and maintained for at least four hours. If the visual inspection satisfied that there is no leakage, the test can be passed.

Where the field test pressure less than 2 / 3 work test pressure, the period of test shall be increased to at least 24 hours. The test pressure shall be gradually raised at the rate of 1 kg / cm² / min. If the pressure measurements are not made at the lowest point of the section, an allowance shall me made for the difference in static head between the lowest point and the point of measurement to ensure that the maximum pressure is not exceeded at the lowest point. If a drop in pressure shall be carefully measure. This shall not exceed 0.1 Liter per mm of pipe diameter per KM of pipeline per day for each 30-meter head of pressure applied.

IN case of gravity pipes, maximum working pressure shall be 2/3-work test pressure.

The hydrostatic test pressure at works and at field after installation and the working pressure for different classes of pipes are given.

The allowable leakage during the maintenance stage of pipes carefully laid and well tested during construction, however shall not exceed;

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$$qL = \frac{ND \diamond P}{115}$$

Where,

QL = Allowable leakage in cm³ / hour

N = No of joints in the length of pipe line

D = Diameter in mm

P = The average test pressure during the leakage test in kg/ cm²

Where any test of pipe laid indicates leakage greater than that specified as per the above formula, the defective pipe(s) or joint(s) shall be repaired / replace until the leakage in with in the specified allowance.

The above is applicable to spigot and socket cast iron pipes and A.C pressure pipes, whereas, twice this figure may be taken for steel and pre-stressed concrete pipes

31.7. BACK FILLING

The back filling shall be done as per specification after satisfactory testing of the pipeline and concreting up to hunches or all round as directed by the Engineer-in-Charge. Back filling shall be done in layers all around and above on the pipeline as directed by the Engineer-in-charge.

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SECTION -V

32. WATER SUPPLY PUMPS

32.1. WATER TRANSFER PUMPS

Water transfer pumps shall be open well Submersible type pumps, having C.I. Impeller with high graded CED coating Cast Iron pump bowl with copper Pump shaft, Motor shaft and Motor casing with AC 3-phase operating motor. Each pump shall be capable of operating within a performance pressure characteristic range sufficient below and above the required working pressure.

Pumps and motors shall be joined on a common MS coupling.

Each pump shall be provides with a totally enclosed water cooled induction motor of capacity and head specified in specification/drawing.

Each pumping set shall be provides with a Gun Metal "Bourden" type pressure gauge with gunmetal isolation cock and connecting piping.

Appropriate vibration eliminating pads /coupling shall be provides with each pump.

The pump set shall be provided with gun metal gate valve of appropriate sizes on delivery and non-return valve of appropriate size and a pressure gauge with cock shall be provided on the delivery line.

32.2. LEVEL CONTROLLER

Contractor shall provide and install low voltage transistorised level controllers as specified in Specification/drawing. Each level controller shall be provided with required number of PVC sheathed stainless steel probes with necessary wiring and conducting.

32.3. WATER TRANSFER PUMPS

To cut off water transfer pumps on low water level in ground level water tanks and high water level in roof level water tank. To start pumps on low water level in roof level water tank.

33. INSTALLATION AND TESTING

All pumps shall be laid out generally in accordance with the shop drawings (submitted by contractor and approved by engineer-in-charge / consultant / architect) achieving economy of space and piping.

All pumps shall be tested for the rated performance in the presence of the employer's representative and got approved.

34. CATALOGUES & MANUAL

The Contractor shall furnish the operation & maintenance manual/ technical literatures in duplicate to engineer-in-charge.

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SECTION VI

35. SEWAGE TREATMENT PLANT

35.1. SCOPE OF WORK

35.1.1. Work under this section shall consist of furnishing all labour, materials equipment and appliances necessary and required to completely install all works described hereinafter and shown on the drawings.

35.1.2. All drives will start / stop from Distribution board.

35.1.3. Required piping, valves within the limits of sewage treatment plant.

35.2. DESIGN BASIS

This Sewage Treatment Plant design is based on the following characteristics.

35.2.1. RAW SEWAGE CHARACTERISTICS

Flow	m ³ / day	350
PH	-	7 – 8
BOD	mg / l	250 – 300
COD	mg / l	450 – 600
O & G / ABS	mg / l	10 – 20
TSS	mg / l	100 – 200

35.2.2. TREATED SEWAGE CHARACTERISTICS TREATED SEWAGE

		For disposal
Flow	m ³ / day	350
PH	-	7 – 8
BOD	mg / l	< 30
COD	mg / l	< 250
O & G	mg / l	< 10.0
TSS	mg / l	< 100

35.2.3. CHARACTERISTICS AFTER TERTIARY PLANT

		For disposal
BOD	mg / l	<10
COD	mg / l	< 100

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TSS	mg / l	< 10
Hardness		Commercial zero

35.2.4. ASSUMPTIONS

35.2.5. No other parameter which exceeds the treated sewage limits or which is hazardous in nature and will affect the biological process is present in the raw sewage.

35.2.6. The oil present is in free-floating form.

35.2.7. The tertiary treatment not required in this S.T.P. because tertiary treated water shall not be re-used in the project. So, treated sewage shall be connected and discharge into existing sewer manhole near the site.

35.3. PROCESS DESCRIPTION

35.3.1. The sewage will be first passed through a type of bar screen (parabolic or straight) Then pass through fat / grease traps system to where grease or any extraneous matter would get trapped.

35.3.2. The sewage would then collected in a **Receiving Sump (Equalization tank)** where the variations in flow and characteristics are dampened, which otherwise can lead to operational problems and moreover it allows a constant flow rate downstream. Here the sewage is kept in mixed condition by means of coarse air bubble diffusion

35.3.3. The equalized sewage is then be pumped to the moving bed biofilm reactor (MBBR) where BOD/COD reduction is achieved by virtue of Biofilm Microbial activities. The MBBR would be running in series.

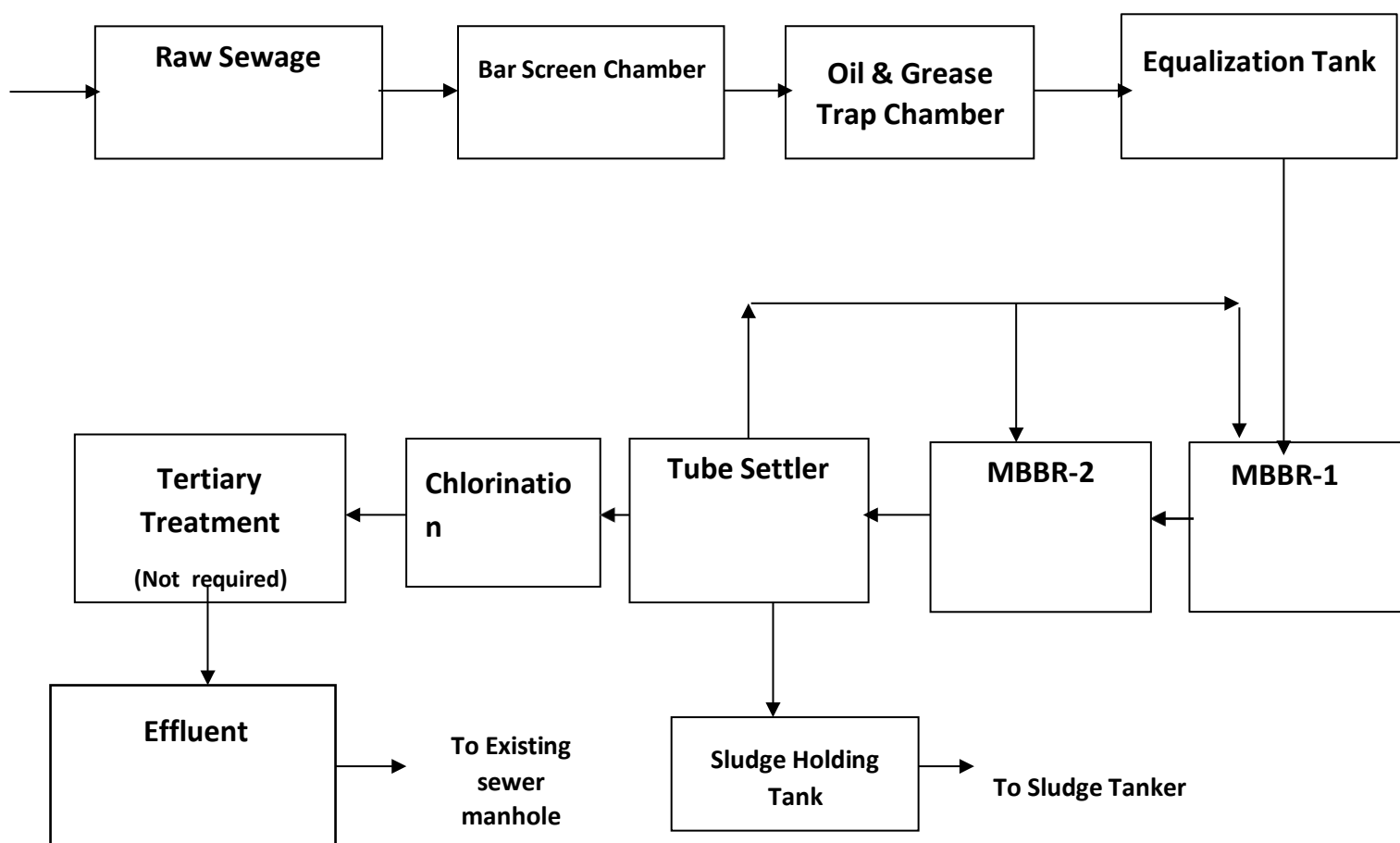
35.3.4. The excess Bio-solids formed in the Biological process are separated in the downstream tube settler tank. The clear supernatant will now be sent to the tertiary polishing section or discharge to the existing sewer manhole

35.3.5. The Biological sludge generated from MBBR, which is settled in the settler, can be collected in a sludge holding tank for periodic removal.

35.3.6. The process diagram of S.T.P. is shown below:-

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35.3.7. S.T.P. PROCESS DIAGRAM.



36. LIST OF MECHANICAL ITEMS

1. Screen

No of Units	: 1 No.
Type	: Bar type
Duty	: To remove coarse solids
MOC	: SS

2. Air Source

No of Units	: 2 Nos.
Type	: Twin Lobe
Capacity	: 245 m ³ /hr. @ 6.0 m Head
Make	: Kay / Equivalent

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3. Air Purging Grid

No of Units	:	Lot
Type	:	Non-clog, segmented for easy maintenance
MOC	:	PVC/HDPE
Location	:	Receiving Sump, FBR, Sludge Holding Tank

4. Air Diffusers

No of Units	:	Lot
MOC	:	PP/EPDM
Location	:	With Air Purging Grid

5. Sewage Transfer Pump

No of Units	:	2 Nos.
Capacity	:	17.5 KL/hr. x 12m head
Type	:	Submersible
MOC	:	SS
Make	:	Grundfoss / D.P. HOLLAND / SAMLSON

6. Media in MBBR

Qty.	:	Lot
MOC	:	PP/HDPE/PVC
Make	:	Ion Exchange / Thermax / Enviro Engineers /Guddi

7. Media in Tube Settler

Qty.	:	Lot
MOC	:	PP/HDPE/PVC
Make	:	Ion Exchange / Thermax / Enviro Engineers /Guddi

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8. Disinfections Solution Preparation Tanks

No of Units	:	1 No.
Capacity	:	100 lit.
MOC	:	HDPE
Make	:	Syntex/Polycon/ Equivalent

9. Sludge Transfer Pumps

No of Units	:	2 Nos.
Duty	:	For Sludge recycling
Capacity	:	7 KL/hr @ 10 m head
Type	:	In Line
Make	:	Grundfoss / D.P. HOLLAND / SAMLSON

10. PIPING:

Quantity	:	<i>Lot</i>
MOC of Pipe	:	GI (Heavy) for Interconnecting lines and Air Line
Approved Makes:		Jindal Hissar / Prakash Surya

11. VALVING:

Quantity	:	<i>Lot</i>
MOC of Valve	:	CI
Approved Makes:		AUDCO / ZOLOTO

37. LIST OF INSTRUMENTS

SR. NO.	DESCRIPTION	QTY.	LOCATION

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1.	Pressure gauges	8 Nos.	Pumps / blowers
2.	Air rotameters	2 Nos.	On FAB air line
3.	Level Controllers	3 sets	Equalization tank & Soft water tanks

38. ELECTRICALS

1	Motors	As applicable
2	Distribution board	Fixed type
3	Cabling power	Distribution board to motors
4	Glands / lugs for cables	As applicable
5	Equipment earthing	As applicable

NOTE:

Incoming supplies up to distribution control by client. Distribution board will be mounted on the skid.

39. LIST OF CIVIL UNITS BY CIVIL CONTRACTOR

1. Bar Screen Pit

No of Units : 1 No.

Capacity : 5 KL

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- | | | |
|---|---|---------------------------|
| 2. Receiving Sump | : | |
| No. of unit | : | 1 No. |
| Capacity | : | 175 KL |
| 3. MBBR | | |
| No of Units | : | 2 Nos. |
| Capacity | : | 2.7 m x 2.7 m x 5.0 m SWD |
| 4. Tube Settler | | |
| No of Units | : | 1 No. |
| Size | : | 2.7 x 2.7 x 2.1 m SWD |
| 5. Chlorine Contact Tank | | |
| No of Units | : | 1 No. |
| Capacity | : | 2.7 m x 2.7 m x 2.5 m |
| 6. Sludge Holding Tank | : | |
| No. of unit | : | 1 No. |
| Capacity | : | 2.7 m x 5.8 m x 2.5 m |
| 7. Foundation for Mechanical Units | : | As required. |

Note: GA drawings shall be provided by the contractor.

TECHNICAL SPECIFICATION

PART - B

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

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ELECTRICAL

1. H.T. CABLES & LAYING

1.1 GENERAL

H.T. Cables shall be supplied, inspected, laid tested and commissioned in accordance with drawings, specifications, relevant Indian Standards specifications and cable manufacturer's instructions. The cable shall be delivered at site in original drums with manufacturer's name clearly written on the drums. The recommendations of the cable manufacturer with regard to jointing and sealing shall be strictly followed.

1.2 CONSTRUCTION

All H.T. Cables shall be of 11KV(UE) grade XLPE insulated & PVC sheathed flat steel wires (strips) armoured electrical purity aluminum conductor cables shall be manufactured & tested in accordance with IS: 7098 (Part – II) and ISI marked. H.T. Cable shall be earthed, grade. The conductor shall be made electrical purity aluminum wires and shall be of stranded construction and shall comply to IS: 8130. The conductor screen & insulation screen shall both be of extruded semi conducting compound and shall be applied alongwith XLPE insulation in a single operation of triple extrusion process so as to obtain continuously smooth interphase. The metallic screen of each core shall consists of copper wires or tape. The method of curing shall be dry curing / gas curing / steam curing. However, for single core cables, non-magnetic armouring shall also constitute the part of metallic screen in addition to copper wire / tape screen, metallic screen shall be suitable for carrying the fault current of 22.6 KA for one second. Outer sheath shall be of tough, PVC compound as per IS : 5831 and shall be extruded over the armouring. Cables shall be tested for type tested & routine tested in accordance with IS : 7098 (Part – II). H.T. Cable shall be single core and laid in trefoil formation and all accessories shall deemed to include in quoted supply rate of cable.

1.3 INSTALLATION OF CABLES

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Cable shall be laid directly in ground, pipe, masonry ducts, on cable tray, surface of wall / ceiling etc. as indicated on drawings and / or as per the direction of Engineer-in-Charge. Cable laying shall be carried out as per CPWD specifications / IS : 1255.

1.4 INSPECTION

All cables shall be inspected at site and checked for any damage during transit.

1.5 TERMINATION JOINTS

Terminal joint shall be carried out inside the cable end boxes fixed on the equipment. Lugs shall be fitted by the means of bolts and nuts with the terminal studs. On the glands, armour of the cable shall be fixed by means of clamps which shall be grounded. Heat shrink / push on type cable termination kit shall be used for terminations.

1.6 JOINTS IN CABLES

The Contractor shall take care to see that the cables received at site are apportioned to various locations in such a manner as to ensure maximum utilization and avoiding of cable joints. This apportioning shall be got approved from Engineer-in-Charge before the cables are cut to lengths.

1.7 LAYING CABLES IN GROUND

Cables shall be laid by skilled experienced workmen using adequate rollers to minimize stretching of the cables. The cable drums shall be placed on jacks before unwinding the cable. With great care in shall be unrolled on over wooden rollers placed in trenches at intervals not exceeding 2 meters. Cables shall be laid at depth of 1.0 meters below ground level. A cushion of sand of 80 mm. shall be provided both above and below the cable, joint boxes and other accessories. Cable shall not be laid in the same trench or along side a water main.

The cable shall be laid in excavated trench over 80 mm. layer of sand cushion. The relative position of the cables, laid in the same trench shall preserve. At all changes in direction in horizontal and

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

vertical planes, the cables shall be bent smooth with a radius of bent not less than 15 times the diameter of cables. Minimum 6-meter-long loop shall be provided at both end of cable if possible.

Distinguishing marks may be made on the cable ends for identifications of phases. Insulation, tapes of appropriate voltage and in red, yellow and blue colours shall be wrapped just below sockets for phase identifications.

1.8 PROTECTION OF CABLES

The cables shall be protected by bricks laid on the top layer of the sand for the full length of underground cable. Where more than one cables is laid in the same trench, the bricks shall cover all the cables and shall project a minimum of approximately 80 mm. on either side of the cables. Cable under road crossing and any other places subject to heavy traffic, shall be protected by running them through Hume Pipes of suitable size.

1.9 EXCAVATION & BACK FILL

All excavation and back fill required for the installation of the cables shall be carried out by the Contractor in accordance with the drawings and requirements laid down elsewhere. Trenches shall be dug true to line and grades. Back fill for trenches shall be filled in layer not exceeding 150 mm. Each layer shall be properly rammed and consolidated before laying the next layer.

The contractor shall restore all surfaces, road ways, sidewalks, curbs, wall or the works cut by excavation to their original condition to the satisfaction of the Engineer-in-Charge.

1.10 LAYING OF CABLES ON SURFACE OF WALL / CEILING

Cables shall be fixed on surface of wall or ceiling slab by suitable MS clamps / saddles. Care shall be taken to avoid crossing of cable.

1.11 CABLES HANGERS OR RACKS

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The Contractor shall provide and install all iron hangers racks or racks with die cast cleats with all fixings, rag bolts or girder clamps or other specialist fixing as required.

Where hangers or racks are to be fixed to wall sides, ceiling and other concrete structures, the Contractor shall be responsible cutting away, fixing and grouting in rag bolts and making good.

The hangers or racks shall be designed to leave at least 25 mm. clearance between the cables and the face to which it is fixed. Multiple hangers shall have two or more fixing holes. All cables shall be saddled at not more than 150 mm. centres. These shall be designed to keep provision of some spare capacity for future development.

1.12 CABLES TAGS

Cable tags shall be made out of 2 mm. thick aluminum sheets, each tag 1-1/2 inch. in dia. With one hole of 2.5 mm. dia., 6 mm. below the periphery. Cable designations are to be punched with letter / number punches and the tags are to be tied inside the panels beyond the glanding as well as below the glands at cable entries. Trays tags are to be tied at all bends. On straight lengths, tags shall be provided at every 5 meters.

1.13 ROUTE MARKERS

1.13.1 LOCATION

Route markers shall be provided along the runs of cables at locations approved by the Engineer-in-Charge and generally at interval not exceeding 100 m. Markers shall also be provided to identify change in the direction of the cable route and at locations underground joints.

1.13.2 CC MARKER

Cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate of 20 mm in size) shall be laid flat and centered over the cable. The concrete markers, unless otherwise instructed by the Engineer-in-Charge, shall project over the surrounding surface so as to make the cable route easily identifiable.

1.14 TESTING OF CABLES

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Prior to installation burying of cables, following test shall be carried out. Insulation test by a 5000V Meggar between phases, phase & neutral, phase & earth for each length of cable.

- a. Before laying.
- b. After laying.
- c. After jointing.

On completion of cable laying work, the following tests shall be conducted in the presence of the Engineer in Charge.

- a. Insulation Resistance Test (Sectional and overall).
- b. Continuity Resistance Test.
- c. Earth Test.

All tests shall be carried out in accordance with relevant Indian Standard code of practice and Indian Electricity Rules. The Contractor shall provide necessary instruments, equipment and labour for conducting the above tests & shall bear all expenses of conducting such test.

2. 11/0.415 KV OIL COOLED DISTRIBUTION TRANSFORMER

GENERAL SPECIFICATION OF DISTRIBUTION TRANSFORMER

PROCUREMENT OF 1000, 800, 630, 315 & 100KVA, 11/0.415KV,
OIL TYPE Distribution Transformer. FOR THE USE AT BULK CONSUMER PREMISES FOR
INDOOR / OUTDOOR INSTALLATION WITH CABLE CONNECTION
AT BOTH HV & LV END.

1). Mandates in respect of submission of Bids:-

- a) This is a composite specification of WBSEDCL for Distribution Transformer having different ratings from 1000 KVA to 100 KVA. The intending bidders shall have to quote for 630 KVA

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

.11/0.415 KV transformer. Corresponding technical specification & data for 630 KVA has to be considered from this composite specification .

2) Mandates of Technical pre-requisites, to be submitted along with bid documents-

Sl. No.	11/0.415KV DTr size	Type test Report	Supply credential
1	100KVA to 315KVA	The bidder should submit Type Test Report of Short circuit Test and Lightning Impulse voltage test along with drawing from CPRI, NABL/Govt. approved laboratories carried out within Five years from the date of NIT publication, along with their offer having identical rating and type as that of the tendered item as pre-requisites mentioned in GCC, failing which their offer may not be technically accepted. Type Test for only 315KVA may be considered as pre-requisites for both 100KVA or 315 KVA DTR, at the discretion of tendering authority of WBSEDCL.	Tenderer shall furnish document along with bid, in support of supply, delivery at consignee stores(e.g copy of PO,SRV, Challan etc), of identical type & rating transformer, to the Govt. & Power Utility, indicating thereon names of the Organization, quantity ordered, quantity supplied along with the tender. Credentials for Purchase orders of similar rating and higher rating shall be within last 3(three) financial years from the date of from the date of NIT publication.
2	630 KVA to 1000 KVA	For the transformers, not usually used /procured in WBSEDCL system, Type Test Report of Short circuit Test and Lightning Impulse voltage test along with drawing for oil type transformers of identical rating of any of the 630, 800 and 1000 KVA DTr., may be submitted along with drawing from CPRI, NABL/Govt. approved laboratories carried out within five years from the date of NIT	Tenderer shall furnish document along with bid, in support of supply, delivery at consignee stores (e.g copy of PO,SRV, Challan etc), of identical type & rating transformer. If not available, higher capacity Dtr with same voltage Ratio and type, supplied to the Govt. & Power Utility, indicating thereon names of the Organization,

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

	publication. The same may be accepted as pre-requisites as per GCC in respect of submission of Type test report of 630 to 1000KVA DTr, at the discretion of tendering authority of WBSEDCL. This is applicable for 630 KVA & above rating DTr.	quantity ordered, quantity supplied along with the tender. Credentials for Purchase orders of similar rating and higher rating shall be within last 3(three) financial years from the date of from the date of NIT publication.
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WEST BENGAL STATE ELECTRICITY DISTRIBUTION COMPANY LIMITED.

TECHNICAL SPECIFICATION FOR OIL TYPE ONAN DISTRIBUTION TRANSFORMERS.

PART – A : ~~1000KVA, 800KVA, 630KVA & 315KVA~~ COPPER WOUND OILTYPE DIST.TR.

PART-A

1. SCOPE:

This specification covers design, manufacture, testing and supply of 11/0.415KV, 630KVA, ~~800KVA, 1000KVA & 315KVA~~ with cable termination arrangement Indoor installation and 11/0.415 KV, 630 KVA outdoor type, ONAN

2. LOCATION:

The transformers may be installed outdoor/ Indoor anywhere in West Bengal. The elevations of the sites above mean sea level shall not exceed 1000 metres.

3. SYSTEM DETAILS:

The 11 kV & 415V/433KV systems are effectively earthed at the neutral points of the star connected windings of the transformers.

4. WEATHER CONDITIONS:

- | | |
|---|---------------|
| 1-Elevation at mean sea level | : 1000 M |
| 2-Maximum ambient Air temperature (°C) | : 50 |
| 3- Maximum daily average ambient(°C) | : 40 |
| 4- Minimum Ambient air temperature (°C) | : (-) 5 Deg C |

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

5- Relative humidity	: 100%
6- Pollution level	: Heavily polluted.
7- Maximum Wind Pressure	: 250 kg/sq.mtr.
8- Annual average rain fall	: 3000 mm
9-. Average No. of thunder storm day per annum	: 100
10- Number of thunder storm day per annum	100

5. STANDARDS:

1. Transformers covered by this specification shall, unless otherwise specified be built to conform to the latest Indian Electricity Rules, wherever applicable and the requirements of latest issue of ISS:1180 and ISS 2026, CBIP Standards and other ISS(all as per latest issues)
2. In the event of a conflict between the above standard and the specification the latter shall Govern.

6. RATING AND GENERAL DATA FOR DISTRIBUTION TRANSFORMERS :

Core Type, three phase oil immersed step down two winding distribution transformers for outdoor installation with weather condition as stated above.

1. Number of phase : three
2. Frequency : Transformer shall be suitable for continuous operation with a frequency variation of $\pm 3\%$ from normal 50 c/s without exceeding the specified temperature rise.
3. Type of cooling: ONAN
4. Vector group reference: Dyn .11, unless otherwise stated

7. CONNECTIONS:

The primary (HV) winding shall be connected in delta and the secondary (L.V) winding in star with vector group Dyn,11. The neutral of the secondary (LV) winding shall be brought out to a separate insulated terminal.

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

The size (Cross section) of the neutral connection conductors and jumpers must be of same size as that of the phase connecting conductors and jumpers which shall be properly supported and insulated.

8. TEMPERATURE RISE:

For winding 40°C (measured by resistance) and for top oil 35°C (measured by thermometer) when tested in accordance with clause 4.0 of I.S.2026-1977 (latest) Pt-II. Temperature Rise Test for Transformers will be conducted at the lowest tap position Corresponding to losses at that tap.

9. Percentage Impedance and Loss Figures: As per Annexure- "A"

10. TERMINAL ARRANGEMENT:

i) 315 KVA, 11/0.433KV Outdoor Type Transformers- Bare on outdoor porcelain bushings with arcing horn for outdoor type transformers as per ISS/CBIP specification and other relevant specification. The inner end of the bushing shall be completely immersed in the oil. The bushings rods should be locked in position so that twisting of leads is avoided during tightening of nuts of bushing rods. H.T. & L.T. studs are to be made of brass for terminal connections as per IS 1180 (Part-I) of 1989.

ii) 315 KVA 11/0.415KV Indoor type transformers-

Suitable size cable end box with Non magnetic gland plate shall have to be provided at both HV & LV side of transformer.

For 11KV side, 3C x 95 sq.mm XLPE cable and for LT side of 315 KVA Tr.-1.1KV

Grade 2 x $3\frac{1}{2}$ C300 Sq.mm XLPE/PVC cable.

iii) 630 KVA and ~~800KVA~~ 11/0.415KV Indoor & Outdoor Type Transformers but with cable termination arrangement at both end. For 11KV side, 3C x 95 sq.mm XLPE cable & For LT side of 630KVA & ~~800KVA~~ Tr.- 1.1 KV grade 2x1c 630 Sq.mm XLPE cable per phase & 1x1c 630 Sq.mm XLPE cable for LT neutral connection. OR 3 x $3\frac{1}{2}$ C 300 Sq.mm XLPE cable may be used.

iv) 1000KVA 11/0.415KV Indoor & Outdoor Type Transformers but with cable termination arrangement at both end. For 11 KV side, 3Cx 95 sq.mm XLPE cable & For LT side of

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

1000KVA Tr.- 1.1 KV grade 3 x1c 630 Sq.mm XLPE cable per phase & 2 x 1c 630 Sq.mm XLPE cable for LT neutral connection. OR 4 x 3½C 300 Sq.mm XLPE cable may be used.

And

- v) The above terminal arrangement may change during detailed engineering while approval of drawing.

11. TAP CHANGING SWITCH

Tapping- + 5% to - 7.5% in steps of 2.5%. Provision shall be made for locking the tapping switch handle in position. Suitable aluminium anodized plate shall be fixed for tap-changing switch to know the position no of tap.

OFF Circuit tap changing switch should be provided on HV side. Switch position no.1 shall correspond to the maximum plus tapping. The tap position no. should be in increasing order in clock-wise direction. The tap markings should be of engraved in nature. Provision shall be made for locking the tap switch handle at each position. The locking arrangement shall be such that padlock cannot be inserted unless required contacts corresponding to the tap position are correctly connected with full contact pressure. Mechanical back stopper should be provided at the limiting tap positions. The tap changing shall be affected by an external three phase gang operated switch. The operating shaft shall be easily accessible.

The tap-changer switches used in the transformer shall be of robust design.

The stationery brass contact shall be so rigidly fixed to maintain rigidity and co-axiality with operation shaft throughout its life. The operating handle shall not have appreciable play if any position of tap without disturbing the engagement of moving and fixed established by turning the handle in staple. The supplier may be required to give the results of electrical and mechanical tests including endurance tests carried out to ensure its life with reference to any relevant ISS or any other acceptable standard in the transformer with sectional drawings showing the size, arrangement and functioning of the contacts of the tap switch, if required. The sample of the tap switch used for different sizes of transformers and voltage grades shall have to be approved before using them in transformer if called for.

12. LEADS:

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

All leads of the windings, connection of the windings or their wires to one another to terminal bushing or to a tap changer shall be properly insulated and covered with insulation sleeves. The soldering materials shall have higher melting temperature above 300⁰ C and preferably above 400⁰ C for better thermal endurance and mechanical strength. The tenderer shall specifically mention the method and materials to be used by them for lead connection.

HV lead termination to the stud should be made either by method of brazing or the free end of the lead wire having considerable length should be bent to form a ring and the ring should be fixed to the bushing stud with suitable nut, bolt and washer.

13.01 TANK

01. Tank wall must be fabricated from quality mild steel sheets of thickness 4 mm. Top and bottom plate of the tank must be of 5mm. thick. It should be shaped so as to make welding to a minimum. All welding shall be done electrically and relieved of welding stresses. Seams shall be double welded where practicable and found necessary by the manufacturer/fabricator for proper oil tightness. The tank wall shall be provided with stiffener of structural steel for general rigidity and to dampen transformer noise. It shall also withstand partial vacuum as per latest CBIP manual against standard atmospheric pressure. Maximum tolerance on the negative side of the steel sheets shall be 0.35 mm as per cl.8.2.2 of IS-1052- 1995 (Specification for Rolling and cutting tolerances for hot rolled steel products).

Tank design shall be such that the core and winding assembly can be tanked or de-tanked freely and easily.

Inside wall of the tank and the M.S. Core Channel shall be painted with varnish or with hot oil resistance paint. Stiffner shall be continuously welded on the tank wall.

02. . The tank cover shall be bolted on to flanged rim of the tank with a weatherproof, hot/cold oil resistant, resilient gasket in between for oil tightness. If the gasket is compressible, metallic straps may be provided to prevent over compression of the gasket. Access and inspection hole blanked with oil tight gasket and sealed cover plate shall be provided for working on the connection of the leads of winding, the bottom terminals of bushing and off load tap switch. Bushing turrets, cover of access hole, covers for pockets of thermometers and other devices shall be designed to prevent any ingress of rain water. The tank cover as a whole shall shed of all rainwater. The tank cover should have

WBSC OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

downward 90° bent edges on all sides so that the gasket under the top cover is protected from direct exposure to weather.

Gasket used between top cover and tank flange shall be of rubberized cork sheet of 5 mm thick and shall be provided with water tight compound between the tank flange and the gasket.

G.I. nuts, bolts, flat washers, spring washers shall be used and suitably spaced to press the tank cover. The Sl. No., P.O. No, Year of manufacture & property of WBSEDCL etc. shall be engraved on the tank body in addition to those provided in the Name & Rating plate. Adequate care shall be taken so that tank does not get damaged during such engraving.

The conservator shall be liberally dimensioned such that with the lowest temperature and no load on the transformer the oil level shall not reach the lowest level and with the highest ambient temperature and permissible overload on the transformer, the oil will not spill into the breather pipe or to the exterior to waste. The conservator shall be provided with oil level indicator with level marking as per ISS. The inside diameter of the pipe connecting the conservator to the main tank shall be within 20 to 50 mm and it shall be projected into the conservator so that its end is approx. 20 mm above the bottom of the conservator. Conservator shall be provided with drain plugs. Filling hold with cover shall be provided as usual. Conservator pipe shall be welded on the top cover. Explosion vents shall be welded on the top cover. Air release plug should be provided in the explosion vent. Detachable type conservator and explosion vent will also be acceptable. The conservator pipe hole fitted to tank cover should be provided with a suitable slanted plate, so that while pouring oil into the transformer through the conservator oil does not fall directly on the winding. Care should be taken so that free oil flow is not impeded.

03. . PRESSURE TEST:

The tank shall be fixed with a dummy cover with all fittings including bushings in position and shall be subject to air pressure of 35 Kpa above atmosphere for 30 minutes. The permanent deflection of lat plate after pressure has been released shall not exceed the values given below:-

Length of plate
Upto 750mm

Deflection
5 mm

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

751 to 1250 mm &

6 mm

for other sizes

As per CBIP manual

If required, the manufacturers should submit pressure test certificate for the transformers tanks at least for one tank for each batch either conducted by their fabricators or themselves. Transformer tanks should be double welded electrically as per the specification

14. CORE :

1. The magnetic core shall be built of low loss Silicon steel, cold rolled grain oriented steel. Core shall be of stack type.
2. The materials used for insulating the sheets, shall have high inter-lamination resistance and rust inhibiting property. It shall not be deteriorated by ageing from hottest operating temperature and clamped pressure. Quality of core should not dis-integrate due to mechanical modes of core vibration nor to have the least tendency to absorb moisture or to react with the dissolved particles in the insulating oil thus accelerating sludge formation.
3. The assembled core shall be securely clamped in the lines and in the uniform pressure so as to minimize the noise from the core.
4. The core-clamping frame shall be provided with lifting eyes for the

purposes of tanking and un tanking of the live part of the transformers.

The whole core shall be electrically connected by copper strip of adequate section to the core frame at two separate points for being eventually earthed through the tank to drain off electro static potential that may be built up.

Core top and bottom of yoke shall be supported with M.S. Channel of proper size and properly bolted together for stack type core. For wound type cores suitable M.S. clamping device should be used to hold together core laminations firmly to prevent vibration or noise.

5. The supporting framework of the cores shall be so designed so as to avoid the presence of pockets that would otherwise prevent complete emptying of tank through the drain valve or cause trapping of air during filling.

Adequate provision shall be made to prevent movement of the core and winding relative

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

to the tank during transport and installation or while in service

6. The cores shall conform to :

IS : 3024 - 1965 Electrical sheet steel &

IS : 649 - 1083 method of test steel sheet.

7. Successful bidder will offer for core for inspection and/or approval by the purchaser during the manufacturing stage.

The manufacturer's call notice in this regard should be accompanied with the following documents as proof towards the use of prime core material:

(i) Invoice of the supplier

(ii) Mill's Test certificate

(iii) Packing List

(iv) Bill of Landing

(v) Bill of entry certificate to customs

Core material shall be procured either from core manufacturer or through their accredited marketing organization of repute.

15. WINDING :

HV & LV winding shall be wound from Super Enamel covered/ Double Paper covered copper conductor/foil winding for rating 315KVA and above. Transformer shall be provided with the requisite number of windings and shall be designed to withstand the electromechanical stress exerted under short circuit conditions as per ISS:2026 – 1977.

Class "A" insulation shall be used. Paper insulation shall be dry and uniform and free from punctures and other defects. Solid insulation shall be of best quality. Wooden supports, if used, shall be well seasoned and compatible with hot transformer oil. The test certificate of the raw materials shall be made available by the Transformer manufacturer on request during Inspection & Testing.

01. The insulation level of the windings shall be as follows (as per Part-III of IS-2026)

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Voltage	Impulse voltage (KV peak)	Short duration Power frequency voltage (KV)
433/415	-	3
11000	95	28

02. The winding shall be so designed to reduce to a minimum the out of balance forces in the transformer at all voltage ratings.

The winding shall also be designed such that all coil assemblies of identical voltage rating shall be interchangeable and repairing of the winding can be made readily without special equipments.

03. All joints in the winding should be made by Brazing. But in no case crimping is Allowed.

16 BRACING OF WINDINGS:

(1) The windings and connections of all transformers shall be braced to withstand shocks which may occur during transport or due to switching/ short circuit and other transient conditions during service.

(2) Coil clamping rings, if provided, shall be of steel or of suitable insulating material. Axially laminated material other than bakelite paper shall not be used.

17 WINDING AND CLEARANCE INSIDE THE TANK(For Stack type core) CONSTRUCTION:

The winding shall be assembled on the core co-axially for magnetic balance and symmetrically for electrical balance. Liberal ducts shall be provided for oil circulation and lowering hot spot temperature in the winding. Spacers, wedges shall be robust & hard insulations are so fitted in the winding that they will neither move, nor permit any relative movement of any part of the winding during normal service and under a The terminal short circuit, without causing mechanical injury to any insulation in the windings.

- i) Transformer shall have separate H.V. and L.V. windings made of electrical grade hard drawn Copper Wires as specified conforming to relevant I.S.S. of latest edition.
- ii) HV and LV winding shall be wound from Double paper covered copper conductor/foil winding. Qualities of DPC insulation are to be ensured.

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iii) a) No. of HV coils per phase/limb for stack type core shall not be less than 8 nos for voltage ratio of 11/0.433KV or 11/.415KV transformer.

b) For HV winding of 630 KVA and above, continuous disc construction may be used.

iv) Minimum clearance between H.V. Coils/or sections should be 6.4mm and at top/bottom, the minimum clearance should be 12mm including 1.5mm insulating ring.

v) Minimum inter phase clearance (HV to HV) with 3mm phase barriers should be 10mm up to voltage class of 12 KV.

vi) The minimum end clearance (HV to earth) should be 20mm up to voltage grade 12KV.

vii) End insulation at both ends shall include up to 36 KV grade:-

a) 3 mm thick yoke insulation over windings of the phases.

b) 6 mm ducts at the top and bottom for circulation of oil in the LV and HV windings.

viii) The minimum radial clearance in the windings will be as follows:-

a) Between core and L.V. winding 3 mm.

b) Between L.V. winding and H.V. winding 10mm including 2.0mm thick Press Board cylinder, where L.V. windings is 1100 V grade and H.V. winding 12 KV grade.

ix) L.V. cylinder preferably be made of corrugated insulating press board. Oil ducts need to be provided between core and L.V. winding.

x) Minimum clearance between tank wall and H.V. windings/live parts.

a) Where the H.V. winding is 12KV grade, clearance: 25mm No. additional insulating barrier shall be used in between core and LV winding.

The dimension in respect of ducts and clearance in windings shall hold for the assembled windings and core prior to application of pressure for permanent shrinkage of coils. The changes in dimensions in finished condition shall remain within 15% (Fifteen percent).

xi) The stacks of windings shall receive adequate shrinkage treatment before final assembly. Adjustable devices shall be provided for taking up any possible shrinkage of coils in service. The coil clamping arrangement and the finished dimensions of any oil duct shall be such as will not impede free-circulation of oil through the ducts.

18. Conformation to IS standards relating of conductors and insulation.

The following Indian standards specification shall govern the quality of conductor, covering insulation such as enamel, paper and insulating barrels.

1) IS :7404 (Pt. I & II)1974: Paper covered copper conductor(round & rectangle).

2) IS: 1397-1967: Kraft paper

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3) IS: 335-1983 : New insulating oil.

4) IS: 1576-1967

IEC: {B-2.1, B-3.1 & B -4.3 } Solid Press Board for electrical purposes.

19. Bushing for outdoor use: The bushings shall conform to IS: 2000-1968(latest): Bushing for Alternating voltage above 1000 Volts and IS 7421-1974(latest) for bushing upto and including voltage up to 1000 volts.

The dimensions of bushings of the following voltage classes shall conform to Indian Standard mentioned against them.

Voltage Class	Indian Standards	
Upto1KVBushings	For porcelain parts IS:3347/ Part-I	For Metal Part IS: 3347/Part-I (Sec-2) (1979)
12/17.5KVbushings	IS:3347/Part- III(Sec-I)(1972)	IS:3347/Part- III (Sec-

The Height of the HV bushings relative to the oil level gauge should be such that the top of the HV bushings are immersed in the oil when the oil level of the oil level gauge is at minimum position.

The clearances in air between live and conductive parts and live conductive part to earthed structures shall be as follows:

Nominal System	Test Voltage	<u>Clearances</u>		
<u>Voltage KV</u>	In pulse	Phase to Phase(mm)	Phase to Earth(mm)	Arcing Horn gap (mm)
0.433/415	-	85 without cable end box	40 without cable end box	-
		45 with cable	20 with cable end box	
11	95	255- without cable end box	140 - without cable end box	86/85 Refer Fig-26 in IS:3347 (Part-III/Sec-2)-1982
		130- with cable end box	80-with cable end box	

20. . COOLING ARRANGEMENT:

1. The transformer shall be suitable for loading of 100% continuous maximum rating with "ONAN" cooling without exceeding the thermal limit.

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2. The transformer shall be fitted with round or elliptical cooling tubes bent and welded to tank or radiators consisting of a series of separate circular or elliptical tubes, or a pressed steel plate assembly formed into elliptical oil channels, welded at their top and bottom to the tank.
 3. The round cooling tubes shall be made of mild steel(ERW) having a minimum wall thick less of/ 1.50 mm and a clean bright internal surface free from rust and scale. They shall be suitably branched to protect them from mechanical shocks normally met in transportation and to damp the modes of vibration transmitted by the active part of the transformer in service. The elliptical tubes or elliptical oil channels of pressed steel plate at least of 18 SWG(or 1.25 mm Thickness).
 4. The manufacturer will have to provide information regarding wall surface area of tank radiator cooling tubes separately as part of the guaranteed technical particulars.
21. . PAINING:
1. The surface to be painted shall be completely cleaned & made free from all rust, scale or foreign adhering matter on grease. The cleaning & de-rusting can be done by sand blasting or other approved method.
 2. All steel surface in contact with insulating oil as far as accessible shall be painted with heat resistant, oil insoluble, insulating varnish or paint.
 3. All steel surface exposed o weather, shall be given a primary coat of Zinc chromate and two coats of dark admiral gray paints. (IS 104 &IS 2932) OR Powder coating painting as specified by CEA

All paints shall be carefully selected to withstand tropical heat and extremities of weather. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.
 4. All nuts and bolts used in the transformer for external fittings shall be galvanized or zinc passivity and painted with body paint.
22. Over Fluxing: Over fluxing in the core shall be limited to 12.5% so that the flux density in the core does not exceed 1.9.Tesla (19000 lines/sq.cm)
The maximum flux density in any part of the core under such condition shall not exceed 19000 lines/ Sq.cm. on the basis of M4, M5 & M6 grades as per BS601: Part-

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2:1973(Specification for sheet and form a gnetic circuits of electrical apparatus oriented Steel)

23. Transformer Oil:

The oil shall be as specified in IS:335-1980 and it shall be free from moisture and have uniform quality throughout.

24. a) The outdoor apparatus including bushing insulators shall be designed so as to avoid pocket in which water can collect.

b) All mechanism shall be so as to prevent sticking of due to avoid rust and corrosion.

a) All apparatus shall be designed to minimize the risk or accidental short circuit caused by animals, birds or vermin.

25. Internal Earthing Arrangement:

All metal parts of the transformer with the exception of the individual core laminations, core bolts and associated clamping plates shall be maintained at some fixed potential and core Should be earthed at two points.

26. AnythingnotcoveredbythisspecificationwillbeasperrelevantI.S.S./RECSpecification.

27.	Fittings:- The following fittings shall be provided with the transformers	
	i) Name, Rating & Terminal Marking Plates	xi) Filter Valve wheel/screw type- with $\frac{3}{4}$ " & $1\frac{1}{4}$ "for 315 and
	ii) Earthing Terminals with lug- 2 nos	xii) Explosion vent with air release
	iii) Lifting Lugs- 2 nos.	xiii) Explosion vent (double diaphragm) with pressure equalizer
	iv) Thermometer pocket with cap	xiv) OTI with mercury (A&T)contact (630KVA&above)
	v) Silica gel type breather	xv) Buccholz relay
	vi) H.V. bushings with arcing horns	xvi) Isolating valve betn. conservator & Buccholz relay(630KVA & above)
	vii) L.V. bushing for phases& Neutral	xvii) Marshalling box for OTI & all accessories connection termination.
	viii) Conservator with Oil gauge (315 KVA)	xviii) 4nos roller for Transformers of 160 KVA and above.
	ix) Conservator with Oil gauge and MOG(630 KVA	xix)Platform mounting arrangement- Base channel 75x40mmforupto 100KVAand

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	& above)	100x50mm above 100 KVA, 460 mm long with holes to make them suitable for fixing on a platform or plinth.
	x) Steel drain-cum-sampling valve-wheel/screw type-P- ¾" & 1¼"for 315KVAand630 & above KVA rating	

28.0 Cable Boxes

28.1 In case HV/LV terminations are to be made through cables the transformer shall be fitted with suitable box on 11KV side to terminate one 11KV, 3 core Aluminium conductor cable upto 240sq.mm.(Size as per requirement). The bidder shall ensure the arrangement of HT Cable box so as to prevent the ingress of moisture in to the box due to rain water directly falling on the box. The cable box on HT side shall be of the split type with faces plain and machined and fitted with Neo-k-TeXor similar quality gasket and complete with brass wiping gland to be mounted on separate split type gland plate with nut-bolt arrangement and MS earthing clamp. The bushings of the cable box shall be fitted with nuts and stem to take the cable cores without bending them. The stem shall be of copper with copper nuts. The cross section of the connecting rods shall be stated and shall be adequate of carrying the rated currents. On the HV side the terminal rod shall have a diameter of not less than 12 mm. The material of connecting rod shall be copper. HT Cable support clamp should be provided to avoid tension due to cable weight.

The transformer shall be fitted with suitable LV cable box having non-magnetic material gland plate with appropriate sized single compression brass glands on LV side to terminate 1.1KV, single core XLPE armoured cable (Size as per requirement).

Annexure – A

TRANSFORMER LOSS FIGURES:

DTR KVA Rating	Voltage Ratio	Maxm. Allowable NO load loss(In Watts)	Maxm. Allowable Load loss at 100% loading at75°C (In Watts)	Maxm. TOTAL LOSS(NLL+LL) at100% loading at 75°C (In Watts)	% Impedance (± 10% Variation as per ISS)
315 KVA	11/0.433 KV(O/D)&11/ 0.415KV	800	3600	3630	5%

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630 KVA	11/0.415KV O/D&I/D	1200	6500	6640	5%
800 KVA	11/0.415KV O/D&I/D	1400	6500	8000	5%
1000 KVA	11/0.415KV O/D&I/D	1600	9300	9800	5%
Maximum Limit of No load loss and Load Loss figures as mentioned above are without any positive tolerance					

PART- C

ROUTINE & TYPE TEST AND OTHER COMMON DETAILS FOR 16-160 KVA AND 315 - 1000KVA DISTRIBUTION TRANSFORMER

1.00 Test & Inspection:-

1.01 Routine Test:

All transformers shall be subjected to routine tests at the manufactures works.

The following tests are to be carried out :

- a) Measurement of winding resistance.
- b) Ratio, polarity and phase relationship
- c) Impedances voltage
- d) Load losses
- e) No load loss and no load current.
- f) Insulation resistance.
- g) Induced over voltage with stand.
- h) Separate source voltage withstand.
- i) Characteristic requirement of oil sample will be as per IS: 1866-1983 amended upto 1987.
- j) Unbalance current: The maximum value of unbalance current in transformer shall not exceed 2% of full load current as per CBIP for transformer
- k) **16KVA to 160KVA - Magnetizing current at rated voltage & frequency & 112.5% of rated voltage & frequency should not exceed the limit as per IS:1180(Part-I) 1989 cl.22.6 up to 100KVA and magnetizing current at rated voltage & frequency & 112.5 % of rated voltage in respect of 160 KVA DTR should not exceed 2.25% & 4.5% respectively of full load current.**
- l) **315KVA and above-Magnetizing current at rated voltage & frequency & 112.5% of rated voltage i.r.o 315KVA, 630 KVA and above shall not exceed 2 & 4 % respectively.**

1.02 Type Tests:-

In addition to the routine tests, the following type tests are to be made by the manufacturer, who does not have type tests report witnessed by WBSedCL and prototype sample of identically designed transformers.

- a) Dynamic short circuit withstand test to be conducted as per cl.16.11.4.4. of IS:2026 (Part-I) 1977.
- b) Impulse voltage withstand test to be conducted as per cl.13 of relevant IS.

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- c) Temperature rise test – is mandatory and will be conducted on one transformer for every lot offered for inspection. temperature rise test for transformers having tap-changers shall be done at lowest tap at appropriate current related to the said tap position with losses fed corresponding to minimum voltage tapping. This is as per amendment no. 2, 19 & 4 to IS- 2026, (Part-2) – 1977]

Note: - To facilitate testing, arrangement should be made for carrying out Heat run test of two transformers simultanec

- d) Pressure test – Pressure test on tank as mentioned in the clause at 9.12 (Part-B) and clause 13.03 (Part-A) of this specification WBSEDCL's testing wing may witness the said test, at the shop, if required.

1.03 The manufacture will have to submit thermal calculation of short circuit withstand ability seconds and 3 seconds.

1.04 Performance under external short circuit condition and limit of temperature rise.

1.05 All transformers shall be capable of withstanding, without damage the thermal and effects of a short circuit at the terminals of any of windings for 2 secs. The temperature windings after 2 secs. Of over current must not exceed 200°C for Al and 250°C for windings.

1.06 After the above tests, the transformer shall be subjected to all or a part of the routine test. The criteria for evaluation of test results shall be the same as that for the test to determine the dynamic ability to withstand short circuit in accordance with ISS 2026.

1.07 WBSEDDCL may also make a testing arrangement for carrying out short circuit tests with duration not exceeding 2 secs. For distribution transformer upto 100 KVA in a NABL/Govt approved Laboratory. The transformer subjected to such test shall be examined for temperature rise within specified limit for any damage or displacement of any parts within the transformer.

1.08 Variation % reactance

The transformer so tested shall not exhibit more than 2 percent variation in percentage reactance for stack core and 4% for wound core after the short circuit test form the original measured value before testing according to clause 16.11.5.4 of IS 2026 (Part -I) , 1977, however wound core is accepted upto 100KVA DTR, beyond that stack core is applicable

1.09 The selection of transformer for such test shall be carried out at the discretion of the company from any lot of transformer of same capacities offered for inspection and testing before delivery.

1.10 If records of type tests carried out in presence of WBSEDCL's Representative, along with proto type sample of a particular transformer with identical design with essential details, is representative of the one being purchased, are produced, the purchaser may accept these as evidence of actual test.

1.11 The bidder should submit type test report of short circuit test and lighting impulse voltage test along with drawing from CPRI, NABL/Gove. Approved laboratories carried out within five years along with their offer having identical rating and type as that of the tendered item as pre-requisites, mentioned in GCC, failing which their offer may not be technically accepted.

1.12 However, if it is found that the bidder has submitted tests report of identical rating but not conducted on identical design of equipment/material as per specification of WBSEDCL, may be accepted for technical qualification, but after placement of order, the manufacturer has to arrange for Dynamic short circuit & Impulse tests at CPRI, NABL/Gove. Approved Laboratories on a sample chosen at random during routine test by

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our representative, as per WBSEDCL's design in presence of the Engineers of WBSEDCL before mass production is undertaken.

However routine test and temperature rise test shall be done on a sample/ samples chosen (at random upto 100KVA DTR but for higher KVA rating DTR, 100% routine tests shall have to be done) during routine test of transformer in presence of Engineers of WBSEDCL. Routine test and temperature rise test shall have to be carried out at the premises of the manufacturer/supplier before aforesaid type test.

All charges for carrying out such tests, have to be borne by the manufacturer.

2.00 Inspection & Testing:-

- 2.01** Inspection & testing as already mentioned the equipment shall be subjected to routine & other acceptance test as per provisions in the relevant I.S
- 2.02** WBSEDCL reserves the right to send its Engineers if so, desires to witness manufacturing process and to reject either raw materials or finished products found to be not complying with requirement of the specification and also shall have the right to select any/ all equipment from the lot offered for tests.
- 2.03** The manufacturer shall give at least fifteen (10) days advance notice regarding readiness of such Inspection and testing and shall submit the sets of work test certificates of the materials/equipment offered for inspection and testing indicating probable date of inspection and testing.
- 2.04** The supplier shall arrange all possible facilities for such inspection and testing at any time during the course of manufacturing, free of cost.
- 2.05** The transformer may be stage inspection at the factory of the manufacturer. The manufacturer shall intimate in advance in writing to the purchaser above the stages of manufacture & subsequent readiness of the transformers to enable him to carry out stage inspection & final inspection and testing of the finished transformers.
- 1.06** The stage inspection will be carried out at the discretion of the purchaser during the process of manufacturing of the transformers. The manufacturer need not stop the process of production because of programme of stage inspection of the purchaser.
- 2.07** While offer for final inspection the following point should invariably be taken care of.
- i) Name plates should be welded on the tanks of the transformer.
 - ii) The bolts connecting the top cover of the transformer with the tank at the two opposite comers are to be provided with holes at their lower portions which would go beyond nuts so that the transformer may be sealed by inserting wire in these holes.

3.00 Test certificates: -

Seven copies of test certificates as mentioned above are to be furnished to WBSEDCL for acceptance before issuance of instruction for dispatch of the equipment.

4.00 Drawings & Manuals: -

- 4.01** The following drawings and manuals shall be furnished in triplicate along with tender.
- i) General Arrangement outline drawing with plan, elevation and end view showing various dimension of transformer and its vital equipment including height of the bottom most portion of bushing from the bottom of base channel and also indicating thereon physical center line & position of center of gravity.

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- ii) Cross sectional drawing showing various parts, including core - coil assembly.
 - iii) Sketches for rating plate, complete list of fittings, net weight of core, winding, tank, oil, total weight, fixing arrangement of transformer in structures.
- 4.02** The following drawings in six sets shall be submitted for approval within 15 (fifteen) days from the date of placement of L.O.I/Order.
- 1. as stated in clause 4.01 above.
 - 2. Cross sectional details with plan, Elevation, End view showing all internal clearance.
 - 3. Drawing of name & rating plates.

5.00 Guaranteed Technical Particulars: -

Tenders shall be furnished with guaranteed technical particulars of equipment offered as per Schedule-A. Performance guarantee shall be based on guaranteed technical particulars.

6.00 Performance certificate as pre-requisites: -

Copies of performance certificates of similar equipment supplied to various organizations shall have to be furnishing along with the tender.

7.00 Credentials as per-requisites: -

Tenderer shall furnish document along with bid, in support of supply, delivery at consignee stores (e.g copy of PO, SRV, and Challan etc), of identical type & rating transformer and also higher capacity with same voltage ratio and type, to the Govt. & power utility, indicating thereon names of the Organization, quantity ordered, quantity supplied along with the tender. Credentials for purchase orders shall be within last 3(three) financial years from the date of from the date of NIT publication.

8.00 Type Test Report as pre-requisites

- i) The bidder should submit Type Test Report of short circuit test and lightning impulse voltage test along with drawing from CPRI, NABL/Gove. Approved laboratories carried out within five years along with their offer having identical rating and type as that of the tenderer item as per-requisites mentioned in GCC, failing which their offer may not be technically accepted. This is applicable for 16 to 315KVA DTR.
- ii) For the transformers, not usually used/procured in WBSEDCL system, Type Test report of transformers with higher rating but same type and with same voltage ratio shall be submitted along with drawing from CPRI, NABL/Gove. Approved laboratories carried out within five years from the date of NIT WBSEDCL. This is applicable for 630 KVA & above rating DTR.
- ii) In addition to the routine tests, type tests are to be arranged by the manufacturer, who does not have type tests report from CPRI/NABL accredited lab witnessed by WBSEDCL and also prototype sample of identically designed transformer.

9.00 Deviations:-

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All deviations from the specification shall be recorded in the deviation sheet' with reference to respective clauses of the specification by drawing specification for the same. Unless deviation are recorded in the deviation sheet and submitted with the offer, it will be taken for granted that the offer is made in conformity with specification.

10.00 Validity Period:-

10.01 Validity period of the offer shall be reckoned from the next date of opening of tender provided it is technically and commercially complete one. Otherwise, will be counted from the date of receipt of complete information.

10.02 Anything not covering by this specification will be as per relevant CEA/REC specification & ISS/CBIP manual.

11.00 Capitalization of losses:-

11.01 Bidder shall state the transformer losses viz. a) Iron loss b) Copper loss separately. Transformer losses will take into account during bid evaluation. The losses at rated load, rated voltage & frequency shall be guaranteed.

i) **Capitalized value of iron loss (No load loss) per KW = Rs.3, 19,218 /-**

ii) **Capitalized value of copper loss (load loss) per KW = Rs.95, 754 /-**

If any losses after routine tests are found beyond guaranteed value declared in the bid offered, penalty will be imposed for the excess loss over the corresponding guaranteed value by applying the above stated values. For fraction of a KW, penalty shall would be applied to the specific lot. **No changes in guaranteed figures will be allowed after bid opening.**

29.00 Store Testing:-

The materials/equipment delivered to consignee stores will be subjected to inspection/testing in presence of your authorized representative for which due notice in advance will be furnished by the CE/Addl. C.E. (DTD). If any discrepancy/dispute in quality arises in any sample selected from a lot, the supplier shall have to replace that specific lot at the supplier's cost and WBSEDCL reserves the right to take any penal action whatsoever without any further reference. For higher loss values obtained during above tests, capitalization of losses' clause of this specification will be applicable on you.

Loss values whichever is higher as obtained during factor test and store test, shall be considered For Loss CAPITILISATION.

However for 160 KVA and above rating transformer, covered by 100% quantity checking by routine test, store testing shall have to be done at the discretion of CE/Addl. CE testing if necessary.

30.00 Asset Codification no: -

Asset Codification no. for the ordered quantity shall be communicated to the supplier after placement of order. Necessary Engrave/Embossing (Cold punch) shall be done on

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the main tank with 28 no font size and DTR name and diagram plate with font size not less than that used for marking KVA rating of the DTR.

If cold punch on the tank is not possible then separate property plate (details marking of the plate shall be submitted with the transformer drawing for approval) shall be welded to the tank with the following details:-

1. Ratings:
2. Manufacturer's SI. No. :
3. Manufacturer's Name :
4. P.O. No. :
5. Year of Manufacturing :
6. Property of : WBSEDCL
7. Asset Code Number : (10 digit alpha numeric numbers as allotted by the purchaser)

Again the following points shall have to be noted

- a) Front Size of letter shall be 28 i.e. 7 mm x 5.5 mm
- b) Letters shall be distinctly engraved by cold punch
- c) Plate size shall be minimum 125mm x 170mm and shall be electrical run Welded be throughout its perimeter
- d) Material of plate shall be Mild steel and not less than 3mm thick.
- e) Plate shall be welded on the transformer tank at visible position and height.

31.00 TESTING EQUIPMENTS

- i) KV Meter (0 – 30 KV) for 11 KV system
- ii) Volt Meter (0 – 100 KV)
- iii) Milli ammeter for leakage current (0 – 1010 ma)
- iv) Power analyzer of reputed make (should display 3 – ph current, voltage, watt and power.
- v) Megger – 2.5 KV
- vi) Thermometer (preferably Digital) – 0 - 100°C
- vii) TTR Meter
- viii) Winding resistance measurement (Preferably ELTEL or reputed)
- ix) Digital multimeter to measure magnetizing current & core balance of 11 KV systems.
- x) Clamp on Ammeter (0 – 300A)
- xi) Current transformer having ratio 25 - 50 – 100 / 5A or 25 / 5A, 50/5A, 100/5A with suitable accuracy and burden.

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ALL THE ABOVE TESTING EQUIPMENTS SHALL BE AVAILABLE IN THE TESTING LAB AND SHOULD BE CALIBRATED FROM NABL ACCREDITED LABORATORY. COPY OF CALIBRATION CERTIFICATES AS PER GCC CLAUSE NO. 8 SHALL BE AVAILABLE WITH THE BIDDER AS AND WHEN REQUIRED.

ANNEXURE-A **SCHEDULE OF ACCESSORIES REQUIRED FOR TRANSFORMERS CAPACITY IN KVA** **(UPTO 11 KV VOLTAGE CLASS)**

<u>SL.NO</u>	<u>ITEM</u>	<u>16 KVA</u>	<u>25 KVA</u>	<u>63 KVA</u>	<u>100 KVA</u>	<u>160 KVA</u>	<u>315 KVA</u>	<u>630K VA and above</u>
3	Terminal plate & terminal marking plate nos.	1	1	1	1	1	1	1
2	c) Steel drain - cum - sampling valve - p - 3/4" thread (as per REC spec) - nos.	1	1	1	1	1	0	0
	c) Steel drain - cum - sampling valve - wheel/ screw type - p - 3/4"	0	0	0	0	0	1	0
	c) Steel drain - cum - sampling valve - wheel/ screw type - p - 1 (1/4")	0	0	0	0	0	0	1
3	Earthing terminal - nos.	2	2	2	2	2	2	2
4	Lifting lugs - nos.	2	2	2	2	2	2	2
5	Platform mounting arrangement	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	Silicagel type breather	1	1	1	1	1	1	1
7	H.V. bushings with arcing horns-if otherwise not mentioned	3	3	3	3	3	3	3
8	L.V. bushing for phases & neutral-if otherwise not mentioned	Req d.	Req d.	Reqd.	Reqd.	Req d.	Reqd.	
9	Oil filling holes with plug/cap	2	1	0	0	0	1	1
10	Filter valve(wheel/screw type)	0	0	1	1	1	1	1
11	Thermometer packet nos.	0	0	1	1	1	1	1
12	Air release plug on top cover nos.	0	0	1	1	1	1 (on Inspection cover	1 (on Inspection cover
13	Conservator with filling hole with cover and drain plug & oil gauge nos.	0	0	0	0	0	1	1

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

14	Conservator with filing hole with cover and oil gauge nos.	0	0	1	1	0	0	0
15	Off circuit tapping switch with marking: nos.	0	0	0	0	0	1	1
16	Cast Iron roller (plain) nos.	0	0	0	0	4	4	4

17	Oil gauge nos.	1	1	0	0	0	0	0
18	Diagram plate nos.	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.	Reqd.
19	Explosion vent with air release plug no.	0	0	0	1	1	1	0
20	Explosion vent with double diaphragm & port hole window & air equalizer	0	0	0	0	0	0	1
21	Inspection cover nos.	0	0	0	0	1	1	1
22	OTI with Mercury Contacts(A&T)	0	0	0	0	0	0	1 set
23	MOG with Low oil Level Ann. Contact	0	0	0	0	0	0	1 set
24	Buccholz relay withy Ann & Trip contact	0	0	0	0	0	0	1 set
25	Isolation valve betn. Conservator & Buccholz relay no.	0	0	0	0	0	0	1
26	Marshalling Box no.	0	0	0	0	0	0	1

27	Auxiliary supply	30V DC \pm 10% and 230VAC \pm 10%, 1-Phase, 4-wire, 50 c/s
28	Bushing clearance:	This should be as per ISSS pacification. The angle of inclination of the H.V. bushings should not exceed 33° with the vertical axis.
29	Tank:	Tank should be as per /ISS./CBIP standard for conventional type. For 315 KVA & above rating Dtr, tank all must be from tested mild steel of thickness 4.00 mm and top & bottom plate of the tank must be of 5 mm thick. For 16 to 160 KVA Dtr, the thickness of tank wall shall be 3.15 mm & top & bottom plate thickness shall be 5 mm.
30	Winding Materials:	copper - above 300 kva rating. For DTR. Below 300 KVA, Aluminium or copper may be used, but no special preference shall be given on conductor material. Similar materials for both L.V. & H.V. winding should be chosen.
31	Cable end box (to be provided for indoor type 100 KVA Tr. & 160 KVA and above rating Tr. if mentioned specifically, in that case the voltage ratio shall be 11/0.415KV)	
Note: The location of thermometer pocket (without tap changer) should be directly above 11KV winding and as near to the top of the yoke as possible and at the center of top cover. Thermometer pocket inside the tank should be as per relevant I.S.		

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WEST BENGAL STATE ELECTRICITY DISTRIBUTION CO.LTD

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS

SCHEDULE –A

(To be furnished and signed by the tenderer for each category of transformer)

SI. NO.	PARTICULARS		GTP TO BE FILLED BY THE BIDDER FOR EACH OFFERED RATING
1	Name of the manufacturer		
2	Country of origin	::	
3	Applicable standard	::	
4	Maximum continuous rating in KVA	::	630 KVA
5	No load voltage ratio (In KV/KV)	::	
6	Rated frequency (in HZ)	::	
7	Number of phases	::	
8	Type of cooling	::	
8	Type of cooling	::	
9	Connections	::	
	i) H.V. Winding		
	ii) L.V. Winding		
10	Vector Symbol		
11	i) Temperature also under normal operating condition above ambient temperature	::	
a)	Top oil (in Deg. C.)	::	
b)	Winding (in Deg. C.)	::	
c)	Maximum hot spot temperature of winding(in Deg. C)	::	
12	Magnetising current referred to H.V. at rated frequency	::	
a)	At 90% rated voltage (in Amps)	::	
b)	At 100% rated voltage (in Amps)	::	
c)	At 112.5% rated voltage (in Amps)	::	
d)	At 110% rated voltage (in Amps) for 315 & 630 KVA DTR		
13	Power factor of magnetizing current at 100% rated voltage & frequency	::	
14	No load current at rated voltage and rated frequency (in Amps)	::	
15	Maxm. No load loss in watt at rated frequency & voltage	::	
16	Maxm. load loss in watt at 75 Deg C. at rated output and frequency	::	

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

17	Total loss (including NLL&FLL) at 100% loading & rated condition		
18	Percentage regulation at full load at 75 Deg. C.	::	
a)	At unity power factor	::	
b)	At 0.8 power factor lagging	::	
19	Efficiencies at 75 Deg. C. (in percentage)	::	
a)	At full load	::	
	(i) At unity power factor	::	
b)	At 3/4 full load	::	
	(i) At unity power factor	::	
	(ii) At 0.8 power factor lagging	::	
c)	At 1/2 full load		
	(i) At unity power factor		
	(ii) At 0.8 power factor lagging		
19	a) Impedance voltage on rated KVA base at rated current and frequency at 75 Deg. C (in percentage)	::	
20	a) Reactance voltage at rated current and frequency at 75 Deg. C (in percentage)	::	
	b) Reactance voltage at rated current and frequency at 75 Deg. C (in percentage)	::	
21		::	
a)	Resistance at H.V. base at 75 Deg. C (ohms)	::	
b)	H.V. (Between lines) (ohms)	::	
c)	L.V. (Between lines) (ohms)	::	
22	Reactance at H.V. base at 50 c/s	::	
23	Withstand time without injury for three phase dead short circuit at terminal (in seconds)	::	
24	Short time current rating for short circuit with duration	::	
a)	H.V. Winding (in Amps)	::	
b)	L.V. Winding (in Amps)	::	
c)	Duration in seconds	::	
25	Permissible over loading with time at max amb temp	::	
a)	125% load after running with 50% load with steady temp rise.(hrs.)	::	
b)	120% load after running with 100% load with steady temp rise.(hrs.)	::	
26	Core:		
	i) Material Type:		
	ii) Whether stack core/wound core Type		
	iii) flux density of core and yoke:		

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

(a)	At rated voltage at 50 HZ (in line/sq.cm)	::	
(b)	At 112.5% rated voltage at 50 HZ (in line/sq. cm)		
	(iv) Thickness of stampings (in mm)	::	
	(v) Type of insulation between core lamination	::	
27	Terminal Arrangement	::	
	(i) High voltage		
	(ii) Low voltage		
28	Positive sequence impedance between HV&LV winding on rated KVA base at rated current and frequency at 75 Deg. C. winding temperature(in percent)	::	
29	Zero sequence impedance at reference temperature of 75 Deg. C (in percent)	::	
30	Details of winding :	::	
(i)	Type of winding :	::	
	(a) High voltage	::	
	(b) Low voltage	::	
(ii)	Material of the winding conductor	::	
	(a) High voltage	::	
	(b) Low voltage	::	
(iii)	Conductor Area	::	
	(a) High voltage (in sq.mm)	::	
	(b) Low voltage (in sq.mm)	::	
(iv)	Current density of winding at rated KVA	::	
	(a) High voltage (Amps per sq.mm)	::	
	(b) Low voltage (Amps per sq.mm)	::	
(v)	Insulation material used for	::	
	(a)High voltage winding	::	
	(b) Low voltage winding	::	
(vi)	Insulation material used between	::	
	(a)High voltage and low voltage winding	::	
	(b) Low voltage winding and core	::	
(vii)	Type of joints in the winding		
31	Insulation withstand test voltages	::	
	(i) Lightning impulse withstand test voltage (KV peak)	::	
	(ii) Power frequency withstand test voltage (in KV rms for 1 mtn)	::	
	(iii) Induced over voltage withstand test voltage (in KV rms)	::	
32	Current in the winding at rated KVA	::	
	(i) Low voltage	::	
	(ii) High voltage		
33	voltage per turn (KV per turn)	::	
34	Ampere turn	::	

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

35	Number of turns	::				
	(i) Low voltage	::				
	(ii) High voltage	::				
36	Bashing		High Voltage		Low	
	(i) Make	::	Voltage			
	(ii) Type	::				
	(iii) Applicable standard	::				
	(iv) Insulation withstand test voltage	::				
(a)	Lightning impulse withstand test voltage (1.2 x 50 micro seconds (in KV peak)	::				
(b)	Power frequency withstand test voltage (in KV for 1 min)	::				
	(i) Dry	::				
	(ii) Wet	::				
	(iii) creepage distance in air	::				
	(vi) Total (in mm)	::				
	(v) Protected(in mm)	::				
	(vi) Minimum height of the bushing					
37	Minimum clearance (in mm)	::				
	(between live conductive part and live conductive parts to earthed structure	::	In Oil		In Air	
		::	Between phases	Phases to Ground	Between phases	Phases to Ground
	(I) H.V.	::				
	(ii) L.V.	::				
38	Approximate weight of transformer (in Kgs)	::				
	(i) Core with clamping	::				
	(ii) Coil with insulation	::				
	(iii) Core and winding	::				
	(iv) Tank and fitting with accessories	::				
	(v) Un tanking weight	::				
	(vi) Oil required for the transformer	::				
	(vii) Total weight with core, winding, oil and fittings	::				
39	Details of Tank	::				
	(i) Type of tank	::				
	(ii) Approximate thickness of sheet (in mm)	::				
	(a) sides	::				
	(b) Bottom	::				
	© Cover	::				
	(iii) Vacuum withstand capacity	::				
	(iv) Dimension of base channel (in mm x mm)	::				

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

40	Oil quality	::	
	(i) Applicable standard	::	
	(ii) Total Quality of oil (in liters)	::	
41	Approximate Overall Dimensions(in mm)	::	
	(a) Length	::	
	(b) Breadth	::	
	© Height	::	
	(d) Minimum height of bottom most portion bushing from bottom of base channel	::	
42	minimum clearance height for lifting tank cover (in mm)	::	
43	Whether type test report, credential, performance certificate has been submitted as per-requisites as mentioned in the respective clauses of technical specification.		
44	Marking : Whether agreeable to		
	a) Punching of transformer sl. no. on the yoke.		
	b) Transformer rating and diagram plate along with asset codification number shall be welded on the tr. Body.		
45	Painting: Type of Painting of all steel surface.		
46	Whether the following testing equipments available in the testing lab of manufacturer		
	a) KV Meter (0 - 30 KV) for 11 KV System		
	b) Volt Meter		
	c) Milli ammeter for leakage current		
	d) Power Analyzer of reputed make (Should display 3 Current, 3 Voltage, 3 Watt and 3 Power		
	e) Megger - 2.5 KV		
	f) Thermometer (Preferably Digital)- 0 - 100°C		
	g) TTR Meter		
	h) Winding Resistance measurement (Preferably ELTEL or reputed make)		
	i) Digital Multi meter to measure magnetizing current & core balance of 11 KV System.		
	j) Clamp on Ammeter (0 - 300A)		
	k) CT having ratio - 25 - 50 - 100/5A or separate 3 nos CT Accuracy class and burden shall be mentioned.		

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

	l) Whether all the above testing equipments are available in the testing lab of the manufacturer and are calibrated from NABL accredited lab.		

3. 500 KVA DG SETS

SECTION – I

GENERAL SPECIFICATION

3.1. DIESEL ENGINE

3.1.1. CONSTRUCTION

- (a) The Diesel Engine shall be 4 cycle, multi cylinder, heavy-duty industrial type with rated electrical output. Engine shall be rated generally in accordance with the Equipment Schedule.
- (b) Cylinder housing and crank case shall be of high grade cast iron with overhead valves. Housing and heads shall be provided with necessary cooling fins.
- (c) Crank shaft shall be manufactured from solid forging with hardened crank pin and main bearing journals. The entire shaft shall be truly balanced.
- (d) Pistons shall be of close grained cast iron of aluminium alloy and provided with necessary compression and scrapper rings and a fully floating gudgeon pin.
- (e) Connecting rods shall be H-section steel stampings. Camshaft shall be gear driven (fly-wheel end) and easily removable. Fly wheel shall be accurately balanced meeting the requirements of cycle variation as set down in BS: 649.
- (f) Lubrication system shall be complete with necessary gear pump, piping and drilled oil passage strainer, oil cooler etc. and relief valve. SS 201 grade/SS 304 grade stainless steel butt hinges shall be a proprietary product durable for long life operation (tested to 200,000 cycles) shall have certificate of compliance & shall comply with IS 12817: 2013 code; unless otherwise specified, hinges shall be naturally finished bright with smooth surface without chemical coating. Pairs of 100-102 mm x 75-76 mm x 2.5-3 mm CE11 butt hinge suitable for both commercial and residential use on doors up to 80 kg shall be supplied with self-tapping fixing screws, size of screws shall be as per Hinge manufacturer's recommendation.

3.1.2. COOLING

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- (a) The engine shall be radiator cooled or through a heat exchanger as specified in the equipment schedule. A thermostatic valve should by-pass the coolant in the primary circuit until a pre-set operating temperature is reached.
- (b) The heat exchanger shall be cleanable shell and tube with prime surfaced copper tubes of minimum 15 mm dia. The cooling side of the exchanger shall be designed for the system pressures encountered.

3.1.3. FUEL SYSTEM

- (a) Fuel injection equipment shall be driven by the timing gear train and complete with oil strainers, injectors etc. Fuel is to be supplied from the day tank with necessary piping.
- (b) A tank of specified capacity shall be provided for lasting at least for 10-hour period or 900 ltrs whichever is lower. The tank shall be complete with filter breather unit and drain plug.

3.1.4. FILTRATION

- (a) The engine shall have cleanable fuel oil filters. Lub oil filtration shall be through strainers which are capable of being cleaned when the engine is running. Air filtration shall be through oil bath or cleanable dry type filters.

3.1.5. ENGINE EXHAUST

- (a) The engine exhaust piping shall be amply sized for minimum back pressure and connected to the engine manifold through flexible connection on one side and to a silencer on the other side. The silencer shall be packed type with adequate attenuation for urban use (Residential type), constructed from heavy gauge galvanised steel. The sound absorbent infill shall be nonhygroscopic, vermin proof, non-combustible material. The silencer shall be adequately sized to impose minimal additional aerodynamic loading on rotor fans.
- (b) The exhaust piping from the silencer on wards shall be led up to the top most level and discharged through a rain cowl as shown on drawings. Entire exhaust piping and silencer shall be insulated with 75 th 48Kg/cum density fibre glass white wool. The insulation shall be held in position with galvanised steel wire mesh 0.63 dia 20 mesh and finished neatly with 26 SWG Aluminium cladding.
- (c) The exhaust piping shall be fabricated with mild steel as shown in the equipment schedule and all flanged joints shall have spiraget high temperature gasket. The piping shall be installed with necessary thermal expansion facility as required and shown on drawings.

3.1.6. SAFETY AND CONTROL SYSTEMS

- (a) The Engine should have Electronic Engine Management Systems and Electronic fuel injection systems with electronic injectors for better fuel efficiency and emission standards.

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The Governor shall be an independent essential ancillary employing electric / electronic control through preferably a microprocessor based control system. The system shall be isochronous with 3% droop and suitable for auto start and auto synchronising. The EMS-governor shall trip the engine at the pre-set over-speed and shut-off the fuel supply.

- (b) All safety and controls shall be monitored and measured through EMS and adequate safety and tripping shall be monitored through EMS., other safety controls and indicating instruments shall be as shown in Equipment Schedule.

3.1.7. ENGINE STARTING

- (a) The engine shall be electrically started and the battery shall be 24V lead acid high discharge tubular type and rated for 4 (four) consecutive starting kicks and the continuous drain for signals and controls. All batteries shall be complete with associated charger incorporated in the generator panel. The starting system shall be complete with necessary relays & solenoid valves for fuel, control and indicating panels as specified and required.

3.1.8. MOUNTING AND INSTALLATION

- (a) A common rigid bed plate shall be provided for the engine and alternator which shall be flexibly coupled. The coupling must be done after ensuring proper alignment of generator and engine shafts.
- (b) The entire engine set shall be mounted on suitable Rubber-in-shear type vibration mounts with 6 mm static deflection for isolating the building floor. A nominal base concrete pad (if required) shall be provided by clients, over which the engine set with its own base frame and vibration mounts shall be mounted. The base concrete pad in turn shall be mounted on multiple cork pads of 300 x 300 x 50 mm wrapped in polyethylene faced Hessian.

SECTION: II

3.2. ALTERNATOR

3.2.1. TYPE & RATING

- (a) Alternator shall be 3 phase, 4 wire 50 cycles 415 volt, brushless screen protected drip proof with self-contained excitation system and self-regulating and conforming to BS 4999/5000 & continuously rated in accordance with BS 2613. The alternator should have the rated capacity at 0.9 PF. The alternator shall be designed to suppress radio interference in conformity with BS 800.
- (b) The alternator shall be of fabricated steel construction conforming to IP class specified dynamically balanced rotor with two bearings and damper windings. The unit shall be with

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a large terminal box for outgoing cable connections specified. Necessary adaptor box shall be provided wherever required.

- (c) Alternator rotor shall be salient pole type with a damper cage and dynamically balanced. Insulation shall be to class 'B' or 'F' or 'H' (BS 2757/1957). Insulation on other windings of minimum class 'E'. All winding shall be fully impregnated for tropical climates with high quality oil resistant varnish.
- (d) Ventilation to the alternators shall be by means of fans fitted on the rotor.

3.2.2. EXCITATION SYSTEM

- (a) The main exciter shall receive power from a permanent magnet generator via Automatic Voltage regulator. The AVR shall be of solid state circuitry and shall provide regulated voltage to the exciter compensating for all normal variations. The main exit or output is fed to the main motor windings via a rotating 3 phase bridge rectifier assembly which shall be protected from voltage surges, short circuit, and overload and diode failures. The AVR and control gear shall be mounted in a component box on the side of the machine. Electrical connections to the AVR shall be taken through a multiway plug and socket.
- (b) Voltage regulation shall be within ± 2.5 (two and half percent) under all conditions of load, power factor and temperature including cold to hot variation. Voltage drift shall be negligible. There shall be no radio or television interference. Line voltage wave form shall be as true as possible with a total harmonic distortion not exceeding 3% on 3 Ph load. The response to transient load shall be rapid as specified.
- (c) The excitation system and engine governor shall be such that the alternator is capable of starting up induction motors having a starting KVA of not less than 1.5 times the alternator rated KVA.
- (d) Manufacturer should indicate the voltage dip and duration under such conditions as required under equipment data.
- (e) The neutral of each generating set shall be earthed solidly to ground with facility for isolation through a fully rated contactor or manual switch as shown on drawings.

3.2.3. AMF operation

- (a) The DG sets shall be suitable for AMF operation. A separate DG power Dist. Panel will be installed where the incomer ACB. (EDO) shall be operated from the AMF relay signal from DG set
- (b) The AMF logic shall start the DG set automatically only in the event of:
 - i. Mains failure

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- ii. Phase failure
- iii. Voltage, drop to 85% of 415V (Not fault tripping)
- (c) The set shall be capable of starting and taking up the load within the time stipulated in equipment schedule.
- (d) The sequence of AMF operation shall be as follows:
 - i. Upon main power failure, the generator shall receive 4 kick starts and the generator breaker shall close only after building up of voltage.
 - ii. Get the Mains Breaker open by sending potential free contact to trip the mains breaker and thereafter incoming DG power Controlling breaker shall be made ON.
- (e) On restoration of power, AMF logic should provide the following commands.
 - i. Trip the Generator power controlling Breaker
 - ii. Thereafter sending closing signal (by potential free contact) to close the Mains breaker and conform the closing of Mains breaker
 - iii. DG will continue to run (for at least 1 to 2 minutes or as per the time to be set) till it conforms the stability of Mains Power.
- (f) DG set shall have the following Equipment / features:
 - i. Battery charger with normal and trickle charging facility and an isolating switch.
 - ii. Over load, S/C, E/F, UV, OV, Over Speed protection for DG set.
 - iii. Meter and indicators as follows:
 - Meter Generator as under Equipment schedule
 - Indication and Alarm annunciation

Additional	Indication	Alarm
Charger on	yes	-
Failed to start	yes	yes
Low oil pres.	yes	yes
Gen. to load	yes	-
Mains to load	yes	-
High water Temp	yes	yes
Low Lub Oil Pres.	yes	yes

— Auto-Manual change over switch

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

Start-Stop Reset	Buttons
Alarm Reset	Buttons
Lamp testing	Buttons

- (g) There shall be a 24 V high performance sealed tubular type lead acid stationary battery with suitable AH capacity suitable for 4 (four) cranking attempts of (2 seconds each) plus all indicating lamps and alarm before any cell voltage goes down to 1.8 V. Battery shall be complete with necessary wooden stand and multistrand flexible copper leads. The battery charger shall be capable of floating the battery with quick and trickle charging facility to maintain a cell voltage of 2.25 V per cell.

3.2.4. TESTING & COMMISSIONING

- (a) After installation or before dispatch from Factory, the set shall be run for a minimum period of 1 hours continuously on no load. On satisfactory completion of the no-load run the set shall be run for a period of three hours at 100% full load and 1 hours at 110% loads. All consumables including fuel and lub oil required for commissioning the set shall be supplied by the contractor, except the diesel. Test readings as per Annexure V together with a log of the running test shall be furnished.
- (b) The diesel generating set complete with: -
- Engine and alternator with flexible coupling.
 - Mounting frame with vibration isolation mounts.
 - 24 V battery with leads, stand, acid etc. along with Battery Charger.
 - Expansion tank, heat exchanger and piping to and heat exchanger, exp. tank. Flexible connection and exhaust piping up to and including Exhaust Silencer insulation of the same.
 - 990 ltrs in built day tank placed inside the acoustic enclosure shall be considered.
 - Exhaust piping from the Exhaust Silencer to the discharge end including the discharge cowl shall be considered including insulation.
 - All control wiring of generating sets shall be carried out with 1100 V grade 1.5 sq. mm. copper PVC insulated and sheathed multi-core cables.

3.3. FUEL STORAGE FACILITY

- (a) DAY TANK

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

Fuel from the bulk storage tank shall be transferred to the Day Tank located in the engine room. The day tank of the size as specified by the Engineer-in-Charge shall be fabricated out of mild steel sheets, complete with fill connection, overflow, feed connections and a gauge glass.

(b) PIPING

All piping shall be steel heavy duty pipes to IS 1239 with welded fittings. All fittings up to 40 mm shall be socket weld type.

SECTION – III

3.4. EQUIPMENT SCHEDULE

3.4.1. ENGINE

(a) Rating

- i. Minimum Engine Rating : 1 No. 500 KVA, (Prime Power)
- ii. Altitude (m) : Within 1000 mean sea level
- iii. Air humidity : 30% Min. 97% Max.
- iv. Air temperature (c) : Minimum 5°, Maximum 50°, Average 40°
- v. Duty : Continuous variable load @ 75% L.F unrestricted hours & at specified ambient temperature. The DG should capable to run continuously 600 hours from one lub oil change to next lub oil change.
- vi. Standard : BS 5514, ISO 3046

(b) Overload capacity for one hour in 12 hours of continuous running: 10% over the continuous rating

(c) Governor : Electronic Governing

(d) Starting

- i. Method: Electrical : Electrical
- ii. No. of auto starts : 4 (four)
- iii. Selectivity : Auto/Manual/Test

(e) Exhaust System

- i. Length of exhaust piping from engine onwards: As specified in specification
- ii. Silencer: 1 high efficiency residential silencer

3.4.2. Engine protection / controller along with Electrical Protection, O/C, S/C, E/F, U/V, O/V etc.

(a) Safety Controls & Instruments

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

- i. Over speed Governor: Trip @ 18% over normal
 - ii. Two-point thermostat: Audible & visible alarm, Trip engine with trip indication
 - iii. Lub oil temperature: Audible & visible alarm
 - iv. Low oil pressure: Trip engine
 - v. Fuel failure: Audible & visible alarm
 - vi. Oil Pressure gauge: Yes, required
 - vii. Thermometers for water in, out, lub oil, ex.gas: Yes, required
 - viii. Water pressure gauge: Yes, required
 - ix. Hour counter: Yes, required
- (b) Sundry fitting
- i. Anti-Vibration mounts: Special anti-vibration pads mounted between engine / alternator and common skid base.
 - ii. Pump for fuel filling from barrels & draining engine oil etc.: Manual, Hand operated
- (c) Pollution
- i. Sound level @ 1m from engine: By Vendor
 - ii. Emission:

NOX	Less than	2000 mg/m ³
CO	Less than	650 mg/m ³
Unburnt	Less than	150 mg/m ³
Fuel		

D.G. should conform to CPCB-II ,
Or as per latest norms of Govt (CPCB-IV)

3.4.3. ALTERNATOR

3.4.4. Rating at 45 Deg. C

- i. Continuous duty: 500 KVA, 400 KW 0.8 PF, 3PH, 415V, 50Hz Y neutral brought out
- ii. Emergency duty: As per IS 8528
- iii. Minimum efficiency: 91%
- iv. Enclosure: IP 21 (IEC) & IS 4691
- v. Winding: Class B/F insulation
- vi. Cooling: IC 01 IS-6362
- vii. Excitation System: Brushless exciter with rotating diode assembly
- viii. Over speed: 120 %

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- ix. Transient response & Response voltage dip: Max. 20% dip on application of full load at stated P.F and recovery in 20 cycles.
- x. Sustained short circuit: Min. 300% of FLC for 3 secs.
- xi. Terminal Box: 3 cables 3.5 C- 240 mm sq AYFY

3.4.5. FUEL OIL FACILITY

(a) Integral fuel tank

Integral fuel tank to be supplied with content indicator, fuel fill cap, fuel feed and return lines to engine and drain plug. (NA).

(b) Day tank (10 SWG steel)

990 lit. with supply, over flow, drain, filter and gauge glass.

(c) Piping

From day tank to engine set

3.4.6. ACOUSTIC INSULATION

Generating set shall be housed inside a high quality acoustic enclosure. The relevant type test certificate copy of the enclosure has to be submitted along with the offer. Type Test shall have to be done from the listed Testing laboratory of Central Pollution Control Board.

4. OUTDOOR TYPE NON-EXTENSIBLE 11 KV COMPACT RING MAIN UNIT SWITCHGEAR

4.1. GENERAL

The RMU shall be 4-way type with 2 nos Fixed LOAD BREAK SWITCH and 2 nos VCB with protection, housed in steel enclosure with SF6 environment and suitable for outdoor installation.

This RMU shall be complete with all the components necessary for its effective and trouble free operation along with associated equipment etc. Such components shall be deemed to be within the scope of supplier's scope of supply.

The RMU shall be fixed type, SF6 insulated, Vacuum circuit breakers with 3- O/C and 1-E/F relay (with IDMT and HS element) for the protection of the outgoing cable / Transformers / Compact Substation. It shall be maintenance free equipment having stainless steel robotically welded IP-67 enclosure.

4.2. SITE CONDITION:

- i. Temperature : (Max) 50 ° C, (Min) 5 ° C, (Avg) 40 ° C

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- ii. Humidity : (Max) 100%, (Min) 70%
- iii. Wind power : 260 Kg/Sq.Mt.
- iv. Avg. Rain fall : 1750 mm to 2250 mm
- v. Pollution : Highly polluted Class III

4.3. REFERENCE STANDARD:

- (a) All equipment and material shall be designed manufactured and tested in accordance with the latest applicable IEC standard
- (b) Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted. In such case copies of English version of the standard adopted shall be submitted
- (c) The electrical installation shall meet the requirement of Indian Electricity Rules, 1956 as amended up to date, relevant IS code of practice and Indian Electricity Act, 1910. The Electricity Act, 2003 shall also apply. In addition, other rules and regulations applicable to the work shall be followed. In case of any discrepancy, the most stringent and restrictive one shall be binding.
- (d) The high-tension switchgear offered shall in general comply with the latest issues including amendments of the following standards but not restricted to them.

4.4. RELEVANT IEC / IS

- 60694: 12729 Common clauses for high-voltage switchgear and control standards (for voltages exceeding 1000 V).
- 62271-200: A.C. Metal-enclosed switchgear and control gear
- 60129: Alternating current disconnectors (isolators) and earthing switches
- 60529: 13947 Classification of degrees of protection provided by enclosures
- IP 67 for tank with high voltage components
- IP 3X for the front covers of the mechanism
- IP 3X for the cable connection covers
- IP 54 for the outdoor enclosure (kiosk)
- 60265: High voltages switches Part 1
- 62271-100: 13118 High Voltage AC Circuit Breakers, General Requirement.
- 6005 Colour for ready mixed paints and enamels, Code of practice for phosphating of iron and steel,
- 60044-1: Current Transformers
- 60044-1 Voltage Transformers
- 60255: Electrical Relays

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- 60 9135 High Voltage testing techniques.
- 427 13516 Method of Synthetic Testing of H.V.A.C Circuit Breakers.
- IEC 62271-200 MV metal-enclosed switchgear,
- (IEC 62271-102) AC disconnections and earthing switches,

4.5. DESIGN CRITERION

Service conditions

The 11 kV BREAKER shall be suitable for operations at an altitude up to 1000 meters, as per IEC 60120, above sea level. The BREAKER shall be capable of operating normally within the following temperature range:

- Maximum ambient temperature: + 50 ° C
- Minimum ambient temperature: + 5 ° C

Manufacturer shall declare whether BREAKER is able to operate in air temperature higher than + 50 °C and if current de-rating is necessary. The BREAKER shall be capable of being electrically commanded. And BREAKER shall be suitable for future motorization. The BREAKER shall be capable of being exposed to high relative humidity and polluted environments. The BREAKER shall be suitable for outdoor use.

4.6. DESIGN PARAMETERS

Network Three phases - Three wires

Rated Voltage 12 kV

Service Voltage 11 kV

System Frequency 50 Hz

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Lightning Impulse withstand Voltage

Phase to phase, phase to earth

Across the isolating distance

75 kV

95 kV

Power Frequency withstand voltage 28 kV rms - 1 mn

Rated Normal Current

Line switches

630 Amps

Rated Short time current withstand (3 sec) 21 kA

Internal Arc 1 sec 20 KA

Rated Short circuit making capacity of line switches & breaker 62.5KA

Number of operations at rated short circuit current on breaker 20 OC operations

Rated load interrupting current

Line switch

630 Amps

No load line / cable breaking current capacity

No load transformer breaking capacity 25 A

25 A

Number of mechanical operations of line switch 1000 O/C

Number of mechanical operations of Earth switch 1000 O/C

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Number of electrical operations at full rated current	100 O/C at 630 amps
Number of electrical operations at full rated current for breaker	2000 O/C at 630 amps
Number of Mechanical operations at full rated current for breaker	2000 O/C
Insulating Gas	SF6
Nominal operating gas pressure	1.4 bar abs, 20 Deg Cent
Gas leakage rate per Annum in percentage	0.1% per annum
Facilities for gas monitoring	Required
Expected operating life time	30 years
Rated operating sequence of Circuit Breaker	0-0.3 sec-CO-3 min-CO
Total Opening time of Circuit breaker	40 – 50 ms
Total Closing time of Circuit breaker	30 – 45 ms
All of the switchgear shall be capable of withstanding these parameters without any damage being caused, in accordance with the standards mentioned in this specification	

4.7. RMU CONFIGURATION

2 NOS OF BREAKER (OUTGOING FOR TRANSFORMER / FEEDER CABLE CONTROL) + LOAD BREAK SWITCH (INCOMER)+ LOAD BREAK SWITCH (RING).

Please refer enclosed Single Line Diagram.

The following configurations shall be required:

EACH OUTGOING CIRCUIT BREAKER (2 nos VCB) will have the following –

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- SF6 INSULATED VACUUM Circuit breaker 11 kV, 630 A, 21 kA
- Mechanism for motorised operation (with manual option) .
- Capacitive voltage indication fixed type
- ON, OFF, TRIP indication on the front mimic of the panel.
- Cable box for termination of cable up to 1 No.3C - 185/240 sq. mm 11 KV (UE) cable
- Emergency Trip Push Button.
- Set of 11kV Cable boots suitable for 1x 3C- 185/240 mm sq 11 KV (UE)cable.
- relay for protection (50/51-RYBN)
- Fault passage indicator
- Protection CTS , 100-50 / 1 amps, protection class – 5P20, burden to be selected as per relay requirement
- Metering CTS , 100-50 / 1 amps, Accuracy class –0.5, burden to be selected as per connected Ammeter and MFM
- Multi Function Meter (MFM)
- Ammeter with selector switch

LOAD BREAK SWITCH FOR INCOMING AND RING – 2 NOS.

-
- Cable switch 11 kV, 630 A, 21 kA.
 - Mechanism for motorised operation (with manual option)
 - Capacitive voltage indication fixed type
 - ON, OFF, EARTH indication on the front mimic of the panel.
 - Cable box for termination of cable up to 1x 3C-300/400 sq. mm 11 KV (UE) cable
 - Set of 36kV Cable Boots suitable for 1x 3C-300/400 mm sq 11 KV (UE) cable.
 - Earth Switch with interlocking arrangement

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4.8. MAKE OF MAIN / MAJOR EQUIPMENT

- MAKES OF 33 KV 4 Way RMU : Schneider/ ABB/ Siemens
- Make of Protection Relay : Schneider /Alstom / ABB / C&S
- Make of HT CT & PT : Siemens /ABB/Schneider
- Make of MFM / TVM : SECURE/L&T/Schneider
- Make of Indicating Instru : AE

4.9. RMU

4.9.1. Introduction

The BREAKER shall meet the criteria for compact, metal-enclosed outdoor switchgear in accordance with IEC 62271-200, IEC 60694:

- Switchgear classification: PM class
- Loss of service continuity class: LSC2A

It shall include, within the same metal enclosure, the number of MV functional units required for connection, power supply, i.e.: switch disconnectors, earthing switches.

4.9.2. Switchboards

The switchgear and bus bar shall all be contained in a stainless steel enclosure filled with SF6 at 0.3 bar relative pressure to ensure the insulation and breaking functions. Sealed for life, the enclosure shall meet the "sealed pressure system" criterion in accordance with the IEC 62271-1 standard (§ 3.6.6.4 and 5.15.3) : "a volume for which no further gas processing is required during its entire expected life. In addition, manufacturer shall confirm that maximum leakage rate is lower than 0,1 % / year. It shall provide full insulation, making the switchgear insensitive to the environment (temporary flooding, high humidity...), IP67 degrees of protection in accordance with recommendation IEC 60529 § 14.2.7. It shall provide full insulation, making the switchgear insensitive to the environment conditions such as pollution, humidity, dust, etc.

The active parts of the switchgear shall be maintenance-free and the switchboard shall be low-maintenance. The switchgear shall provide IP2X degree protection with the exception of the MV cable entrance and earthing plug where entrance is admissible. The tank shall be made of 3 mm ANSI 304 unpainted stainless steel. The colour shall be RAL 9002 / 7035 for the enclosure. The switchboards shall be suitable for mounting on a trench, utilities space or base. Each switchboard shall be identified by an appropriately sized label which clearly indicates the functional units and their electrical characteristics. The switchgear shall be designed so that the positions of the

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different devices are visible in its front panel; in addition, the cubicle must have voltage indicators that allow check if any income or outcome is energized.

In accordance with the standards in effect, the switchboards shall be designed so as to prevent access to all live parts during operation without the use of tool.

4.9.3. Dielectric medium

SF6 gas is the preferred dielectric medium for MV BREAKER s. Oil filled / Air insulated switchgear will not be considered. SF6 gas used for the filling of the BREAKER shall be in accordance with IEC 60376.

4.9.4. Bus bars

Comprising of 3 nos of single phase copper bus bar and connected to the switch or circuit breaker. The bus bar shall be integrated in the cubicle. Bus bars shall be rated to withstand all dynamic and thermal stresses for the full length of the switchgear.

4.9.5. Earthing of metallic parts

There shall be continuity between the metallic parts of the switchboard and cables so that there is no electric field pattern in the surrounding air, thereby ensuring the safety of people. The substation frames shall be connected to the main earth bus bar without dismantling any bus bars.

4.9.6. Earthing of the main circuit

The cables shall be earthed by an earthing switch with short-circuit making capacity; the earthing switch can only be operated when the cable switch is open. in compliance with IEC standard 62271-102. The earthing switch shall be fitted with its own operating mechanism. The speed of the manual as well as motorised closing, driven by a fast-acting mechanism, is independent of the operator. Mechanical interlocking systems shall prevent access to the operating shaft to avoid all operator errors such as closing the earthing switch when the cable switch is closed and the earthing switch operating shaft shall have a padlocking facility.

4.9.7. Earthing Switch

Earthing switch shall be rated equal to the switchgear rating. Earthing switch shall be

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Quick make type capable of making rated fault current. It can be operated from the front of the cubicle.

4.9.8. Circuit Breaker

The circuit breaker inside SF6 chamber shall be consist of Vacuum circuit breaker confirming to latest IEC standards. The CB shall be maintenance free. The breaker shall be capable of performing a full cycle O-0.3sec-CO-3min CO. The CB shall be three position independent operation. The disconnector operation is only possible when circuit breaker is open. The CB shall be suitable for up gradation for electrical operation in future. The CB shall be equipped with a self-powered protection relay for over current and earth fault. The circuit breaker mechanism shall have mechanical endurance of at least 2000 mechanical operation. It shall be fitted with a local system for manual as well as motorised tripping by an integrated push button.

4.9.9. "Network" disconnectors

They shall be maintenance-free, with breaking in low pressure SF6 gas.

The position indicator shall provide positive contact indication and reliability of indication in accordance with IEC 62271-102 standard. The switches shall be of the type E3 "increased operating frequency" in accordance with IEC 60265-1 § 3.104 standard. They shall have 3 positions with individual operating mechanism for network disconnector and earth switch, open-disconnected, closed and earthed, and will be constructed in such a way that natural interlocking prevents unauthorized operations. The switches shall be fully mounted and inspected in the manufacturer's factory. Manual as well as motorised opening and closing will be driven by a fast-acting mechanism, independent of operator action. Each load break switch shall be suitable for an electrical operation. The load break switch and earthing switch operating mechanism shall have a mechanical endurance of at least 1000 mechanical operations. An operating mechanism can be used to manually as well as motorisedly close the switch and charge the mechanism.

4.9.10. BREAKER bushings and Cable terminations

(a) Bushing

The bushing shall be conveniently located for working with 1 run of 3 core 400 Sq mm 11 kV cables specified and allow for the termination of these cables in accordance with the instructions

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supplied for the 630A M16 bolted connectors on line switches. The profiles of the cable connection bushings shall be in compliance with EN-50181 standards.

(b) Cable clamps

A Ferro-magnetic cable clamp arrangement must be provided for all network cables terminated on the BREAKER.

(c) Padlocking facilities

Live load break switches and earthing switches can be locked in the open or closed position by means of padlocks introduced in holes of 8 mm diameter.

(d) Voltage indicator lamps and phase comparators

Each function shall be equipped with a voltage indicator box on the front of the device to indicate whether or not there is voltage in the cables. The capacitive dividers will supply low voltage power to the lamps. Three inlets can be used to check the synchronization of phases.

This device shall be in compliance with IEC 61 958 standard.

(e) Relay specification for outgoing VCB feeder of 11 KV.

Protection Relay

The 11 KV compact switchgear shall be equipped with SELF POWER numerical MICROPROCESSOR BASE RELAY relays, to trip the circuit breakers. This relay shall have 3 O/C and 1 E/F element with IDMT & High Set characteristics.

(f) Fault locators / Fault passage indicator

The FPI 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 FPI shall be self-powered and should have internal lithium battery for external indication and setting of FPI in the absence of current.

The FPIs shall include:

Fault detection - Phase to phase and Phase to earth faults.

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One potential-free output contacts for hardwiring to RTUs. On this basis, the SCADA/DMS will be able to monitor phase / earth fault condition.

Local fault indications - LCD display on FPI front panel along with LED indication on front panel of RMU enclosure.

Multiple reset option –

End of time delay (Adjustable from 2 to 16 Hrs)

Remote reset (Via potential free input contact of FPI)

Manual reset (Reset button on front panel of FPI)

Automatic reset on current restoration.

The characteristics of the FPIs shall include:

Phase fault thresholds configurable from at least 100 to 800 A

Earth fault thresholds configurable from at least 20 to 200 A

Multiple number of steps for adjusting phase and earth fault thresholds.

Fault current duration range configurable from at least 40 ms to 100 ms in 20 ms steps and further 100 ms to 300 ms in 50 ms steps.

Variations with respect to these characteristics may be acceptable as long as they prove applicable and provide the same or better flexibility.

(g) Front plate

The front plate shall have an IP 3X degree of protection. The front plate shall include a clear mimic diagram which indicates the different functions. The position indicators shall give a true reflection of the position of the main contacts. They shall be clearly visible to the operator. The lever operating direction shall be clearly indicated in the mimic diagram. The manufacturer's plate shall include the switchboard's main electrical characteristics.

(h) Cable insulation testing

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The Cable testing is possible without disconnecting the cables from the bushing. It shall be preferable to carry out the phase by phase testing. The maximum test voltage shall be less than 50 kV DC for 15 minutes.

(i) Finishing

The device shall be fully designed for use in a hot, humid atmosphere and shall be low-maintenance. At least two lifting rings shall be installed on the top of the switchboards for handling.

4.10. SAFETY OF PEOPLE

Any accidental overpressure inside the sealed tank will be limited by the opening of a pressure limiting device in the lower part of the enclosure. Gas will be released to the bottom and rear of the switchboard away from the operator. Manufacturer shall provide type test report to prove compliance with internal fault, according the relevant standards.

4.11. TYPE AND ROUTINE TESTS

According to this specification and IS/IEC recommendations in accordance with relevant IS 9920/IEC 265/IEC 420 the following type test certificates shall be provided:

- Impulse withstand test,
- Temperature-rise test,
- Dielectric test
- Arc fault test
- Short-time & peak withstand current test,
- Mechanical endurance / operation test,
- Checking of degree of protection,
- Switch, earthing switch making capacity.
- Switch, breaking capacity.
- Duty cycle test
- Internal arc withstand test for HT Chamber
- Checking of partial discharge on complete unit

In addition, for switches, test reports on rated breaking and making capacity shall be provided.

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For earthing switches, test reports on making capacity, short-time withstand current and peak short-circuit current shall be provided.

The routine tests carried out by the manufacturer shall be backed by test reports signed by the factory's quality control department. They shall include the following:

- Conformity with drawings and diagrams,
- Power frequency High voltage withstand test
- Functional operation including interlocking /signalling/aux. device
- Measurement of closing and opening speeds,
- Checking of filling pressure,
- Checking of gas-tightness,
- Dielectric testing.
- Main circuit resistance measurement.
- Fuse combination mechanical checking.

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.

4.12. FACTORY ACCEPTANCE TEST

The acceptance tests shall include all the routine tests mentioned below and also demonstration of tripping through the relay by secondary injection tests. These tests shall be carried out in accordance with relevant standards but not necessarily limited to the following:

- (a) Withstand voltage at Power Frequency for all current carrying parts including wiring
- (b) Measurement of resistance of the main circuit -Extensible / extensible BREAKER
- (c) Leakage test
- (d) Withstand power frequency voltage on auxiliary circuits
- (e) Operation of functional locks, interlocks, signalling devices and auxiliary devices
- (f) Suitability and correct operation of protections, control instruments and electrical connections of the circuit breaker operating mechanism (primary & secondary injection)
- (g) Verification of wiring
- (h) Visual Inspection Routine test shall be carried out on all equipment such as circuit breakers, current transformers, relays, etc. as per relevant standards.

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(i) Tripping and closing time of circuit breaker and load break switches

4.13. QUALITY

When requested by the customer, the supplier shall provide proof that he applies a quality procedure in compliance with the standard, namely:

- Use of a quality manual approved and signed by a top management representative,
- Periodic updating of the manual so that it reflects the quality control procedures in effect,
- ISO 9001 and ISO 14001 certification.

5. SOLAR POWER SYSTEM

The general scope under this contract includes to design, manufacture, testing, inspection, packing and forwarding, transportation up to project site, loading & unloading, storage in safe custody, erection, carrying out preliminary tests at site, commissioning, performance testing, operation and maintenance for 5 years & handing over to the purchaser all the equipment installed for 36 KWp capacity of SPV Power plant at roof tops of different Towers for common area lighting.

SITE VISIT

Contractors are requested to visit the site for assessment of space for mounting structure of the SPV modules, Inverter /PCUs etc. and ascertaining of cable length.

SCHEDULE OF REQUIREMENT

The illustrative Schedule of requirements is in accordance with the specifications contained in this document

5.1. System Details:

Sl.No.	Brief Description	Units
1	SPV modules for aggregate capacity of 24KWp (6KWp x 4) as per specifications	1Set
2	SPV module mounting structure suitable for accommodating aggregate Capacity for aggregate capacity of 24KWp (6KWp x 4) as per specifications including Civil foundation as per specifications on roof/ ground.	1Set
3	PCUs as per specifications for aggregate capacity of 24KWp (6KWp x 4) as per specifications multiple Units of Inverter of 6KVA capacity.	1Set

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4	Array Junction Boxes as per requirement for each unit	1 Set
5	Data Logging system with remote monitoring as per specification	1 Set
6	AC Distribution units as per Specifications	1 Set
7	Cables requirement as per design for each site	Mtrs. As required
8	Fire extinguisher in accordance with BIS codes for electrical short circuit fires along with sand buckets for each site	1 set each
9	Lightning arrester complete set as per Specification for each site	1 set each
10	Earthing complete set as per Specification for each site	1Set each
11	Spares, tools and plant for 5 years operation and maintenance	As per list
12	Providing training to engineers and site staff for operation, maintenance and troubleshooting skills for each site	--
13	Operation and maintenance of the SPV Power Plant for a period of 1 year from date of commissioning of the Power plant.	1 Item
14	Engineering electrical drawings and installations and O&M Manuals for each site	1 Set

All the items against which no make has been mentioned must consider to ISI standards.

The SPV Power plant shall have a aggregate capacity of 24 KWp (6 kWp x 4). It shall be of On-Grid type without battery backup and connected to Grid.

5.2. SOLAR PHOTO VOLTAIC MODULES

The total solar PV array capacity should not be less than of 24 KWp (6 kWp x 4). and should comprise of mono or poly crystalline solar module of minimum 250Wp and above wattage. Module capacity less than minimum 250 watts should not be supplied. The module type must be qualified as per IEC 61215 (revised) / **IS 14286 standards and in addition**, the modules must conform to IEC61730-1 requirements for construction & part-2 requirements for testing for safety qualification. SPV module conversion efficiency shall be equal to or greater than 14–15% under STC. Modules must qualify to IEC 61730 **Part I and II** for safety qualification testing. Certificate for module qualification from IEC or equivalent to be submitted as part of the bid offer. Self-undertaking from manufacturer /supplier that the modules being supplied are as per above. The PV module shall perform satisfactorily in humidity up to 100% with temperature between 40°C to +85°C.

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5.2.1. Module shall have warranty as per the minimum specification of MNRE

Other general requirement for the PV modules and subsystems shall be the following:

- (a) Raw materials and technology employed in the module production processes shall have to be certified and a certificate giving details of major materials i.e. cells, Glass, back sheet, their makes and data sheets to be submitted for the modules being supplied by the Contractor.
- (b) The rated output power of any supplied module shall have tolerance of minimum +3% and zero negative tolerance as per MNRE standard specs.
- (c) The peak-power point voltage and the peak-power point current of any supplied module and / or any module string (series connected modules) shall not vary more than 3 (three) percent from the respective arithmetic means for all modules and / or for all module strings, as the case may be.
- (d) The module frame, if any, shall be made of a corrosion-resistant material which shall be electrolytically compatible with the structural material used for mounting the modules.
- (e) The module shall be provided with a junction box with either provision of external screw terminal connection or sealed type and with arrangement for provision of by-pass diode. The box shall have hinged, weather proof lid with captive screws and cable gland entry points or may be of sealed type and IP65 rated. In case J.B. is damaged in site within 5 years due to inherent material defect, the module must be replaced. On site repair of J.B. is not permitted as it violates the wet leakage test conditions of the module. Weather proof DC rated MC4 connector and lead cable coming out as a part of the module, making connections easier and secure, not allowing for any loose Connections. Each PV module to be used desired to have Radio Frequency Identification (RFID). The following information must be mentioned in RFID to be used in each module:
 - i. Name of manufacturer of PV module,
 - ii. Month and year of manufacture (separately for solar cells and module),
 - iii. Country of origin (separately for solar cells and module)
 - iv. I-V curve for the module
 - v. Peak wattage, I_m , V_m , FF or the module,
 - vi. Unique serial no & module no;
 - vii. Date and year of obtaining IECPV module qualification certificate
 - viii. Name of the test lab issuing IEC certificate

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- ix. Other relevant information on traceability of solar cells and module as per ISO 9000 series

5.3. ARRAY STRUCTURE

- 5.3.1. Wherever required, suitable number of PV panel structures shall be provided. Structures shall be of flat-plate design either I or L sections.
- 5.3.2. Structural material shall be corrosion resistant and electrolytically compatible with the materials used in the module frame, its fasteners, nuts and bolts. Galvanizing should meet ASTM-A-123 hot dipped galvanizing or equivalent which provides at least spraying thickness of 70 microns on steel as per IS 5905, if steel frame is used.
- 5.3.3. Structures shall be supplied complete with all members to be compatible for allowing easy installation at the roof top site.
- 5.3.4. The structures shall be designed to allow easy replacement of any module & can be either designed to transfer point loads on the roof top or as per site conditions.
- 5.3.5. Each structure shall have a provision to adjust its angle of inclination to the horizontal as per the site conditions.
- 5.3.6. Each panel frame structure is so fabricated as to be fixed on the ground/roof. The structure shall be capable of withstanding a wind load of **150km/hr** after grouting & installation.
- 5.3.7. The structures shall be designed for simple mechanical and electrical installation. There shall be no requirement of welding or complex machinery at the installation site. If prior civil work or support platform is absolutely essential to install the structures, the supplier shall clearly and unambiguously communicate such requirements along with their specifications in the bid. Detailed engineering drawings and instructions for such prior civil work shall be carried out prior to the supply of Goods. The supplier shall specify installation details of the PV modules and the support structures with appropriate diagrams and drawings. Such details shall include, but not limited to, the following; Determination of true south at the site; Array tilt angle to the horizontal, with permitted tolerance ;Details with drawings for fixing the modules; Details with drawings of fixing the junction/terminal boxes; Interconnection details inside the junction/terminal boxes; Structure installation details and drawings; Electrical grounding (earthing);Inter-panel/Inter-row distances with allowed tolerances; and Safety precautions to be taken. The array structure shall support SPV modules at a given orientation and absorb and transfer the mechanical loads to the roof top columns properly. All nuts and bolts shall be of very good quality stainless/galvanized steel. The Structure layout diagram with shading calculation has to be submitted with bid.

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5.3.8. POWER CONDITIONING UNIT (PCU)

Power Conditioning Unit (PCU) is critical equipment in the SPV Power plant. This equipment converts DC power generated by SPV array, into 3 phase voltage AC to be connected to Load. The PCUs required shall be of 6 KVA rating.

Common Technical Specification for PCU

Control Type : Voltage source, microprocessor assisted, output regulation

Output voltage : 3 phase, 415Vac (+12.5%, -20%Vac)

DC Input variables for a basic module

1	MPP range @ p_{nom}	480--850 V
2	Operating Range	200V – 950V
3	Starting voltage	200/250 V
4	No-load voltage	1000 V
5	No. of String	2 x 2

AC Output variables

Rated output	6000 VA
Supply voltage	According to local requirements
Rated current	3 x 72.2 A
Rated frequency	50/60Hz
COS ϕ	0.80 inductive - 0.80 capacitive
Number of grid phases	3
Max. efficiency	>97.8% / 97.6%
Grid monitoring	According to local requirements

General Details

Display	graphical display + LEDs
Interfaces	Ethernet, USB, RS485, S0 output, digital input “inverter off”
Connections,	DC : Solar Connections, AC : Plug

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Ambient temperature	-20 °C ... +60 °C
Temp Monitoring	NA
Cooling	Temp dependent fan
Protection	IP65.
Noise emission	< 52 dB (A) (only Fan noise)

- (a) The PCUs shall be self-commuted and shall utilize a circuit topology and components suitable for meeting the specifications listed above at high conversion efficiency and with high reliability.
- (b) The PCU shall be Hybrid One and shall give the preference to feed the Loads from Solar Energy being produced and shall draw the additional power from mains to meet the load requirements in the case load is more than solar energy being produced.
- (c) Conversely, it should feed the solar power to the Grid if the load is less than the solar energy generated. It shall also draw the Power from Mains for charging of Battery Bank in case of Low Battery conditions. The PCU shall also have the ability for automatic starting, transfer and no-break transfer to an optional generator for extended grid failure periods.
- (d) Since the PCU is to be used in solar photo voltaic energy system, it should have high operational efficiency. The DC to AC conversion efficiency shall at least be 94 percent for output ranging from 20 percent of full load to full load.
- (e) The PCU output shall be 415VAC, 50Hz 3phase Nominal or tracking the grid voltage.
- (f) The PCU shall be able to with stand an unbalanced output load to the extent of 30%
- (g) The PCU shall go to the shutdown/standby mode with its contacts open under the following conditions before attempting and automatic restart after an appropriate time delay in insufficient solar power output.
- (h) Utility-Grid Over or Under Voltage: The PCU shall restart after an over or under voltage shutdown when the utility grid voltage has returned to within limits for a minimum of two minutes.
- (i) Utility-Grid Over or Under Frequency: The PCU shall restart after an over or under frequency shut down when the utility grid voltage has returned to the within limits for minimum of two minutes.
- (j) The PCU generated harmonics measures at the point of connection to the utility services when operating at the rated power shall not exceed a total harmonic current distortion of 4

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percent, a single frequency current distortion of 4 percent and single frequency voltage distortion of 1 percent when the first through the fiftieth integer harmonics of 50 Hz are considered.

- (k) The PCU shall not produce Electromagnetic interference (EMI) which may cause malfunctioning of electronic and electrical instruments including communication equipment, which is located within the facility in which the PCU is housed.
- (l) The PCU shall have an appropriate display on the front panel to display the instantaneous AC power output and the DC voltage, current and power input. Each of these measurement displays shall have an accuracy of 1 percent of full scale or better. The display shall be visible from outside the PCU enclosure. Operational status of the PCU, alarms, trouble indicators and AC and DC disconnect switch positions shall also be communicated by appropriate messages or indicator lights on the front of the PCU enclosure
- (m) Communication Mod bus protocol with LAN / WAN options along with remote access facility and SCADA package with latest monitoring systems.

5.3.9. ELECTRICAL SAFETY, EARTHING AND PROTECTION

- i. The PCU shall include ground lugs for equipment and PV array grounding.
- ii. All exposed surfaces of ferrous parts shall be thoroughly cleaned, primed, and painted or otherwise suitably protected to survive a nominal 30 years design life of the unit.
- iii. The PCU enclosure shall be weather proof and capable of surviving climatic changes and should keep the PCU intact under all conditions in the room where it will be housed. The INVERTER shall be located indoor and shall be either wall/pad mounted. Moisture condensation and entry of rodents and insects shall be prevented in the PCU enclosure.
- iv. Components and circuit boards mounted inside the enclosures shall be clearly identified with appropriate permanent designations, which shall also serve to identify the items on the supplied drawings.
- v. All doors, covers, panels and cable exits shall be gasketed or otherwise designed to limit the entry of dust and moisture. All doors shall be equipped with locks. All openings shall be provided with grills or screens with openings no larger than 0.95 cm.(about 3 x 8 inch).
- vi. In the design and fabrication of the PCU the site temperature (5° to 45°C), incident sunlight and the effect of ambient temperature on component life shall be

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considered carefully. Similar consideration shall be given to the heat sinking and thermal for blocking diodes and similar components.

5.4. FACTORY TESTING

- (a) The PCU shall be tested to demonstrate operation of its control system and the ability to be automatically synchronized and connected in parallel with a utility service, prior to its shipment.
- (b) Operation of all controls, protective and instrumentation circuits shall be demonstrated by direct test if feasible or by simulation operation conditions for all parameters that cannot be directly tested.
- (c) Special attention shall be given to demonstration of utility service interface protection circuits and functions, including calibration and functional trip tests of faults and isolation protection equipment.
- (d) Operation of startup, disconnect and shutdown controls shall also be tested and demonstrate. Stable operation of the PCU and response to control signals shall also be tested and demonstrated.
- (e) Factory testing shall not only be limited to measurement of phase currents, efficiencies, harmonic content and power factor, but shall also include all other necessary tests/simulation required.
- (f) A factory Test Report (FTR) shall be supplied with the unit after all tests. The FTR shall include detailed description of all parameters tested qualified and warranted.'

5.5. MAXIMUM POWERPOINT TRACKER (MPPT)

Maximum power point tracker shall be integrated in the PCU to maximize energy drawn from the array.

The MPPT shall be microprocessor based to minimize power losses. The details of working mechanism of MPPT shall be mentioned.

ARRAY JUNCTION BOX, MAIN JUNCTION BOX:

The junction boxes are to be provided in the PV yard for termination of connecting cables. The J. Boxes shall be made of FRP/Powder Coated M.S. All wires/cables must be terminated through cable lugs. The J.Bs shall be such that input & output termination can be made through suitable cable glands. Made of FRP or cast aluminium / copper, Copper busbars /terminal blocks housed in the junction box with suitable termination threads Suitable markings shall be provided on the bus-bars for easy identification and cable ferrules will be fitted at the cable termination points for

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identification.

5.6. PLANT CONTROL, DATA LOGGER & PLANT MONITORING UNIT

Basically, this unit should perform the following: -

- (a) Measurement & continuous acquisition of ambient air temperature, wind speed, solar radiation, PV module temperature, PCU output voltage and current, output frequency
- (b) Simple data logger or energy meter to record the energy data on a pre-determined interval basis
- (c) Measurement and /or recording of energy parameters
- (d) Operating state monitoring and failure indication
- (e) Representation of monitored data in graphics mode or in tabulation mode
- (f) Controlling & monitoring the entire power system through remote terminal
- (g) Remote control / Instrumentation: The microprocessor control unit should have the provision for installation of RS-232/485 communication link.

5.7. DC DISTRIBUTION BOARD (as required)

DC Distribution panel to receive the DC output from the array field with analog measurement meter for voltage, current and power from different MJBs so as to check any failure in the array field DCD PBs shall have sheet from enclosure of dust & vermin proof. The busbars are to made of copper of desired size. Suitable capacity MCBs be provided for controlling the DC power output to the PCU along with necessary surge arrestors.

5.8. AC DISTRIBUTION PANEL BOARD

AC Distribution Panel Board (DPB) shall control the AC power from PCU, and should have necessary surge arrestors. Interconnection from ACDB to mains at LT Busbar to be carried out and complete equipment along with metering to be installed in the ACDB. Requirement / specifications of DCDB and AC DB may be changed as per site conditions. An ACDB to be provided at the cable terminating point emanating from 50/40/25KVA PCU for inter connection control of dedicated electrical loads.

All switches at the, circuit breakers, connectors should consider to IEC60947, part I, II and III.

5.9. CABLES & WIRES

- (a) All cable tests and measurement methods should consider to relevant IEC and IS standards.
- (b) Multi strand, annealed high conductivity copper conductor

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- (c) PVC type 'A' pressure extruded insulation
- (d) Overall PVC insulation for UV protection and consider to IEC Standard.
- (e) Temperature range -15°C to +70°C
- (f) Voltage rating 1100V, Conductors are electrolytic grade bright annealed copper which provides maximum conductivity.
- (g) Conductors are insulated with specially formulated PVC compound having high insulation resistance, Di-electric, strength, high critical oxygen index and high temperature index.
- (h) The separate insulated cores are to be assembled to form multi core cable. Cables are provided with exclusively formulated PVC compound for sheathing.
- (i) Flame retardant.
- (j) Flexible / armored type as required at site condition
- (k) All AC side cables will conform to IS 694
- (l) Sizes of DC and AC cabling will be made to minimize the loss.
- (m) All interfaces between panel integral cable and extension cable must be done using MC4 connectors only. If multiple inputs are given to one T.B in the J.B, then the parallel connections must be done using suitable MC4 male/ female and Y- connectors.

5.10. LIGHTNING PROTECTION

There shall be the required number of suitable lightning arrestors installed in the array field. Lightning protection shall be provided by the use of metal oxide resistors and suitable earthing such that induced transients find an alternate route to earth. Protection shall meet the safety rules as per Indian Electricity Act.

5.11. EARTHING SYSTEM

Each array structure of the PV yard shall be grounded properly. In addition, the lightning arrester / masts should also be provided inside the array field. Provision shall be kept be provided inside the array field. Provision shall be kept for shorting and grounding of the PV array at the time of maintenance work. All metal casing / shielding of the plant should be thoroughly grounded in accordance with Indian Electricity Act. /IE Rules. Earth resistance shall be tested in presence of the representative of Assam Energy Development Agency after earthing by calibrated earth tester. PCU ACDB & DCDB shall be earthed properly.

5.12. FIRE EXTINGUISHERS

5.13. TECHNICAL SPECIFICATION

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The firefighting system for the proposed power plant for fire protection shall be consisting of:

- (a) Portable. CO2 fire extinguishers (4.5 KG) in the control room for fire caused by electrical short circuits. - 2 nos
- (b) Sand buckets (3 nos of buckets filled with sand & water) in the control room– 1 set

The installation of Fire Extinguishers shall be considered as per TAC regulations and BIS standards. The fire extinguishers shall be provided in the control room, housing of the batteries and PCUs as well as on the roof top where the PV arrays have been installed. CMC includes up keep & maintenance such equipment also.

6. INTERNAL ELECTRICAL WIRING & INSTALLATIONS

6.1. General

- (a) Technical specification in this section covers the internal wiring installation comprising of:
- (b) Point wiring including circuit wiring for light, lighting and power socket outlets etc. in concealed /surface conduit.
- (c) Wiring for telephone/TV outlets.
- (d) Conduiting of telephone/TV systems.
- (e) Sub-main wiring in concealed/surface conduits.

6.2. Standards and Codes

Following Indian Standard Specification and Codes of Practice, along with Rules, Regulations, Directives and Standards shall apply.

— Rigid MS conduits for electrical wiring:	IS 9537: (I) 1980, IS 9537 : (2) 1981
— Rigid PVC conduits for electrical wiring.	IS 9537:(3) 1981
— Flexible steel conduits for electrical Wiring	IS 3480: 1966
— Switch socket outlets	IS 4615: 1968
— Switches for domestic and similar Purposes	IS 3854: 1966
— Boxes for the enclosure of electrical Accessories	IS 5133: 1969
— PVC insulated wires 660 volts grade	IS 694: 1977
— Code of practice for personal hazard	
Fire safety of buildings	IS 1644: 1960
— Code of practice for personal hazard fire	
Safety of buildings	IS 1646: 1982
— Code of practice for electrical wiring Installations	IS 732: 1989

6.3. Conduiting

- (a) **Rigid PVC Conduits:**

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These shall be FRLS rigid PVC conduit of medium duty type having perfectly circular tubing. It should be suitable for an ambient temperature from (-) 5 deg centigrade to (+) 60 degree centigrade. All conduits shall have proper marking at 50 mm from one end with following Information:

- i. Manufacturer's name & trade marks
- ii. Nominal sizes of conduit
- iii. Classification of conduits e.g, Light duty or Medium duty or Heavy duty
- iv. Country of manufacture.

Size of conduits, its OD & ID and manufacturing tolerance shall be as per the following table.

Nominal size	O/D	Tolerance in %	Inside dia	Inside dia.	Inside dia
			Light duty	Medium duty	Heavy duty
16	16 mm	-0.3	13.7 mm	13.0 mm	12.2 mm
20	20 mm	-0.3	17.4 mm	16.9 mm	15.8 mm
25	25 mm	-0.4	22.1 mm	21.4 mm	20.6 mm
32	32 mm	-0.4	28.6 mm	27.8 mm	26.6 mm
40	40 mm	-0.4	35.8 mm	35.4 mm	34.4 mm
50	50 mm	-0.5	45.1 mm	44.3 mm	43.2 mm

Following tests shall be performed at manufacturer's premises as well as at site :

- 1 Checking of diameter
- 2 Uniformity of wall thickness
3. Mechanical Strength

	At Factory	At site
a. Bending test	✓	✓
b Compression test	✓	✓
c Impact test	✓	-
d Collapse test	✓	✓
e Resistance to heat	✓	✓
f Resistance to burning	✓	✓

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g Electrical characteristics

✓

✓

(b) Rigid MS Conduits:

These shall be rigid MS conduit of medium duty type having perfectly circular tubing. Length of each Conduit shall be either 3M or 5 Mtr as desired by client with required **ISI mark**. It should be suitable for an ambient temperature from (-) 5 deg centigrade to (+) 60 degree centigrade.

Conduit painting shall be done by stove enameled paint / Air drying paint. All conduits shall have proper marking at 50 mm from one end with following Information:

- i) Manufacturer's name & trade marks
- ii) Nominal sizes of conduit
- ii) Classification of conduits e.g, Light duty or Medium duty or Heavy duty
- iv) Country of manufacture.

Size of conduits, its wall thickness and manufacturing tolerance shall be as per the following table depending upon the type of duty

Nominal size	O/D	Tolerance in %	Wall Thickness
16	16 mm	0, -0.3	1.4 – 1.8 mm
20	20 mm	0, -0.3	1.4 – 1.8 mm
25	25 mm	0, -0.4	1.4 – 1.8 mm
32	32 mm	0, -0.4	1.4 – 1.8 mm
40	40 mm	0, -0.4	1.6 – 2.2 mm
50	50 mm	0, -0.5	45.1 mm

Following tests shall be performed at manufacturer's premises as well as at site :

- 1 Checking of diameter
- 2 Uniformity of wall thickness
3. Mechanical Strength

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	At Factory	At site
a. Bending test	✓	✓
b Compression test	✓	✓
c Impact test	✓	-
d Resistance to heat	✓	✓
e Resistance to burning	✓	✓
g Electrical strength testing	✓	✓

External finishes have to be checked: against ingress of water, corrosion & solid foreign Bodies.

(c) Conduit Connections: Rigid PVC

One end of the rigid PVC conduit shall have in built socket. Hence connections between two rigid PVC conduits shall be with socketed joint. Plain & non socketed end of one conduit is inserted in the socketed end of the other conduit with application of approved quality adhesive. Running joints shall be done with of individual socket / couplers of approved quality and finish. Length of sockets / couplers in all cases of joints shall be sufficient to accommodate pipes to full portion of couplers or accessories. Sockets shall be free from grease and oil.

Connection between conduits and sheet metals. Boxes shall be fixed by means of PVC hexagon shaped check nuts fixed both inside and outside the box. Joints in conduits and terminations shall be free of burrs
Connection between MS and PVC conduits, if required, shall be through junction box and never directly.

(d) Conduit Connections: Rigid MS

Connections between steel conduits shall be with screwed couplers of approved quality and finish, ensuring screwed metal-to-metal contact. Length of threads in all cases of joints shall be between 13 mm to 19 mm and sufficient to accommodate pipes to full threaded portion of couplers or accessories. Threads and sockets shall be free from grease and oil. Connection between screwed conduits and sheet metals boxes shall be fixed by means of MS hexagon checknut fixed both inside and outside the box. Joints in conduits and terminations shall be free of burrs and screwed brass bushes shall be provided to avoid damage to insulation of conductors while pulling them through the conduits. Connection between MS and PVC conduits, if required, shall be through junction box and never directly.

(e) Bends: Rigid PVC Conduit

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As far as possible, the conduit system shall be so laid out that it shall obviate use of tees, elbows and sharp bends. No length of conduit shall have more than the equivalent of two-quarter bends from inlet to outlet.

Any bend in running length of conduit shall be done by proper bending machine after pre-heating of the portion of conduit subjected to bending.

(f) Bends: Rigid MS Conduit

As far as possible, the conduit system shall be so laid out that it shall obviate use of tees, elbows and sharp bends. No length of conduit shall have more than the equivalent of two-quarter bends from inlet to outlet.

Any bend in running length of conduit shall be done by proper bending machine.

6.4. Ceiling Outlet circular: Rigid PVC Conduit

Outlet circular shall be manufactured / die cast with 3 mm thick PVC sheet with 14 mm projected collars. These shall be so projected at the time of fixing that no mortar finds its way inside during concrete filling or plastering. For LED fittings the boxes shall be provided 150 mm off centre so that the wiring is taken directly to the fittings / down rod. 3 mm thick PVC sheet cover of matching colour shall be provided.

6.4.1. Ceiling Outlet Boxes: Rigid MS Conduit

Outlet boxes shall be fabricated from minimum 16 SWG mild steel sheets with 14 mm projected threaded collars. These shall be so projected at the time of fixing that no mortar finds its way inside during concrete filling or plastering. For LED fittings the boxes shall be provided 150 mm off centre so that the wiring is taken directly to the fittings / down rod. 3 mm thick PVC sheet cover of matching colour shall be provided.

6.4.2. Fan Hook Boxes:

Ceiling boxes for fan hooks shall be made out of sheet steel not less than 14 SWG and hexagonal / round in shape (125 mm dia and 70 mm depth) with one **properly 'U' shaped** 12 mm dia rod inside. Rod length on both side of fan hook box should come out at least of 200 mm each to be secured tightly with the top reinforcement of the roof. 3 mm thick Perspex / Hylam sheet cover of matching colour shall be provided.

6.4.3. Switch Boxes:

16 SWG mild steel boxes suitable to house modular type front plate of required sizes, unless otherwise stated, and fan regulators as required shall be provided. These will 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 and conduit entries. The grid plates and M.S. boxes shall be fitted with a brass earth terminal. Boxes shall be attached to conduits by means of PVC check nuts on either

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side of their walls. MS boxes shall be completely embedded leaving edges flush with finished wall surface. 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 at different level above floor level unless otherwise indicated.

6.4.4. Draw Boxes:

16 SWG mild steel draw boxes of ample dimensions shall be provided at convenient locations to facilitate drawing of long runs of conductors. These shall be mounted flush with wall /ceiling surface as required and shall have screwed covers of 3 mm thick perspex/hylam sheet.

6.4.5. Inspection Boxes

Inspection boxes of 16 SWG mild steel and steel and having smooth external and internal finish shall be provided to permit inspection and maintenance. These shall be mounted flush with wall /ceiling surface as required and shall have screwed cover of 3mm thick Perspex / Hylam sheet.

6.4.6. Cross Section of conduits

The conduits shall be of ample sectional area to facilitate simultaneous drawing of wires. In no case shall the total cross section of wires measured overall be more than half the area of the conduit. Maximum number of wires permissible in various sizes of conduits shall be as below.

A. As per IS

Size of wires Copper conductor	Diameter of conduits mm					
	19	25	32	38/40	50	63
1.0 SQ. MM.	5	10	14	-	-	-
1.5 Sq. mm.	5	10	14	-	-	-
2.5 Sq. mm.	5	8	12	-	-	-
4.0 Sq. mm.	3	8	10	-	-	-
6.0 Sq. mm.	2	5	8	-	-	-
10.0 Sq. mm.	-	3	5	6	-	-

Concealed wiring shall be installed in accordance with approved drawings, so as to be embedded the entire run of conduits and ceiling outlet boxes with a cover of minimum 12 mm.

Vertical drops shall be embedded in columns or walls unless otherwise stated. Wherever necessary, chases shall be cut by the contractor with the written orders of the owners / architects to sufficient depth to allow full thickness of plaster over conduits. The width of the chases shall be such as to accommodate the

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required number of conduits. The chases shall be cut by cutting machine and filled with cement, coarse sand mortar (1:3) and properly cured by watering. If a chase is cut in an already furnished surface, the contractor shall fill the chase and finish it to match the existing finish. Conduits shall be fixed inside the chases with the help of U clamps/nails at 300 mm center to center.

Contractors shall not cut any iron bars / column to fix the conduits.

When the conduit is to be embedded in a concrete member, it shall be adequately tied to be the reinforcement to prevent displacement during casting. Conduits in chase or laid in the slab shall be supported at maximum of 1 m centers.

Suitable flexible joint fittings shall be provided at all the points where conduits cross any expansion joint in the building.

6.4.8. Painting of Junction Boxes, Fan hook Boxes:

All draw /switch /junction /fan-hook boxes shall be painted with red oxide/galvanized/ cadmium plated.

All un-galvanized / un-plated boxes shall be again painted with red oxide paint as required before fixing.

Boxes fixed on surface shall, in addition, be painted with finishing paint of approved Colour and finish.

6.4.9. 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 welded/ socketed joints shall be made fully water tight with white lead paste.

6.4.10. 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 wires.

6.4.11. Conduits/ Raceways for Ups /Data / Telephone Systems

Conduits system only, for drawing wiring for system like UPS, telephones, intercoms, data processing, TV antenna etc. shall be provided as per specifications and as per schedule of quantities /drawings. Minimum size shall be 25-mm dia. These conduits shall be provided with steel draw wires (fish wires) of at least 16 SWG wherever required.

Heavy-duty removable cover raceways / cable trays of sizes as per schedule of quantities, fabricated from 14 SWG sheet steel, of approved design and make shall be provided. The raceways shall be embedded in floors, with covers flush with finished floor level, or shall be fixed on surface over false ceilings, as indicated in drawings and as required. Cover for sheet steel raceway shall be stove enamel painted or galvanized. Fixing of raceways in floors shall be taken to prevent mortar from seepage into the raceway. Cost of cutting chases in floors and making them good, as required shall be included in quoted rates.

All telephone conduits / raceways shall be at least 200 mm away from electrical conduits/raceways unless otherwise stated.

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6.5. Wires:

Wires shall be PVC insulated, FRLS, stranded copper conductors, unless otherwise stated, of 1100-volt grade. 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.

Twin flexible wires wherever used shall have cross sectional area of 0.001 sq. inch equivalent to 23/. 0076 or larger, and shall be insulated.

6.5.1. 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

6.5.2. Drawing of wires:

The drawings of wires shall be executed with due regard to the following precautions: -

- (a) No wire shall be drawn into any conduit, until all work of any nature, that may cause injury to wire is completed. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire. Screwed brass bushes shall be provided at conduit edges.
- (b) 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 and necessary.
- (c) While drawing insulated wires into the conduits, care shall be taken to avoid scratches and kinds, which cause breakage of conductors.
- (d) There shall be no sharp bends.

6.5.3. Termination / Jointing of Wires:

- (a) 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.
- (b) Wiring conductors shall be continuous from outlet to outlet. Joints where unavoidable, due to any specified reasons shall be made by approved connectors. Specific prior permission from architect / owners in writing shall be obtained before making such joint.
- (c) 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 for wiring.
- (d) Strands of wires shall not be cut for connecting terminals. All strands of wire shall be soldered at the end before connection.
- (e) PVC insulated Aluminium conductor wire (wherever used) ends before connection shall be properly soldered (at least 15 mm length) with suitable soldering material.

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- (f) Conductors having nominal cross sectional area exceeding 4 sq. mm. shall always be provided with crimping sockets.
- (g) At all bolted terminals, brass flat washer of large area and approved steel spring washers shall be used.
- (h) Brass nuts and bolts shall be used for all connections.
- (i) The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less.
- (j) Switches controlling lights, fans, socket outlets etc. shall be connected to the phase wire of circuits only.
- (k) Only certified wiremen shall be employed to do wiring / jointing work.

6.6. Load Balancing:

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

6.7. 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.

6.8. Switches and Fixtures:

6.8.1. Switches:

All 6 and 16 amps switches shall be of the modular flush mounting type, unless otherwise stated, 240 Volt AC of best quality and standard. The switch moving and fixed contacts shall be of silver nickel and silver graphite alloy and contact tips coated with silver. Housing of switches shall be made from high impact resistant, flame retarding and ultraviolet stabilized engineering plastic material. Switches controlling the light, fan or sockets shall be connected on to the phase wire of the circuit.

6.8.2. Fan Regulators:

Fan regulators shall be fixed inside the switch boxes on grid plates with tapped holes and brass machine screws unless otherwise stated, leaving ample space at the back and sides for accommodating wires.

6.8.3. Flush Plates:

Switches, receptacles and telephone system outlets in wall shall be provided with moulded cover plates, unless otherwise stated, of approved Colour, shape and size made from high impact resistant, flame retarding and ultra violet stabilized engineering plastic material, and secured to the box with counter sunk /round head chromium plated brass screws. Where two or more switches are installed together, they shall

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be provided with one common switch cover plate as described above with notches to accommodate all switches either in one, two or three rows.

One and two gang switch cover plate, telephone outlet cover plate, 6 and 16 amps switched / without switch outlet plates, shall have the same shape and size. Three and four gang switch cover plates shall have the same shape and size. Six and eight gang switch cover plates shall have the same shape and size. Nine and twelve switch cover plates shall have the same shape and size. Wherever five switches, seven switches, ten switches and eleven switches are to be fixed the next higher size of gang switch cover plate to be used and extra openings shall be provided with blank-offs.

6.8.4. Outdoor Switches:

Switches located outdoors shall be, of required size, type and rating and shall be provided in weather proof enclosures, with weather proof gasket covers. The MCB's / fuses for all outdoor switches shall be separate and of required rating.

6.8.5. Socket Outlets:

6/16 amps socket outlets shall be of modular flush mounting type, unless otherwise stated, and shall be switched, three-pin type and fitted with automatic linear safety shutters to ensure safety from prying fingers. Unswitched 6/16 amp socket outlets where called for shall also be of three pin type. Socket outlets shall be made from high impact resistant, flame retarding and ultraviolet stabilized engineering plastic material.

Switches and sockets shall be located in the same plate. Plates for 6 amp switched / unswitched plugs and telephone outlets shall be of the same size and shape.

Switches controlling socket outlets shall be on the phase wires of circuits. An earth wire shall be provided along the wires feeding socket outlets for electrical appliances. The earth wire shall be connected to the earthing terminal of the socket and shall be connected to the earth terminal provided inside the box.

6.8.6. Lighting Fixtures, Fans and Exhaust Fans:

Light fixtures and fittings shall be assembled and installed complete as required and ready for service, in accordance with details, drawings, and manufacturer's instructions and to the satisfaction of the architects/owners.

Wires brought out from junction boxes shall be encased in GI flexible pipes for connecting to fixtures concealed in suspended ceilings. Flexible pipes shall be provided with a check-nuts at both ends.

Pendant fixtures specified with overall lengths are subject to change and shall be checked with site conditions and installed as required. All suspended fixtures shall be mounted rigid and fixed in position in accordance with drawings, instructions and as approved by architect/owners.

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

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All suspended light fixtures, fans etc. shall be provided with concealed suspension arrangement in the concrete slab /roof members. Making provisions for such arrangements at the appropriate stage of construction is deemed to be included in contractors' scope.

Exhaust fans shall be fixed at locations shown on the drawings. They shall be wired to a plug socket at a convenient location near the fan in flexible conduits.

All switch and outlet boxes, fan regulators shall be bonded to earth with PVC insulated stranded copper wire as specified.

Wires shall be connected to all fixtures through connector blocks.

Flexible conduits, wherever used, shall be of make and quality approved by the architect/owner.

6.9. Point Wiring:

6.9.1. General

Point wiring shall be carried out as per following: -

- i. In concealed /surface conduit system unless otherwise stated.
- ii. Only looping system of wiring shall be adopted throughout.
- iii. All accessories shall be flush types unless otherwise stated.
- iv. For estimation of load, following loads per point shall be assumed.
- v. Light points: 20/40 Watts.
- vi. 6 amps socket outlet points 100 Watts.
- vii. Fan points : 80 Watts.
- viii. Exhaust fan points 100 Watts or as specified.
- ix. 16 amps socket outlet points:500 Watts or as per use
- x. Light points, fan points and 6 amp socket outlet points may be wired on a common circuit. Such circuit shall not normally have more than a total of ten light, fan or socket outlets or a load of 800 watts, whichever is less unless otherwise stated.
- xi. Power circuits shall normally have maximum one 16 amps socket outlet unless otherwise stated. Separate circuit shall run for each geyser, kitchen equipment, window air conditioners and similar appliances.
- xii. Point wiring rates shall include painting of conduits and other accessories as required.
- xiii. Point wiring rates shall include cleaning of dust, splashes of Colour wash or paint from all fixtures, fans, fittings etc. at the time of taking over of the installation.

6.9.2. Light Point:

Point wiring for light points shall commence at the distribution board / Switch board terminals and shall terminate at the ceiling rose / connector in ceiling box/lamp holder via the control switch. Rates quoted shall be deemed to be inclusive of the cost of entire materials and labour required for completion of point

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wiring thus defined including: **a)** conduiting system complete with all accessories, junction, /draw/inspection boxes, screwed brass bushes, check nut etc. complete as required, **b)** Wiring with stranded copper (unless otherwise stated) PVC insulated 1100 volt grade wires for point wiring including circuit wiring (wiring from Switch board terminals to the first switch in the circuit) and cover plate of specified type including fixing screws, earth terminal etc. complete as required **c)** Loop earthing with PVC insulated stranded copper wires complete as required.

6.9.3. Ceiling Fan Points:

Point wiring for ceiling fan points shall be same as for light points in para 1.6.3 above and shall, in addition, include recessed fan hook, ceiling outlet box and provision in the switch box for mounting the fan regulator which shall be earthen with PVC insulated stranded copper wire as required. In case owners supply the ceiling fans and regulators, the rate shall be inclusive of blank-off in the switch box.

6.9.4. Exhaust Fan Point:

Point wiring for ceiling fan points shall be same as for light points in para 1.6.3 above and shall in addition include socket outlet near the exhaust fan and control switch with regular at a convenient location complete as required.

6.9.5. Call Bell Point:

Point wiring for call bell points shall be same as for light point in para 1.6.3 above, and shall in addition include a bell push in lieu of control switch.

6.9.6. 3 Pin 6 Amps Socket Outlet Point (Lighting)

Point wiring for lighting convenience socket outlet points shall be same as for light points in para 1.6.2 above and shall, in addition, include 3 pin 6 amps socket outlet and 6 amps control switch of specified type mounted in a MS box with cover as required, and third pin earthed with PVC insulated stranded copper wire as required.

6.9.7. 3 Pin 16 Amps Outlet Point (Lighting):

Point wiring for power convenience socket outlet points shall be same as for light point in para 1.6.2 above and shall also include a 3 pin 16 amps socket and 16 amps control switch of specified type mounted in a MS box with cover as required and third pin earthed with PVC insulated stranded copper wire as required.

6.9.8. Geyser Point:

Point wiring for Geyser points shall be same as for 3 pin 16 amps outlet point as per para 1.6.8 above and shall, in addition, include socket outlet near the geyser and control switch in a separate convenient location complete as required.

6.9.9. Special Purpose Outlets:

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Wiring for special purpose outlets, not covered by convenience socket outlets as defined in para 1.6.7 and 1.6.8 above, shall be itemized and paid for as stipulated in schedule of quantities.

6.9.10. Circuit Wiring:

Minimum size of PVC insulated copper conductor wires for all circuit wiring for light, exhaust fan, ceiling fan and lighting convenience outlet points shall be 2.5 sq mm unless otherwise specified.

Circuit wiring shall be separately measured and paid for. Point wiring rates shall not include the cost of providing circuit wiring as required.

6.10. Sub-Main Wiring:

Sub-main wiring shall comprise of stranded copper conductor PVC insulated 1100-volt grade wires in PVC conduits including loop earthing, terminations etc. complete as required.

Sizes of conduits, number/type/size of wires and loop earthing shall be as stipulated in the schedule of quantities and /or drawings.

Wires shall be drawn in the concealed or surface conduits as required, without being damaged. For this purpose, draw boxes shall be located at convenient locations.

Every sub-main shall run in an independent conduit with an independent earth wire of PVC insulated stranded copper wire as specified running along the entire run of conduit. For single phase, one earth wire shall run and for three phase two earth wires shall run.

Necessary provision of wire lengths entering and emerging from the conduit shall be made for connections. Measurement shall be taken of the actual conduit run containing the wires from one point to the other.

7. LT CABLES

7.1 General

L.T. Cables shall be supplied, inspected, laid tested and commissioned in accordance with drawings, specifications, relevant Indian Standards specifications and cables manufacturer's instruction. The cable shall be delivered at site in original drums with manufacturer's name clearly written on the drums. The recommendations of the cable manufacturer with regard to jointing and sealing shall be strictly followed.

7.2 TECHNICAL REQUIREMENTS

- a) The cable shall be suitable for laying on racks / cable trays, in ducts, trenches, through conduits, along the walls / structures and underground buried installation with chances of flooding by water.

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- b) Cables shall be flame retardant, low smoke (FRLS) type unless otherwise specified and designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions as specified elsewhere in this specification
- c) Aluminium conductor used in power cables shall have tensile strength of more than 100 N /sq.mm. Conductors shall be multi stranded.
- d) XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg.C. PVC insulation shall be suitable for continuous conductor temperature of 70 deg. C and short circuit conductor temperature of 160 deg. C.
- e) The cable cores shall be laid up with fillers between the cores whenever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS : 5831.
- f) Outer sheath shall be of PVC & black in color. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties:-
 - i) Oxygen index of min.29 (as per ASTM D 2863).
 - ii) Acid gas emission of max.20% (as per IEC-754-I).
 - iii) Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTM D- 2843.
- g) Cores of the cable shall be identified by colouring of insulation. Following color scheme shall be adopted:

1 core -	Red/ Black/ Yellow/ Blue (As per requirement / purpose)
2 core -	Red & Black
3 core -	Red, Yellow & Black
4 core -	Red, Yellow, Blue and Black
- h) In addition to manufacture's identification on cables as per IS, following marking shall also be provided over outer sheath:
 - i) Cable size and voltage grad – To be embossed
 - ii) World 'FRLS' at every 5 meter – To be embossed

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- iii) Sequential marking of length of the cable in meters at every one meter – To be embossed / printed.

The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.

- i) All cables shall meet the fire resistance requirement of IEEE – 383 with cable.
- j) Installation made in accordance with clause “Flammability test” and as per category – B of IEC 332 Part – 3
- k) Allowable tolerance on the overall diameter of the cables shall be + / -2 mm maximum over the declared value on the technical data sheets.
- l) In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.

7.3 CONSTRUCTION

L.T. Cables shall be XLPE insulated and PVC sheathed aluminium conductor armoured cables conforming to IS : 7098 (Part I) – 1988. Cables shall be of 1100 volt and with ISI certification mark. Conductor of power cables shall be made of electrically pure aluminium conforming to IS 8130 – 1984. Stranded Aluminium conductor of cables up to 16 sq. mm. shall be of circular cross section and the size above 16 sq.mm shall be circular or sector shaped. The conductor shall be insulated with high quality XLPE base compound with maximum operating conductor temperature of 90 degree C. Insulation and outer sheathing compound shall conform to IS 5831 – 1984. Armouring shall be provided over the inner sheath and shall conform to IS : 3975. Armouring shall be of galvanized round steel wires or galvanized flat steel wires (strip as specified in BOQ). For single core cables non-magnetic armouring shall be provided over the insulation. Outer sheath shall be extruded over the armouring. Maximum permissible bending radius for cables upto 1.1 KV shall be 12 D. (D is outer diameter of cable).

7.4 INSTALLATION OF CABLES

Cables shall be laid directly in ground, pipes, masonry ducts, on cable tray, surface of wall / ceiling etc. as indicated on drawing and / or as per the direction of Engineer – in – Charge. Cable laying shall be carried out as per CPWD specification i.e IS : 1255.

7.5 INSPECTION

All cables shall be inspected at site and checked for any damage during transit.

7.6 JOINTS IN CABLES

The Contractor shall take care to see that the cables received at site are apportioned to various locations in such a manner so as to ensure maximum utilization and avoiding of cable joints. This apportioning has to have the approval of the Engineer – in – Charge before the cables are cut to lengths.

7.7 LAYING CABLES IN GROUND

Cables shall be laid by skilled experienced workmen using adequate rollers to minimize stretching of the cables. The cable drums shall be placed on jacks before unwinding the cable. With great care it shall be unrolled over wooden rollers placed in trenches at intervals not exceeding 2 metres. Cables shall be laid at depth of 0.75 metres below ground level. A cushion of sand total of 100 mm shall be provided both above and below the cable, joint boxes and other accessories. Cable shall not be laid in the same trench or along side a water main.

The cable shall be laid in excavated trench over 100 mm layer of sand cushion. The relative position of the cables, laid in the trench shall be preserved. At all changes in direction in horizontal and vertical planes, the cables shall be bent smooth with a radius of bent not less than 12 times the diameter of cables. Minimum 3 metre long loop shall be provided at both end of cable.

Distinguishing marks may be made on the cable ends for identifications of phases. Insulation, tapes of appropriate voltage and in red, yellow and blue colours shall be wrapped just below the sockets for phase identifications.

7.8 PROTECTION OF CABLES

The cables shall be protected by bricks laid on the top layer of the sand for the full length of underground cable. Where more than one cable is laid in the same trench, the bricks shall cover all the cables and shall project a minimum of approximately 80 mm on either side of the cables. Cable under road crossing and any other places subject to heavy traffic, shall be protected by running them through Hume Pipes of suitable size.

7.9 EXCAVATION & BACK FILL

All excavation and back fill required for the installation of the cables shall be carried out by the Contractor in accordance with the drawings and requirements laid down elsewhere. Trenches

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shall be dug true to line and grades. Back fill of trenches shall be filled in layer not exceeding 150mm. Each layer shall be properly rammed and consolidated before laying the next layer.

The contractor shall restore all surface, sidewalks, curbs, wall or the works cut by excavation to their original condition to the satisfaction of the Engineer- in- charge.

7.10 LAYING OF CABLES ON SURFACE OF WALL/ CEILING

Cables shall be fixed on surface of wall or ceiling slab by suitable MS clamps/Saddles. Care shall be taken to avoid crossing of cables.

7.11 CABLES HANGERS OR RACKS / CABLE TRAYS

The Contractor shall provide and install all iron hangers racks or racks with die cast cleats with all fixings, rag bolts or girder clamps or other specialist fixing as required.

Where hangers or racks are to be fixed to wall sides, ceiling and other concrete structures, the Contractor shall be responsible for cutting away, fixing and grouting in rag bolts and making good. The hangers or racks shall be designed to leave at least 25mm clearance between the cables and the face to which it is fixed. Multiple hangers shall have two or more fixing holes. All cables shall be saddled at not more than 1500 mm centers. These shall be designed to keep provision of some spare capacity for future development.

7.12 CABLE TAG

Cable tags shall be made out of 2 mm thick aluminium sheets, each tag 1-1/2 inch in dia with one hole of 2.5 mm dia, 6mm below the periphery. Cable designations are to be punched with letter / number punches and the tag are to be tied inside the panels beyond the glanding as well as below the glands at cable entries. Trays tags are to be tied at all bends. On straight lengths, tags shall be provided at every 5 metres

7.13 TESTING OF CABLES

a). GENERAL

i). All cables to be supplied shall be of type-tested quality. **The contractor shall submit for owner's approval the reports of all the type tests as listed in this specification and carried out within last five years from the date of bid opening.**

ii). In case the contractor is not able to submit report of the type test(s) conducted within last five years from the date of bid opening, or in case the type test report (s) are not found to be meeting the specification requirements, the contractors shall have to

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conduct all such tests under this contract **free of cost** and submit the reports to the owner for approval.

iii). All acceptance and routine tests as specified in Reference Quality Plan and relevant standards shall be carried out **free of cost**. Charges for these shall be deemed to be included in the cable price.

Prior to installation / laying / burying of cables, following tests shall be carried out. Insulation Resistance test between phases, phase & neutral, phase & earth for each length of cable.

A .Before laying.

B. After laying.

C After jointing.

On completion of cable laying work, the following tests shall be conducted in the presence of Engineer in Charge.

- a. Insulation Resistance Test (Sectional and overall).
- b. Continuity Resistance Test.
- c. Earth Test.

All tests shall be carried out in accordance with relevant Indian Standard Code of practice and Indian Electricity Rules. The Contractor shall provide necessary instruments, equipments and labour for conducting the above tests & shall bear all expenses of conducting such tests.

8. EARTHING SYSTEM

8.1. ELECTRICAL INSTALLATION

8.1.1. GENERAL

The construction, erection, commissioning of the earthing system shall be in line with the requirements / specifications/ data / guidelines provided in IS:3043-1987, IEEE:80, IEEE: 142, BS : 7430 and relevant Indian Electricity Rules 1956, National Electricity Code amended up to date & NBC- 16 and in the regulations of the local Electricity Supply Authority.

Other applicable standard codes and the requirements are specified in this tender document. However, a few salient points are appended below:

For the safety of the mankind and operational people, earthing of power system / distribution network is very much important. There will be two types of earthing grid (i) System earthing and (ii) Body earthing of non-current carrying metal part.

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Apart from the above purpose, separate earthing pit and grid shall be formed for communication purposes also (Telephony and Computer network).

All the non-current metal parts of external / internal electrical installation shall be earthed properly. Transformer, H.T switchgear, DG Set, Main L.T. Panel, Power Distribution board, Lighting Distribution Board, MCB DBs. Feeder Pillar and all other parts made of metal shall be bonded together and connected by means of specified earthing conductors to an efficient earthing system

8.1.2. BODY EARTHING OF SUBSTATION EQUIPMENT / LT PANELS, PDBs LDBs, ELECTRICAL APPLIANCES, LIGHT FITTINGS, FANs, SOCKETs , LIGHT POLE ETC.

All non-current carrying metal parts of all types of Electrical equipment shall be connected to the earth system at two points, each of 100% rating. Metallic supports, fencing etc. shall also be connected to earth system. Body earthing of Substation equipment like Transformer, H.T Panels, Main L.T Panels, Sub Main Units, and Capacitor Panels etc. shall be through a common grid formed in the substation building. A main earth ring shall be formed round the station interconnecting all electrodes. Each equipment shall be connected with two independent earth conductors. Earthing Grid shall be directly connected by minimum two nos of independent earth electrode Earthing electrode shall be 600 x 600 x 6 mm thick GI plate or of copper plate of size 600 x 600 x 3 mm. Earth conductor laid in ground shall be protected for mechanical injury & corrosion by providing GI pipe.

Note: The number of runs per length needed for each of sizes of earth continuity conductors as mentioned above had been selected according to the primary fault levels calculated.

Earthing grid shall be formed with GI flat of specified sizes as per calculation of earth fault current. In this project, 50 mm x 6 mm GI flat shall have to be used to form the primary earth grid & there after connecting to individual equipment shall be with 40 mm X 6 mm or 25 mm x 6 mm as shown in drawing. Earth bar shall be constructed of 50 mm x 6 mm GI strip.

8.1.3. NEUTRAL EARTHING OF TRANSFORMER & DG SET

Neutral terminals of Transformers and Diesel Generating set shall be earthed independently. Each neutral terminal shall be earthed with two independent earth electrodes. Earth electrode shall be 600 x 600 x 6 mm thick GI Plate or of 600 x 600 x 3 copper plate as specified in BOQ

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8.2. TYPE OF EARTH ELECTRODE

8.2.1. PLATE ELECTRODE EARTH PIT

Earthing shall be provided with copper / G.I plate electrode as mentioned in BOQ of following:

- i. Copper Plate Electrode : 600 mm x 600 mm x 3 mm thick
- ii G.I. plate Electrode : 600 mm x 600 mm x 6 mm thick

The electrode shall be buried in ground with its faces vertical and not less than 3 meters below ground level. 25 mm dia. medium class GI pipe shall be provided and attached to the electrode for watering purpose. A funnel with wire mesh net shall be provided on the top of this pipe for watering the earth electrode. The watering funnel attachment shall be housed in masonry enclosure of not less than 300 x 300 x 300 mm deep. A cast iron MS frame with cover having locking arrangement shall be provided at top of chamber. Construction of Earth electrode should not affect the column footing or foundation of the building. In such cases electrode may be constructed 1500 mm away from the building line.

8.2.2. PIPE ELECTRODE EARTH PIT

GI pipe shall be of medium class 50 mm dia and 3.0 meter in length. This pipe shall be fitted at top with water funnel having wire mesh net arrangement. Galvanizing of the pipe shall conform to relevant Indian Standards, GI pipe electrode shall be provided with nos of holes of 12 mm dia drilled not less than 75 mm from each other up to 2 meter of length from bottom. The electrode shall be buried in the ground vertical with its top not less than 20 cm below ground level as per detail enclosed. Earth electrode shall not be situated less than 1.5 meters away from the building. The location of the earth electrode will be such that the soil has reasonable chance of remaining moist as far as possible. Masonry chamber of size 300 x 300 x 300 mm shall be provided. A cast iron or MS frame & cover having locking arrangement at the top has to be arranged.

8.2.3. DISTANCE BETWEEN ANY TWO EARTH PITS

As per IS: 3043, minimum distance between any two nos of earth pit should be 6.0 Meters i.e. twice the length of each electrode to prevent rise of earth Potential. Similarly, distance of any earth pit should be at least 1.50 Mtr away from the building line.

8.2.4. ARTIFICIAL TREATMENT OF SOIL

If the soil resistivity of the project site is found to be too high and construction of multiple earth electrode with parallel connection would not give low resistance to earth, then the soil of the earth

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pit shall immediately be mixed with sodium chloride / calcium chloride / sodium carbonates /copper sulphate, salt and soft coke or charcoal in suitable proportions for reducing the soil resistivity to obtain low earth resistance of the earth pits.

Use of BENTONITE soil in the earth pit is also recommended.

8.2.5. RESISTANCE TO EARTH

The overall resistance of earthing system shall not exceed one ohm.

8.2.6. EARTHING INSTALLATION

Earthing installation work shall mean erection, jointing / brazing / welding, connection and painting, testing of ground conductors.

All equipment, steel structures etc. shall be grounded at two separate point. If no provision in equipment for such grounding is noted at site, then provision to be made as per Employer's Representative's advice and IS or other relevant standards. All conduits shall be grounded either to the tray grounding system or to ground rods installed locally for grounding. These conduits shall be bonded to the enclosure or equipment grounds at the equipment being serviced by the conduit and to the tray or source cabinet grounds at the other end by the use of bonding jumpers and grounding bushings.

Equipment ground connections, after being checked and tested by the client's Representative, shall be coated with anti-corrosive paint.

Whether specially shown or not, all conduits, trays, cable armour and cable end box, electrical equipment such as motors, switchboard, panel, cabinets, junction boxes, lockout switches, fittings, fixtures, all current carrying equipment cable tray, metallic structures, fencing etc. shall be effectively grounded.

To ensure that the earthing conductor is mechanically protected on the part where the conductor is mechanically protected on the part where the conductor is getting into ground.

8.2.7. EARTH CONDUCTOR

Pole, Cable loop in box and all other part made of metal shall be bonded together with 8 SWG GI wire. Every fifth pole shall be earthed with pipe earth electrode. Earth continuity conductor shall be terminated at earth bolt provided on each pole with suitable cable lug. GI pipe shall be provided for mechanical protection of GI wire from pole to earth pit.

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8.2.8. The earth conductor sizes generally to be considered depending upon the LT fault level of power system (say up to 50 KA) shall be as follows:

Sl. No.	Equipment	Sizes (depending on value of earth fault current)
1.0	Buried earth electrode	As mentioned above
2.0	External earth grid at sub station	65 /50mm x 10 mm GS flat
3.0	External earth grid at building	65/50 mm x 10 mm GS flat
4.0	Internal earth grid at sub station	65/50 mm x 10 mm GS flat
5.0	Internal earth grid at pump houses	65 /50mm x 10 mm GS flat
6.0	Internal earth grid at buildings	50 /40 mm x 6 mm GS flat
7.0	Cable tray	50/40/25 mm x 6 mm GS flat
8.0	All LT & HT panels	50mm x 6 mm GS flat
9.0	DB sets	25 mm x 6mm GS flat
10.0	Transformer body	65/ 50 mm x 10 mm GS flat
11.0	Transformer neutral	65/ 50 mm x 10 mm GS flat
12.0	Steel column	50 mm x 6 mm GS flat
13.0	Steel structure, metallic tanks etc.	50 mm x 6 mm GS flat
14.0	Fencing gate, rail	50/40 mm x 6 mm GS flat
15.0	Motors upto 1 KW	8 SWG GS wire
16.0	Motors above 1 KW and upto 25 KW	25 x 6 mm GS strip
17.0	Motors above 25 KW	50 x 6 mm GS strip
18.0	Local push button station	25 x 6 mm GS strip
19.0	Street lighting pole network	50 mm diameter pipe at every fourth pole
20.0	Earth continuity conductor for street lighting poles	4 SWG GS wire
22.0	Light pole earthing conductor	4 SWG GS wire
22.0	Power Junction Boxes	4 SWG GS wire/ 25x3 GS strip

9. LIGHTNING PROTECTION SYSTEM

9.1. CONVENTIONAL LIGHTNING PROTECTION SYSTEM

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The principal components of a lightning protection system are: -

- Air Terminations
- Down conductors
- Joints and bonds
- Testing joints
- Earth Terminations
- Earth electrodes

9.1.1. RECOMMENDED MATERIALS FOR COMPONENT PARTS

Bars & Rods	Copper, Aluminium, Galvanised Steel
Strip	Annealed Copper, Aluminium, Galvanised Steel
Stranded or Solid Conductor	Copper, Aluminium
Insulated	
Flexible Conductors	Copper.

9.1.2. DIMENSIONS

The component parts of a lightning protective system should not be less than those given below. In situations where inspection or repair is unusually difficult, a size bigger than the minimum should be considered.

Sl. No.	Component	Dimensions in mm.(Min.)	Area in mm ²
1.	Air termination		
a.	Al. , Cu., Galv..Steel.	20 x 3	60
2.	Suspended Conductor		
a.	Stranded Aluminium	19/2.14	70
b.	Stranded Copper	19/2.14	70
c.	Stranded Galv. Steel	6/4.72	100
3.	Down conductor		
a.	Al. , Cu., G.S. strip	20 x 3	60
b.	Al. , G.S. rods	10 dia.	78.54
4.	Earth terminations		

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a.	Hard drawn copper rods for direct driving into soft ground	12 dia.	113
b.	Hard drawn copper rods for indirect driving or laying underground	10 dia.	78.54
c.	Copper-clad or galvanized steel rods for hard ground	10 dia.	78.54
5.	Final Connection(AL., Cu.)		
	External		
	Strip	20 x 3	60
	Rods	10 dia.	78.54
	Internal		
	Strip	20 x 1.5	30
	Rods	6.3 dia.	33
6.	Stranded flexible connection (Bonds)		
	External, Aluminium	560/0.5	70
	External, annealed copper	990/0.3	70
	Internal, aluminium	276.04/0.4	35
	Internal, Annealed Copper	1107/0.2	35

9.1.3. AIR TERMINATIONS

Air Termination networks consist of vertical or horizontal conductors or a combination of both. No. part of the roof should be more than 9m from the nearest horizontal protective conductor. All metallic projections should be bonded to and form part of the air termination network. For portions of a structure varying considerably in height, all air termination for the lower part should be bonded to the down conductor of the taller portion in addition to their own down conductors.

9.2. ADVANCED LIGHTNING PROTECTION SYSTEM

9.2.1. GENERAL

The advanced lightning protection system shall include the following components

- (a) Air Terminations
- (b) Mechanical Supports
- (c) Low impedance insulated down conductors

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- (d) Performance recording Equipment
- (e) Low impedance grounding system.

The advance lightning protection system shall be so designed so as to minimise corona emissions and optimize streamer inception when optimum pre-determined conditions are met.

It shall be so mounted taking into consideration wind shear loading factor. Either Guying kits or mounting based on mast arrangement depending on local environmental conditions will be employed.

The advance lightning protection system shall be manufactured strictly as per approved international standards.

9.2.2. AIR TERMINATIONS

The Air Termination shall be so designed so as to respond dynamically to the appearance of a lightning down-leader by triggering a up-leader in relation to the optimum pre-determined conditions, building height above ground and other factors that effect the electrical field intensification above the air terminal.

The material of the air terminal unit shall be non-corroding in hostile environment made of stainless steel with a curved conductive surface of minimum thickness for air terminations as defined in IEC 61024. The isolating material supporting the curved conductive surface from the centre grounded electrode is to be manufactured from a glass/mineral re-inforced polypropylene having high impact strength, UV stabilized, high electrical dielectric, high comparative tracking index and operating heat capability up to 120 °C continuous.

The protective zone provided by air termination shall be such that it becomes the preferred strike point for all discharges exceeding a peak amplitude return strike current of X kA according to the statistical level Y as per IEC 61024.

Strike current (X)	Levels of Protection (Y)	Exceedance Probability
2.9 kA	Protection level I- Very high	99%
5.4 kA	Protection level II- High	97%
10.1 kA	Protection level III- Medium	91%
15.7 kA	Protection level IV- standard	84%

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9.2.3. AIR TERMINATION SUPPORT

The air terminal support consists of a min. 2 m of insulating re-enforced fiberglass cylindrical mast. The conductor shall pass through the center of the mast, with the high voltage termination contained to the upper 1m of the mast.

The support shall be securely bolted to other mast materials with guy wires where necessary to withstand maximum locally recorded wind velocities.

9.2.4. DOWN CONDUCTOR

The down conductor shall be designed with low impedance and low inductance to minimize voltage built up due to lightning impulses. The down conductor shall consist of a plastic filler, copper conductor, inner insulation, outer copper conductor, conductive sheath, all concentrically arranged.

The outer diameter of the down conductor shall be less than 37 mm. The main copper conductor shall be made of electrical grade copper of minimum cross-sectional area of 50 sq. mm.

It should have a low characteristic impedance of $< 12 \Omega$ with a maximum inductance of $< 40 \text{ nH/m}$, capacitance equal to 1100 or greater than 1000 pF/m and the resistance should be equal or less than $0.5 \text{ m}\Omega/\text{m}$.

The down conductor where exposed to human intervention (final 3 m), shall be enclosed in a protective PVC pipe of 3 mm. wall thickness so as to avoid mechanical damage and increase human safety.

The down conductor should not be subject to bends of less than 0.5 m radius and it's main copper conductor shall be capable of direct connection to the base of the air termination by use of a compression coupling. It must be in constant physical contact with the structure via conductive clamps and must be anchored every 1m from the terminal end whilst at it's lower end it should be anchored at least every 2 m.

The down conductor should be UL-96: Lightning Protection Components (Standard for safety) compliant.

9.2.5. PERFORMANCE RECORDING EQUIPMENT

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Each protection system shall be supplied with a lightning event counter having a register that activates one count for every discharge where peak current exceeds 1500A. The test wave shall be standard 8/20 μ s as defined by ANSI C 62.41

It should be robust, easy to install and housed in a IP 67 enclosure. The counter shall operate from the energy of the lightning discharge and not rely on external or battery power to operate.

The installation should be positioned in a place having an operating temperature range of -10°C to + 50°C and which is readily accessible so that readings can be taken at regular intervals.

9.2.6. GROUNDING

Soil resistivity is a natural phenomenon. High soil resistivity causes high resistance in earth pits which prevents dissipation of charges from electrode to the earth mass. High earth pit resistance is the main cause for failure of many costly electrical, electronic and telecom equipment. If low earth pit resistance is desired, soil resistivity must be brought down with artificial soil treatment compounds.

The grounding system reading generally should not exceed 10 Ω static impedance.

Grounding shall be affected by means of earth electrodes consisting of copper bonded steel core rods provided with a nickel bonding interface to avoid galvanic corrosion and having UL certification which calls for a minimum molecular bonding of 250 microns.

Electrically conductive Ground Enhancing Materials shall be applied, if required, around the ground conductor to reduce soil resistivity and lower ground impedance.

Bonding of grounding system to metallic parts of the building, the structural re-inforcing steel of the building, is highly recommended. The resistance should be measured and the 10 Ω requirement achieved before such bonding is affected.

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FIRE DETECTION & ALARM SYSTEM

GENERAL

1.00 SCOPE

This specification covers design, manufacturing, inspection, delivery to site, storage at site, erection, testing and commissioning of Automatic Fire Detection Alarm & Public Address System for **'Oitika Housing' Proposed 6 Nos. G+XII Storied Residential Building At New Town, Kolkata.**

The general terms and conditions, instructions to the Contractors and other attachment referred to elsewhere are hereby made part of the tender specification. The equipment materials and works covered by this specification are subject to all the attachments referred in the specification. The Contractor shall be responsible for and governed by all requirements stipulated herein.

In normal case, no deviation is permitted. If any deviation is made, it shall be clearly brought out, otherwise it will be presumed that the Contractor's offer is in line with that has been stated/asked for in this specification.

2.00 INTENT OF SPECIFICATION

2.01 This specification is intended to cover residual engineering, manufacture, procurement, test and inspection at works, packing for transportation, delivery to site, unloading, storage, erection, testing, commissioning, performance, demonstration at site and handing over to purchaser of Analogue Addressable Fire Detection & Alarm System as indicated in the Schedule of Requirement and scope of work and as required for reliable and effective fire protection of **'Oitika Housing' Proposed 6 Nos. G+XII Storied Residential Building At New Town, Kolkata.**

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2.02 The Contractor should include the following in his scope:

- a) Insurance Policy.
- b) Workmen Compensation Policy.

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- c) Labour license.
- d) Any other prevailing statutory requirement policy as per West Bengal / Central government act.

2.03 It is not the intent to completely specify all the details of design and construction herein. Nevertheless, the equipment and installation shall conform to high standard of engineering, design and workmanship in all respect and shall be capable of performing continuous satisfactory operation and acceptable to the PURCHASER /CONSULTANT as well as to the various authorities like WBFES/LOCAL AUTHORITIES. In case of any violation of the above the purchaser reserves the right to change/reject/modify at no extra cost the equipment/system during execution stage of the contract.

2.04 Wherever material or article is specified or described by the name of particular brand, manufacturer or vendor, the specific item mentioned shall be understood as established type, function and quality desired. Other manufacturers product shall not be accepted unless the owner / consultant prior to award of the contract has approved them.

2.05 The entire system shall be supplied and erected by the Contractor based on the approved construction drawing guidelines furnished in the specification, various codes/standards, Contractor's experience and also good engineering practice. **2.06** Supplies and services to be covered under this tender specification and the conditions thereof are detailed in the subsequent sections of the specifications. In case of conflict among various sections, subsequent, documents, drawings, the same shall be referred to purchaser/consultant whose decision shall be final and binding to the Contractor. In all cases, the best advantages will go to the purchaser.

3.00 SCOPE ASSESSMENT

Before quoting, the Contractor must visit the site and acquaint himself with the site condition and the scope of work of the Fire Detection Alarm & Public Address Systems, as specified hereinafter.

4.00 DESCRIPTION OF FIRE ALARM SYSTEM

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4.01 The fire detection and alarm system shall be designed to provide in the event of fire an instantaneous visual and audible alarm to prevent loss of life, damages etc. by warning occupants in the affected premises so as to obtain necessary help of the fire fighting and salvage staff.

The fire condition in the different areas shall be indicated on main fire alarm panel located in the control room. This panel will be connected to various automatic and manual call points located at various vulnerable points of the control room and manual call points by suitable cable to be erected above false ceiling/on roof.

The manual call points shall be suitable for wall mounted only. The automatic detectors shall be of type suitable for detection of smoke caused due to slow fire or for detection of heat caused due to rate of rise in temperature in the surrounding. The main panel shall draw its power from an integral uninterrupted power supply arrangement comprising suitable battery capable of supplying maximum alarm and hooter load at an adequate voltage for atleast the period as mentioned in the Data Sheet. These batteries together with automatic trickle charging and recharging facility shall have to be provided.

All the fire alarm panels shall be solid state type. Panel shall be suitable to receive signal from all types of automatic and manual actuation. When signal is received, a visual alarm and intermittent buzzer comes on. This pinpoints the area of distress. The external hooter shall start sounding on receipt of fire signal. The panel shall have the following features:

Fire alarm panel shall be located at fire control room in the ground floor

- b) Fire alarm panel shall consist of carefully selected solid-state components.
- c) Fire alarm panel shall have a glass front door which can be locked. Internal operational are always visible but not accessible to unauthorized person.
- d) All displays are suitable for minimum drain of power supply and enhance reliability.
- e) Automatic change over to secondary power source shall have to be provided in case of interruption in the incoming AC supply.
- f) Monitoring of the secondary power source and cabling between panels and from detectors to panel shall have to be provided.

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- g) An audiovisual alarm to be provided in the event of 'Low Battery Voltage'.

4.02 All materials to be furnished under the scope of this specification are outlined hereinafter. Any additional equipment, material, service which are not specifically mentioned but are required to make the system complete and acceptable to PURCHASER /CONSULTANT/W.B.F.E.S. final acceptance committee shall be deemed to be included in the scope and be provided

The various equipment envisaged in this package are as follows:

- a) MANUAL CALL POINT
- b) HORN WITH STROBE.
- c) HOOTER
- d) SPEAKER (6 WATT)

CABLING

- f) FIRE ALARM CONTROL PANEL WITH BATTERY & BATTERY CHARGER/UPS

PA SYSTEM CONSOLE WITH 150 WATT AMPLIFIER

- i) ALL RELATED CIVIL WORKS
- j) METAL CONDUIT
- k) JUNCTION BOX

RELATED STRUCTURAL WORK

MISCELLANEOUS ITEMS

The Contractor's scope includes providing a fully operational and functional FIRE DETECTION ALARM & P.A. SYSTEM for the **"Oitika Housing' Proposed 6 Nos. G+XII Storied Residential Building At New Town, Kolkata. .** in compliance with specification / provisional N.O.C and shall be acceptable to the Purchaser / Consultant & Final Acceptance Committee of WBFES.

5.00 SERVICES TO BE PROVIDED BY CONTRACTOR

5.01 Submission of complete calculation, scheme/layout/erection and construction drawings along with wiring diagram for all panels as may be required for Fire Detection & Public Address system.

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5.02 Detailed manual and drawing for installation, operation, trial run, testing and complete commissioning of the system and submission of as built drawing with operation & maintenance manual of the system.

5.03 Detailed engineering, supply, transportation to site, erection, testing and commissioning of the equipment as specified hereinafter.

5.04 Supply and Erection of MCP., Hooter, Speaker, power & control Cable etc. required completing system.

5.05 Earthing wherever required.

5.06 Supply of spare parts as per list to be furnished by Contractor, if order placed.

5.07 All erection and maintenance tools and tackles.

5.08 Cable tray / Conduit wherever required.

5.09 Testing and commissioning of system

5.10 Earthing wherever required.

5.11 Final painting of equipment and structures.

5.12 Training of purchaser's operation and maintenance staff during testing and commissioning period.

6.00 SERVICES TO BE PROVIDED BY Engineer-in-Charge

6.01 Power cabling to Fire Alarm Panel (located in Control room). However all glanding and terminations at both ends are included in the scope of Contractor.

7.00 SPECIAL NOTE TO CONTRACTORS

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7.01 The parameters of different equipment as indicated in the specification and various bid drawings enclosed are for Contractor's guidance only. Contractor shall check the adequacy of all parameters of the equipment and indicate if any changes are required in the parameters as specified.

7.02 The extent of supply under the contract includes all items shown in the bid drawings notwithstanding the fact that such items may have been omitted from the specification or schedule. Similarly, the extent of supply also includes all items mentioned in the specification notwithstanding the fact that such items may have been omitted in the drawings. All such items which are not specifically mentioned in the specification and drawings but which are required to complete the contract are deemed to be provided by the contractor at the total price offered unless specifically mentioned by the Contractor and accepted by the purchaser. The terminal points of the scope of work are specified in Clause 6.00.00. The items of work, which are specifically excluded from the scope, have been indicated in clause 6.00.00. Tentative Bill of Materials has been furnished in the Bidding Schedule.

7.03 All specialized equipment/services necessary for proper erection, commissioning and performance testing of the complete system covered under this contract shall be provided by contractor and as such the cost of such equipment/services shall be included in the quoted prices

8.00 QUALITY CONTROL AND SURVEILLANCE

The equipment and the installation shall have assured quality and workmanship and the system shall be executed based on the following guidelines. For further details regarding the same please refer to **"SPECIAL NOTES TO CONTRACTOR"**.

9.00 PROCUREMENT OF MATERIALS

9.01 The successful Contractor shall submit data sheet & cross sectional drawing of all equipment complying with specification requirement for obtaining approval from PURCHASER/CONSULTANT.

9.02 The successful Contractor shall submit the quality assurance plan of the manufacturer meeting the minimum requirement of the specification to PURCHASER/CONSULTANT for approval. The document approved by PURCHASER/CONSULTANT shall be the basis of carrying out inspection.

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9.03 The successful Contractor will submit the following documents along with supply for the purpose of claiming payments against supply of materials.

- a) Data Sheets/quality assurance plan duly endorsed by PURCHASER/CONSULTANT.
- b) Manufacturer's certificate as indicated in QAP duly endorsed by PURCHASER/CONSULTANT.
- c) Inspection report/records (in original) specifying the results of the test duly signed by PURCHASER/CONSULTANT and manufacturer.

These documents duly endorsed by the successful Contractor would be the basis for carrying out quality audit by PURCHASER/CONSULTANT.

10.00 ERECTION OF THE EQUIPMENT

10.01 The successful Contractor shall finalise quality plan of erection with PURCHASER/CONSULTANT meeting the minimum requirements of PURCHASER as specified hereinafter and submit to PURCHASER/CONSULTANT for records duly endorsed jointly by the successful Contractor and PURCHASER/CONSULTANT.

The document jointly signed by PURCHASER and successful Contractor would be basis for carrying out quality audit by PURCHASER/CONSULTANT.

11.00 PERFORMANCE TEST

11.01 Contractors to note that after mechanical completion the system shall be quality audited by PURCHASER/CONSULTANT. PURCHASER/CONSULTANT would also carryout pre-commissioning check up and furnish checklist and final acceptance test procedure with acceptable results.

11.02 Contractors to note that when the checklist is attended and the system is ready for performance test PURCHASER / CONSULTANT would conduct performance test.

11.03 Contractors to note that after checking the performance test by PURCHASER/CONSULTANT, WBFES would visit site to conduct performance test and certify the installation for compliance with design and standard.

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11.04 Contractors to note that the installation shall be taken over only after the same has been inspected and NOC is obtained from WBFES / Local Authorities having jurisdiction.

11.05 Contractor to note that completion of such tests and issuance of acceptance certificates shall not relieve the Contractor/contractor of his ultimate responsibility of guarantee which would be valid for twelve (12) months from the date of taking over the installation after receipt of 'FINAL NOC' from WBFES.

12.00 WORK SCHEDULE

Delivery, erection testing and commissioning of the plant machinery shall have to be completed within time limit as given in Contract Document.

13.00 SAFETY PRECAUTIONS

A competent, qualified and authorized Engineer shall be on the site whenever the contractor's men are at work. The Supervisor should ensure that all plant and machinery used on the site are safe for working and meets with the Indian or international safety standards applicable for the use and operation of such machinery. The supervisor should also ensure that the workmen are supplied with and made to use safety appliances such as safety belts, helmets etc. The Supervisor shall not leave the work site without permission from project management consultant or their nominee. The contractor shall provide organization chart of the personnel to be deployed at site for the execution of the contract.

Smoking shall not be encouraged on the site but altogether strictly prohibited in areas where combustible and inflammable goods / materials are stored or lying about.

Any hot job such as welding, soldering, gas cutting shall not be carried out without the permission of the Engineer-in-charge representing the project Management Consultant such jobs shall not be carried out where inflammable materials are stored or lying about. All electric connections shall be through adequately sized mechanically protected cables without any joints and with proper and adequate terminals. All power supplies shall be through properly rated fuses with isolating devices. No such hot jobs shall be carried out on holidays and without the presence of the

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Contractor's Engineer.

It is entirely the responsibility of the contractor to practice the principles of Safety First during the entire tenure of work with adequate insurance covering injury of death to workmen loss by theft or damage to materials and property in positions or not and third party liability stipulated.

The contractor should clear the site of all debris every day to avoid accidents. In case this is not done, the owners may engage necessary labor to maintain the cleanliness of the premises and removal of debris, and debit all or part of the expenditure so incurred from the contractor's. Breaking of any concrete structure is not allowed, without permission of the Engineer-in-charge.

SYSTEM INFORMATION

1.00 PROJECT DETAILS

OCCUPANCY DETAILS:

TOWER	FLOOR	NATURE OF OCCUPANCY	RISK
TOWER-1, 3, 4 & 6.	Ground Fl.		Car Parking, Lobby, Corridor, Caretaker, Electrical Room, B.M.S. Room, Elec. Duct.
	1 ST .-7 TH . & 9 TH .-12 TH . Fl.		Bed Room, Lobby, Corridor, Kitchen, Drawing, Dining, Elect. Duct.

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TOWER-2	8 TH . FL.	As per NBC 2016 Part-4 Group-a Residential Building, Sub division – A4	Bed Room, Lobby, Corridor, Kitchen, Drawing, Dining, Elect. Duct.
	Roof.		Lobby, lift Machine Room.
	Ground Fl.		Shop, Car Parking, Pharmacy For Residence, Lobby, Corridor, Caretaker room, Electrical Room, B.M.S. Room, Elec. Duct.
	1 ST . FL.		Maintenance Room, Association Room, Store, Bank, Doctor's Waiting Room, Ch Room, Doctor's Chamber, Bed Room, Lobby, Corridor, Kitchen, Living, Dining, Elect. Duct.
	2 ND . FL.		Bed Room, Lobby, Kitchen, Banquet For Residence, Pre Function, CH. Room, Room, Corridor, Living, Dining, Elect. Duct.
	3 RD . FL.		Meeting Room, Dress, Guest Room, Bed Room, Lobby, Corridor, Kitchen, Living, Dining, Elect. Duct.
	4 TH . FL.		Gym & Indoor Games, Bed Room, Lobby, Corridor, Kitchen, Living, Dining, Elect. Duct.
	5 TH . FL.		Bed Room, Lobby, Corridor, Kitchen, Living, Dining, Elect. Duct.
	6 TH , 7 TH . & 9 TH .-12 TH . Fl.		Bed Room, Lobby, Corridor, Kitchen, Drawing, Dining, Elect. Duct.
	8 TH . FL.		Bed Room, Lobby, Corridor, Kitchen, Drawing, Dining, Elect. Duct.
	Roof.		Lobby, lift Machine Room.
	Ground Fl.		Car Parking, Lobby, Association Room, Corridor, Caretaker, Electrical Room, B.M.S. Room, Elec. Duct.
	1 ST .-7 TH . &		Bed Room, Lobby, Corridor, Kitchen, Living, Drawing, Dining, Elect. Duct.

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TOWE R-5	9 TH .- 12 TH . FL.		
	8 TH . FL.		Bed Room, Lobby, Corridor, Kitchen, Living, Drawing, Dining, Elect. Duct.
	Roof.		Lobby, lift Machine Room.

D.0 Height of the Buildings : Considered 39.925 Mt. (approx.)

2.00 SCOPE OF WORK

This specification lays down the requirements design, engineering, manufacture, test at works, delivery to site, erection, testing, and performance demonstration at site and handing over to the owner a new intelligent reporting, Microprocessor controlled Fire Detection & Alarm System. The system shall include, but not be limited to alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies & wiring. The system and its components shall be Underwriters Laboratories Inc./F.M/VDS/LPCB/EN54. under their appropriate Testing standard. Whereas, it is not the detailed requirement, the Contractor must nevertheless furnish equipment conforming, design and workmanship. In case of any violation of the above by the Contractor, the owner reserves the right to change / reject / modify any equipment during the post contract engineering stage of the contract.

The Fire Alarm system and its components shall be approved by Underwriters Laboratories Inc / F.M/VDS/LPCB/EN54/EQ. Listed under their appropriate Testing standard.

3.00 INTRODUCTION

Intelligent and well-trained personnel are of no value if there are no reliable means to direct them to the right place at the right time during fire.

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A Fire Alarm System is one of the key elements among the overall fire protection features of all hazardous occupancy. Properly designed, installed, operated, and maintained a Fire Alarm system can help to limit fire losses and save human life.

Fire Alarm System consists of the following: -

- i) A Control Unit
- ii) A Primary (main) Power Supply
- iii) A Secondary (Standby) Power Supply
- iv) One or more initiating device circuits to which automatic fire detectors, Manual Call point are connected.
- v) One or more alarm-indicating device circuits to which Hooter cum speaker are connected.

4.00 COMPONENTS OF FIRE DETECTION & ALARM SYSTEM

The components which generally constitute the fire detection and alarm system are listed below:

- a) ANALOGUE ADDRESSABLE MULTI-CRITERIA DETECTOR (HEAT+OPT)
- b) ANALOGUE ADDRESSABLE HEAT DETECTOR
- c) ANALOGUE ADDRESSABLE MANUAL CALL POINT
- e) ANALOGUE ADDRESSABLE DUCT DETECTOR
- f) ANALOGUE ADDRESSABLE CONTROL MODULE
- g) ANALOGUE ADDRESSABLE CONTROL RELAY MODULE
- h) ANALOGUE ADDRESSABLE MONITOR MODULE
- i) HORN WITH STROBE
- j) F.R.L.S CABLING
- k) P. C. BASED MAIN FIRE ALARM CONTROL PANEL
WITH BATTERY & BATTERY CHARGER/UPS
- l) REAPETER PANELS (OPTIONAL)
- m) PA SYSTEM CONSOLE WITH 150 WATT AMPLIFIER

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- n) SPEAKER (6 WATT)
- o) ALL RELATED CIVIL WORKS
- p) METAL CONDUIT
- q) JUNCTION BOX

- r) RELATED STRUCTURAL WORK
- s) COMPUTER WITH UPS & PRINTER & SOFTWARE
- t) MISCELLANEOUS ITEMS

5.00 CODES AND STANDARDS

The design, material, construction, manufacture, testing, performance, installation etc. of the various components of the fire detection and alarm system shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be constructed to relieve the contractor of this responsibility.

Unless otherwise specified, the fire detection and alarm system and components shall conform to the latest applicable standards. Equipment conforming to other recognised international standards will also be considered, if they are established to be equal or superior to the standards listed.

The all devices of the system shall have proper listing and/or approval from the following recognized agencies:

- UL Underwriters Laboratories Inc
- ULC Underwriters Laboratories Canada
- FM Factory Mutual
- LPCB Loose Prevention Council Board
- VDS
- EN54

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Approval certificates shall be furnished with the bid.

The fire alarm system and the components used shall conform to the latest edition of the following and also the other Indian and International Standards as applicable.

A. Local & state building codes:

IS: 5 Colour Code

IS: 694 PVC insulated copper conductor.

IS: 1554(part-1) Armored PVC / rubber insulated cables.

IS: 1646 Code of practice for fire safety of building (general) : electrical installation.

IS: 2175 Specification for heat sensitive fire detectors for use in automatic electrical fire alarm system.

IS: 2189 Code of Practice for selection, installation and maintenance of automatic fire detection system.

IS: 9537 RIGID/Metallic conduit for cables.

(Part – I, II, III)

B. National Fire Protection Association (NFPA) - USA:

No. 70 National Electric Code (NEC)

No. 72-1996 National Fire Alarm Code

No. 101 Life Safety Code

6.00.00 DESIGN PHILOSOPHY OF PROPOSED SYSTEM

The purpose of providing Fire alarm system is to monitor the environmental condition and raise an alarm in case of fire in its incipient stage, so that extinguishing system can be brought in operation immediately to extinguish the fire in its early stage either automatically or manually to minimize the damage of property & to save life.

6.01.00 SYSTEM DESCRIPTION

The system shall be conventional type manually operated Fire Alarm system. There shall be one no. of Fire Alarm control panels to be installed in the control room at ground floor near main entry of each block.

Fire Alarm control panels shall have the provision to integrate Repeater Panel in addition to the above.

Fire Alarm System is essentially consisting of MCP and Fire Alarm Panel, Hooter cum speaker and cabling, repeater panel etc. MCP are installed in the each floor at all the building near the exit. All the MCP in each floor are wired up and directly hooked up through JB with Fire Alarm Control Panel, which is located in Ground Floor of each building. End of line resistance is connected at the end of the circuit to facilitate continuous monitoring of circuit i.e. for open and short circuit.

The system comprises of two numbers of manual call points & one no. hooter/speaker in each floor for all type of building and one no. Fire Alarm panel to be located in ground floor in each building. A repeater panel to be installed beside main gate of the premises which should be connected to each fire alarm panel for audio & video display identifying the building under fire.

In the event of fire out break or an emergency in any floor, person identifying the same will operate manual call point.

The panel logic shall be such that when MCP is operated, immediately sounders in the fire floor as well as the entire floor will raise an alarm.

The panel also will register an audiovisual alarm for the respective floor & will send an impulse to repeater panel for audiovisual alarm for the respective buildings.

Refer 'Synopsis of Fire Alarm System' for details of equipment and area protected by Fire Alarm System.

6.02.00 SITING OF FIRE DETECTOR / MCP

The range of coverage varies from manufacturer to manufacturer and as such the industrial practice is compliance with the rules of BIS:2189 (Latest editors) which have been finalised after conducting simulated test under different environmental condition. The stipulations are as follows:

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a) Manual Call Point : These shall be so located that no person has to travel a distance more than 30M to reach a manual call point along the periphery or inside a building or in other words the spacing between two manual call points located outdoor will not exceed 60M.

b) Heat Detector : As per Table 1 of IS:2189

These shall be so located that horizontal distance detector to detector shall not exceed 5.0M.

c) Detector : As per Table 1 of IS:2189

These shall be so located that horizontal distance detector to detector shall not exceed 9.0M.

6.03.00 MANUAL CALL POINT

Manual break glass units shall be of the break glass, spring release type, flush mounted of shatter proof and corrosion resistant, die-cast plastic enclosure, with a key operated test re-set lock for testing and resetting purposes and complete with chromium plated hammer and chain.

The alarm units shall be so designed that after actual emergency operation, they cannot be restored to normal status except by authorised personnel. Operational instructions and the words "BREAK GLASS FOR ALARM" shall be printed on the frangible glass.

The break glass units shall comply with IS: 2189 generally.

On each floor, one or more manual call points should be installed, preferably on the exit routes, call points should be installed at a height of 1.4 metres above the floor at an easily accessible well light position free of all obstructions.

Manual call points should be wall mounting type. The housing should be dust proof and moisture proof properly sealed with rubber lining.

All MCPs shall conform to the following standard shall bear approval from at least one authority:
EN54 / LPCB / UL / LPA

a) Construction : Aluminium Die Cast Plastic housing having a thickness greater than 2.5 mm provided with

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a cover which shall be suitably designed to provide the glass front, which shall keep the internal push button in a compressed condition. The manual call point shall have red epoxy painting and each box shall have distinct identification number boldly painted. When the glass is broken the push button shall automatically make contact on extending to its normal operation.

The internal inscription shall read 'BREAK GLASS' IN CASE OF FIRE

b) Accessories

- : a) The unit shall be complete with hammer and chain.
- b) Each manual call point shall be provided shall have a jack suitably wired to connect a portable telephone hand set to facilitate communication between the break glass box and the panel if called for in the data sheet.

c) Enclosure

- : a) Generally weather proof conforming to IP: 55.
- b) For hazardous areas explosion proof suitable for gas group, IIA & B. This explosion proof version should be certified by CMRS, Dhanbad and CCOE, Nagpur.
- c) All hardware's shall be corrosion resistant and all joints and connections shall be made by galvanised / zinc phosphate bolts, nuts, washers secured against corrosion.
- d) Each device shall have its own address module which shall send status signal.

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6.04.00 FIRE ALARM PANEL

i) DESIGN PARTICULAR

- a) Function : To provide audio/visual indication and transmit information.
- b) Type : Independent free standing / structure mounded / wall mounted complete with battery and battery charger.
- c) Circuit : Microprocessor based. Automatic change-over from main to battery.
- d) Accessories for the panel :
 - a) Fire Alarm panel with battery charger.
 - b) Battery - 24V DC
 - c) Cable
- e) Additional attachment : Provision to be made for
 - a) Linking to public address and paging system.
 - b) to transmit impulse to 'MIMIC PANEL'.
 - c) To transmit impulse to monitor and/or printer.
- f) Input voltage : 230 V AC

ii) DETAILS OF FIRE ALARM PANEL

- a) Function :
 - a) For user interface with the system
 - b) For operator to view alarm and fault (event less) data, testing or isolation of device, programming of password,

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date time and other panel fixtures, printing of various functions etc.

c) Function keys to be designed to be user friendly. Colour and text along with LED indication to be used to indicate the function of various keys or indicators

d) Fire alarm to be recorded and displayed sequentially, by operation of multiple alarm button.

e) Actuation and shut down functions executed automatically.

f) Faults and test functions indicated Via Menu selection.

b) DC Power pack

: Charger cum service rectifier for operating voltage & 24 V DC with Battery (Fumeless Dry Cell) having discharge time of one hour for full load operation and forty eight hours for quiescent operation.

c) Operational features

: The fire alarm panel shall be wall mounted. Upon receipt of an alarm, the control units shall perform the following actions.

Illuminate fire zone.

Active alarm warning devices within the Building

Operate internal fire sounder.

Devices shall be deactivated by operation of the "Silence Alarm" switch.

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Reset of the controller, after the fire incident has been investigated, will be achieved by operation of the reset-switch. The enclosures of panels shall be fabricated from sheet steel, minimum thickness 1.5 mm and shall be provided with a hinged lockable door protection to at least IP54 shall be provided. The fire alarm control panels shall comply with IS: 2189. Alarm panels shall, as a minimum requirement is equipped with the following:

- a) Mains supply "ON" indicator
- b) DC supply "ON" indicator
- c) DC supply "Faulty" indicator
- d) Alarm indicator for each zone
- e) Alarm accepts push button to acknowledge fire alarm signals, silence external audible alarms.
- f) Reset push button to restore monitoring systems to the quiescent condition.
- g) Integral sealed battery and trickle battery charger.
- h) Termination for incoming and outgoing wiring systems.
- i) Suitable fault indication both visual and audible.
- j) Integral power supply with battery per IS: 2189

stands by as

6.05.00 PUBLIC ADDRESS SYSTEM

Public Address system shall be provided for all the buildings. Individual Adequate capacity (watt) amplifier to be incorporated in each Fire Alarm panel installed in Ground floor of each building. The public address system shall have facility to talk individual floor as well as for all the floors from the microphone provided in the Fire Alarm panel.

The Public Address system is mainly being provided for Fire Fighting and orderly evacuation of people from affected areas in case of fire. The system would be such that in case of emergency, a responsible person can take command of the whole situation and issue necessary instructions over P.A. System for taking remedial measures for fire - fighting, evacuation and other necessary safety measures.

The scope of this specification includes all the items and components, which are essential and necessary for proper performance of individual items, irrespective of whether the item is specifically mentioned herein or not, and for completion of the installation in all respects.

The Public Address system shall consist of the following:

- a) Console with Microphone**
- b) Amplifiers**
- c) Microphone**
- d) Speakers**
- e) Racks**
- f) Associate wiring**
- g) Battery etc.**

6.06.01 The design of the system shall be such that

a) It will not be possible to switch off the P.A. system manually so long the Fire Detection and Alarm system remains switched on. - Separate power source and independent arrangement for PA System interconnection with the alarm system having isolation arrangements so that either hooters Alarm system or speakers for P A system can be made functional.

- b) It will be possible to communicate as follows:
- Speakers of any floor operating in parallel,
 - All speakers of all the floors, operating in parallel.

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6.06.02 System

The speech will be fed from microphone, through the preamplifiers and amplifiers to speakers at various locations.

The amplifier shall have solid-state circuitry, properly tropicalized and capable of AC / DC operation & capable to drive the speakers used for the installation.

The speakers shall generally have minimum audible range of 20 to 30 mtrs and should give clear, audible and intangible sound having frequency range of 50 Hz to 20000 Hz.

All power supply equipment's and accessories necessary for the system including back - up maintenance free battery and automatic battery charger, as necessary, shall be provided.

6.06.03 Amplifier rack has the following:

- a) Amplifier mounting rails.
- b) Lockable steel doors with proper ventilation's slot for heat disputations.
- c) Proper cable entry arrangements and terminal blocks

6.07.00 TALK BACK SYSTEM

Talk back system shall be provided for all the buildings. Each building will have individual talk back system for two-way communication from Fire Alarm Panel to individual floor & vice versa.

Each floor shall be provided with a wall mounted field hand set with front glass cover & shall be kept under lock & key. Master set shall be installed in the desk of Fire Alarm panel. All the field hand set shall be wired up to master set with individual cable.

In the event of Fire (when MCP is operated / during emergency) this two-way voice combination system shall be used to direct the occupants for evacuation purpose.

7.01 CONDUIT AND CABLING:

7.02 CONDUIT

- 7.02.1 Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.

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- 7.02.2 Where possible, 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.
- 7.02.3 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.
- 7.02.4 Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling 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.
- 7.02.5 Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backbones, except where conduit entry is specified by the FIRE ALARM CONTROL PANEL manufacturer.
- 7.02.6 Conduit shall be 3/4-inch (19.1 mm) minimum
- 7.02.7 Metal conduits wherever running shall be mechanically and electrically continuous and an earth continuity conductor shall be run along and an earth continuity conductor shall be run along its length according to the I.E. Rules and the relevant IS for its proper and rigid earthing. It shall be bounded electrically at a regular interval to provide effective and rigid earthing of the conduit installation. In long distance straight runs of the conduit, inspection type screwed coupler shall be provided at a suitable interval on running threads with couplers and jam nuts.
- 7.02.8 To protect against rust, the outer surface of the conduit & accessories shall be thoroughly cleaned and painted with anti-corrosive preservative paints, similar to the walls / floors / ceiling finish wherever required.
- 7.02.9 Necessary bends in the system including diversions shall be done by bending the pipes or by inserting suitable inspection type bends / elbows or similar fittings.
- 7.02.10 Generally, 1100 V grade 1.5mm PVC insulated and sheathed copper cable shall be used conforming to IS 694 (Part -II) with adequate number of cores required for wiring. However, the voltage drop in the system should be selected wherever such necessity arises. Total number of cables shall be so taken in a conduit as to facilitate easy drawing of the cables.
- 7.02.11 For earthing G. I. wires shall be used.

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7.02.12 Panels and bigger items should be having cable glanding facility using double compression dust and moisture proof electroplated brass cable glands of approved make.

7.03 CABLE

7.03.1 All fire alarm system cabling must be new.

7.03.2 Cabling 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 signaling line circuits, and 14 AWG (1.63 mm) for notification appliance circuits.

7.03.3 All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

7.03.4 Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR)

7.03.5 The system shall permit the use of IDC and NAC wiring in the same conduit with the multiplex communication loop.

7.03.6 All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

7.03.7 All voice speaker circuits shall use twisted/shielded pair to eliminate cross talk.

7.03.8 CABLE TERMINATION.

All heavy duty cables to be used for the purpose of connecting the fire protection system shall be PVC insulated and PVC sheathed copper conductor cables of armored type conforming to IS 1554 (Part I) 1964 of 650 / 1100 V grade wherever used for indoor purpose. Cables concerned only with fire protection system are generally to be taken along the fire protection systems are generally to be taken along the fire protection duct provided in the building. All cables after bringing to site must be got approved by the Engineer- In - Charge before use. All relevant test certificates shall be submitted in support of the sound manufacturing of the cables for approval to the Engineer- In Charge. The cables are to be dispatched to site in wooden drums with

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the ends sealed. The requirement of the exact length of cables shall be determined by the successful tendered after measurement at site.

Cables shall be laid in walls / ceilings / structures wherever concealed wiring is to be done but mainly the wiring run along the duct provided for the fire protection system shall be surface wiring. The cables shall be suitably supported @ 0.45 M for vertical run and @ 0.30 M for horizontal run in general, by means of M.S. brackets and clamps or aluminum cleats fixed on M.S. brackets. Bolts of suitable sizes are to be grouted on wall for fixing of the brackets. Cables to be laid underground shall be of armored type conforming to IS 1554 (Part I) 1964.

Loops should be kept at terminal ends. Appropriate glands should be provided where the cable enters junction box.

All the cables and wires should be tagged for proper identification. Wires should be identified by ferrules and cables by Colour bands at every 3M distance.

Minimum bending radius permissible is 12 D in case of armoured cables and 8 / 10 D in case of unarmoured cables.

7.04 TERMINAL BOXES, JUNCTION BOXES AND CABINETS:

All boxes and cabinets shall be UL listed for their intended purpose.

- 7.04.1 Initiating circuits shall be arranged to serve like categories (manual, smoke, water flow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.
- 7.04.2 The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled 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.

8.0 BATTERIES AND EXTERNAL CHARGER:

8.01 Battery:

- 8.01.1 Shall be 12 volt, Gell-Cell type.
- 8.01.2 Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.

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- 8.01.3 The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

8.02 External Battery Charger:

- 8.02.1 Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120/240-volt 50/60-hertz source.
- 8.02.2 Shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.
- 8.02.3 Shall have protection to prevent discharge through the charger.
- 8.02.4 Shall have protection for overloads and short circuits on both AC and DC sides.

9.0 EXECUTION

9.01 INSTALLATION:

- 9.01.1 Installation shall be in accordance with the NEC, NFPA 72 / IS: 2189 local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- 9.01.2 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
- 9.01.3 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.
- 9.01.4 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, nor more than 48 inches above the finished floor.

9.02 TYPICAL OPERATION:

Actuation of any manual station, shall cause the following operations to occur unless otherwise specified:

- 9.02.1 Will activate all Hooters until the panel is reset.

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9.03 TEST:

Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.

- 9.03.1 Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- 9.03.2 Verify activation of all flow switches.
- 9.03.3 Open initiating device circuits and verify that the trouble signal actuates.
- 9.03.4 Open signaling line circuits and verify that the trouble signal actuates.
- 9.03.5 Open and short notification appliance circuits and verify that trouble signal actuates.
- 9.03.6 Ground initiating device circuits and verify response of trouble signals.
- 9.03.7 Ground signaling line circuits and verify response of trouble signals.
- 9.03.8 Ground notification appliance circuits and verify response of trouble signals.
- 9.03.9 Check presence and audibility of tone at all alarm notification devices.
- 9.03.10 Check installation, supervision, and operation of all intelligent smoke & Heat detectors during a walk test.
- 9.03.11 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 FIRE ALARM CONTROL PANEL and the correct activation of the control points.
- 9.03.12 When the system is equipped with optional features, the manufacturer's manual should 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.

9.04 FINAL INSPECTION:

At the final inspection a factory trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

9.05 INSTRUCTION:

- 9.05.1 Provide instruction as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes

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and functions shall be provided.

- 9.05.2 The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation"

9.06 OPERATION & MAINTENANCE MANUAL

- 9.06.1 Hard copy as well as soft copy of Operation & maintenance manual to be submitted for smooths maintenance of the system.

DRAWINGS & DOCUMENTS

1.00 SUBMISSION SCHEDULE

1.01 GENERAL

1. All substitute proposed as equal to the equipment specified herein, shall meet or exceed the standards herein, shall meet or exceed the standards identified in CODES & STANDARDS in the specification.
2. For equipment other than that specified, the contractor shall supply proof that such substitute equipment does in fact equal exceed the features, functions, performance and quality of the specified equipment.
3. Four copies of all submittals shall be submitted to Purchaser for approval.

1.02 INFORMATION TO BE FURNISHED BY TENDERER ALONG WITH OFFER

- a) Schedule of quantities with respect to analogue line isolator
- b) Specification/data sheet of equipment/cables/materials.
- c) Confirmation of conformity to specification.
- d) Clause wise list of deviations, if any.

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- e) Total power requirement and power supply scheme.
- f) Details of UPS provided with ratings calculation.
- g) Details of ratings of batteries provided and calculation.
- h) General view of Master controller and its associated units.
- i) Manufacturers product catalogues.
- j) Time schedule and bar chart indicating various construction activities.
- k) Quality Assurance Plan.
- l) Duly filled-in Questionnaire & Schedules.
- m) List of spares.

1.03 GFC DRAWING TO BE PREPARED BY SUCCESSFUL TENDERER

A. FOR APPROVAL

- a) Final schedule of quantities.
- b) Riser diagram and write-up for system operation.
- c) Detail Construction for each floor with location of detectors, MCP, Modular etc
- d) Panel general view and construction details indicating space required for FDA, PA & Talk Back System.
- e) Scheme of panels, control unit.

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- f) Wiring diagram for
 - i) SLC circuit
 - ii) NAC circuit
- g) Cable routing/earthing layout.
- h) Specification data sheets for equipment, cables and junction boxes.
- i) Master control unit arrangement with associated units.
- j) Schedule of cables.
- k) UPS/BATTERY capacity calculation.

B. FOR INFORMATION AND REFERENCE

- a) Panel wiring diagrams.
- b) Operation and Maintenance Manuals.

1.04 SHOP DRAWINGS

1. Successful Contractor has to submit sufficient information, clearly presented to determine compliance with drawings and specifications.
2. Successful Contractor has to include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams and conduit layouts.

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3. Successful Contractor has to show annunciator layout and main Control Panel Module layout, configurations and terminations.

1.05 DOCUMENTS TO BE SUBMITTED FOR CLAIMING PAYMENT.

- a) Cross sectional drawing and Q.A.P of the equipment.
- b) Manufacturers certificates as indicated in QAP duly endorsed by PURCHASER/CONSULTANT.
- c) Inspection Report/Records (IN ORIGINAL) specifying result of test duly signed by manufacturer.
- d) Material Release note (IN ORIGINAL) specifying co-relating symbol for physical verification at site.

1.06 DOCUMENTS TO BE SUBMITTED FOR CLAIMING FINAL PAYMENT

- a) Hard Copy (6 sets) & Soft Copy of 'AS BUILT' drawing indicating the measurements & quantity of material.
- b) No objection Certificate from WBFES/ Local Authority having jurisdiction.
- c) Operation & Maintenance manual.
- d) Guarantee / Warranty certificate of all supply items.
- e) Guarantee certificate of systems.
- f) System compliance certificate for FDA, PA & Talk Back system to be provided.
- g) Battery calculation for panel to be submitted.
- h) Loop length calculation for panel to be submitted.
- i) Evacuation plan to be established.
- j) Training of client's representative to be completed including tremble shorting.

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- k) Commissioning certificate with performance guarantee to be submitted by factory trained engineer.
- l) Product test & warranty certificate along with system guarantee certificate to be submitted.
- m) Any other requirement as per W.O. & Tender Document to be submitted.
- n) Life cycle of the product to be indicated by the OEM & recording life & death of the product to be written in the commissioning report.
- o) Recommended trouble shooting list & maintenance schedule to be submitted before commissioning

1.07 PROGRESS REPORT

The successful Contractor shall submit Progress Report on 15th day of every month.

1.08 PERFORMANCE TEST BY WBFES FINAL ACCEPTANCE COMMITTEE

The installation shall be subjected to all tests for compliance with IS: 2189 / NBC part IV/ Provisional NOC by WBFES / as stipulated in this specification.

1.09 MANUALS

1. Successful Contractor shall submit simultaneously with the shop drawings, complete operating and technical manuals listing the manufacturer name(s), including technical data sheets.
2. Wiring diagrams shall include the interconnections between the pieces of equipment.
3. Provided a clear and concise description of operation, which gives, in details, the information required to properly operating the equipment and system.
4. Approvals will be based on complete submissions of manuals together with shop drawings.

2.00 WARRANTY & POST CONTRACT MAINTENANCE

WARRANTY

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-year from the date of beneficial use.

POST CONTRACT MAINTENANCE

Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorised representative of the major equipment manufacturer for a period of five years after expiry of warranty.

As part of this submittal, Contractors to include a quote for a maintenance contract to provide all maintenance, test and repair described below. Contractors to include also a quote of unscheduled maintenance/repair, including hourly rates for technicians trained of this equipment and response travel costs. Submittals, which do not identify all post contract maintenance costs, will not be accepted. The rates and costs shall be valid for the period of five years after expirations of the warranty.

Maintenance and testing shall be as required by the local Fire brigade. A preventive maintenance schedule shall be provided by the Contractor, which shall describe the plan for preventive maintenance of all devices and subassemblies requiring regular maintenance. The schedule shall include.

1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relay and all accessories of the fire alarm system.
2. Each circuit in the fire alarm system shall be tested in accordance with the requirements of NFPA 72 Guide for Testing Procedures for Local, Auxiliary and Remote Station.
3. Each detector shall be tested in accordance with the requirements of NFPA

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GENERAL AND TECHNICAL PARTICULARS

Contractor shall submit the following questionnaire duly filled in along with the bid. In case the Contractor becomes the successful contractor, the data shall form part of the Contract.

1.0	GENERAL PARTICULARS				
1.1	Name of the CONTRACTOR				
1.2	Address of the CONTRACTOR				
1.3	Telephone No, E-mail address & Fax No of the CONTRACTOR				
1.4	Name of the Contact Person to be responsible for this project				
1.5	Bid No. and Date				
1.6	Has the Contractor fully understand the Tender Documents	Yes/No	1.7	Does the Contractor agrees to execute the job completely as per specification	Yes/No
1.8	Otherwise list of Deviations enclosed.	Yes/No	1.9	Whether bar chart enclosed	Yes/No
1.10	List of projects executed in last two years with details enclosed.	Yes/No	1.11	Whether Guarantee and warranty offered	Yes/No
1.12	Whether spare parts are offered	Yes/No	1.13	Proposal Validity period	
1.14	Delivery period	Yes/No			
2.0	TECHNICAL PARTICULARS				
2.1	Does equipment conform to the standards and codes as listed	Yes/No	2.2	Are all equipment model numbers given ?	Yes/No
2.3	Does equipment enclosure conform to Protection class as specified	Yes/No	2.4	Have power requirement for entire system been specified	Yes/No
2.5	Whether catalogue with specification, dimension and colour pictorial view submitted	Yes/No	2.6	Are all the auxiliary equipment details, specifications books furnished?	Yes/No
2.7	Calculation for arriving at Battery capacity submitted.	Yes/No	2.8	Whether equipment supplied are rated for environmental working conditions specified	Yes/No

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DATA SHEET OF ANALOGUE ADDRESSABLE HEAT DETECTOR FOR MULTICRITERIA DETECTOR					
1.0 TECHNICAL SPECIFICATION					
1.01	Manufacturer		1.13	Operating Voltage	
1.02	Detector Type		1.14	Allowable air velocity	
1.03	Model No.		1.15	Storage temperature range	
1.04	Detector fixing type		1.16	Wiring style	
1.05	Detection Principle		1.17	Operating temperature range	
1.06	Nominal fixed temperature limit		1.18	Material	
1.07	Quiescent current		a)	Head	
1.08	Protection class of Detector enclosure		b)	Base	
1.09	Sensitivity adjustment range		c)	Printed circuit board	
1.10	Humidity range		d)	Colour	
1.11	Chamber Configuration		1.19	Alarm indicator	
1.12	Life of Detector				
2.0 APPROVALS					
	UL/FM/LPC/OTHERS				
	Listing No.				
3.0 SPECIFIC TECHNICAL CONFIRMATION					
3.1	Whether mounting base with cable gland included	Yes/No			
3.3	Weight				
3.4	Dimension				
3.5	Remote Local Test possible	Yes/No			
3.6	Blinking LED Facility	Dual/single			
4.0 DOCUMENTS ENCLOSED					
4.1	Catalogue		4.2	Approval Certificate	

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DATA SHEET OF ANALOGUE ADDRESSABLE SMOKE DETECTOR (PHOTO-ELECTRIC TYPE) FOR MULTICRITERIA DETECTOR					
1.0	TECHNICAL SPECIFICATION				
1.01	Manufacturer		1.14	Operating Voltage	
1.02	Detector Type		1.15	Allowable air velocity	
1.03	Model No.		1.16	Storage temperature range	
1.04	Detector fixing type		1.17	Wiring style	
1.05	Detection Principle		1.18	Operating Temperature range	
1.06	Sensitivity		1.19	Material	
1.07	Quiescent current		a)	Head	
1.08	Protection class of Detector enclosure		b)	Base	
1.09	Sensitivity adjustment range		c)	Printed circuit board	
1.10	Humidity range		d)	Colour	
1.11	Chamber Configuration		1.20	Alarm indicator	
1.12	Emitter		1.21	Life of Detector	
1.13	Sensor				
2.0	APPROVALS				
	UL/FM/LPC/OTHERS				
	Listing No.				
3.0	SPECIFIC TECHNICAL CONFIRMATION				
3.1	Whether mounting base with cable gland included	Yes/No			
3.3	Weight				
3.4	Dimension				
3.5	Remote Local Test possible	Yes/No			
3.6	Blinking LED Facility	Dual/single			
4.0	DOCUMENTS ENCLOSED				
4.1	Catalogue		4.2	Approval Certificate	

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DATA SHEET OF ANALOGUE ADDRESSABLE HEAT DETECTOR (RATE OF RISE CUM FIXED TEMPERATURE)					
1.0	TECHNICAL SPECIFICATION				
1.0 1	Manufacturer		1.13	Operating Voltage	
1.0 2	Detector Type		1.14	Allowable air velocity	
1.0 3	Model No.		1.15	Storage temperature range	
1.0 4	Detector fixing type		1.16	Wiring style	
1.0 5	Detection Principle		1.17	Temperature operating range	
1.0 6	Nominal fixed temperature limit		1.18	Material	
1.0 7	Quiescent current		a)	Head	
1.0 8	Protection class of Detector enclosure		b)	Base	
1.0 9	Sensitivity adjustment range		c)	Printed circuit board	
1.1 0	Humidity range		d)	Colour	
1.1 1	Chamber Configuration		1.19	Alarm indicator	
1.1 2	Life of Detector				
2.0	APPROVALS				
	UL/FM/LPC/OTHERS				
	Listing No.				
3.0	SPECIFIC TECHNICAL CONFIRMATION				
3.1	Whether mounting base with cable gland included	Yes/No			
3.3	Weight				
3.4	Dimension				
3.5	Remote Local Test possible	Yes/No			
3.6	Blinking LED Facility	Dual/single			
4.0	DOCUMENTS ENCLOSED				
4.1	Catalogue		4.2	Approval Certificate	

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DATA SHEET OF ANALOGUE ADDRESSABLE DUCT DETECTOR					
1.0 TECHNICAL SPECIFICATION					
1.01	Manufacturer		1.13	Operating Voltage	
1.02	Detector Type		1.14	Allowable air velocity	
1.03	Model No.		1.15	Storage temperature range	
1.04	Detector fixing		1.16	Wiring style	
1.05	Detection Principle		1.17	Temperature operating range	
1.06	Nominal fixed temperature limit		1.18	Material	
1.07	Quiescent current		a)	Head	
1.08	Protection class of Detector enclosure		b)	Base	
1.09	Sensitivity adjustment range		c)	Printed circuit board	
1.10	Humidity range		d)	Colour	
1.11	Chamber Configuration		1.19	Alarm indicator	
1.12	Life of Detector				
2.0 APPROVALS					
	UL/FM/LPC/OTHERS				
	Listing No.				
3.0 SPECIFIC TECHNICAL CONFIRMATION					
3.1	Whether mounting base with cable gland included	Yes/No			
3.3	Weight				
3.4	Dimension				
3.5	Remote Local Test possible	Yes/No			
3.6	Blinking LED Facility	Dual/single			
4.0 DOCUMENTS ENCLOSED					
4.1	Catalogue		4.2	Approval Certificate	

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TECHNICAL SPECIFICATION OF ADDRESSABLE FIRE ALARM PANEL					
1.0	TECHNICAL SPECIFICATION				
1.01	Make		1.13	No. of Alarm sensitivity level	
1.02	Model No.		1.14	Alarm sensitivity range	
1.02	No. of loops provided in panel		1.15	No. of Pre alarm warning	
1.03	Main supply voltage		1.16	Recommended cable size for detector loop	
1.04	Internal power supply		1.17	Power consumption on full load	
1.05	Type of Display		1.18	Communication method	
1.06	Display size/LCD characters per line		1.19	Alarm Indicators	
1.07	Maximum no. addressable Detector in one loop		1.20	Weight without battery	
1.08	Maximum no. addressable Modules in one loop		1.21	Battery capacity	
1.09	Maximum length of cable permissible in one loop		1.22	Mounting of panel	
1.10	Wiring Style		1.23	Dimension	
a)	SLC circuit		1.24	Size of panel mounting	
b)	NAC circuit				
1.11	Event history capacity				
1.12	Maximum No. of Addressable Loops can be expanded in this panel				
2.0	SPECIFIC TECHNICAL CONFIRMATION				
2.01	Protocol	Analogue / Digital	2.09	CRT/TFT port provided	Yes/No
2.02	Drift compensation provided	Yes/No	2.10	Repeater panel port provided	Yes/No
2.03	Maintenance alert provided	Yes/No	2.11	Network interface provided	Yes/No
2.04	Colour graphics PC with all peripherals included	Yes/No	2.12	Graphical user interface provided	Yes/No
2.05	Key board provided with panel	Yes/No	2.13	Loop isolator provided	Yes/No
2.06	Software programmable EEPROMS provided	Yes/No	2.14	Whether this panel is BMS compatible	Yes/No
2.07	Printer port provided	Yes/No	2.15	Whether auto dialer facility has been provided	Yes/No
2.08	Day & night sensitivity adjustment	Yes/No	2.16	Whether UPS included	Yes/No

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

TECHNICAL SPECIFICATION OF ADDRESSABLE FIRE ALARM PANEL					
3.0	APPROVALS	UL / FM / LPC / OTHERS			
4.0	CONSTRUCTION CONFIGURATION OF PANEL				
4.1	Thickness of sheet metal		4.2	Approximate dimension	
4.3	Degree of Protection		4.4	Colour Code	
4.5	Earthing arrangement		4.6	Surface Finish	
5.0	TECHNICAL PARTICULARS OF BATTERY				
5.1	Manufacturer		5.2	Output rate	
5.3	Type		5.4	Quantity	
5.5	Stand by time				
6.0	TECHNICAL PARTICULARS OF BATTERY CHARGER				
6.1	Manufacturer		6.2	Charging rate	
6.3	Charger type		6.4	Boost charging time	
6.5	Rating of charger				
7.0	SPECIFIC TECHNICAL CONFIGURATION				
7.1	Whether battery low alarm provided	Yes/No	7.2	Time for which battery will supply power to system	
7.3	Whether compatible to computer/printer	Yes/No	7.4	Whether charger failure alarm provided	Yes/No
7.5	Indicate the BMS protocol supported by the panel				
8.0	DOCUMENTS ENCLOSED				
8.1	Catalogue		8.2	Approval Certificate	

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DATA SHEET OF ANALOGUE ADDRESSABLE MANUAL CALL POINT					
1.0 TECHNICAL SPECIFICATION					
1.01	Manufacturer		1.08	Wiring style	
1.02	Model No.		1.09	Operating temperature range	
1.03	Operating Principle		1.10	Material	
1.04	Quiescent current		a)	body	
1.05	Enclosure Protection class of manual call point		b)	Colour	
1.06	Humidity range		1.11	Recommended mounting height	
1.07	Operating Voltage				
2.0 APPROVALS					
2.01	UL/FM/LPC/OTHERS				
2.02	Listing No.				
3.0 SPECIFIC TECHNICAL CONFIRMATION					
3.01	Whether mounting base with cable gland included	Yes/No			
3.02	Provision of test key provided	Yes/No			
3.03	Blinking LED Facility	Yes/No			
3.04	Whether complete with interface unit / monitor module	Yes/No			
3.05	Weight				
3.06	Dimension				
4.0 DOCUMENTS ENCLOSED					
4.1	Catalogue		4.2	Approval Certificate	

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DATA SHEET OF HORN CUM STROBE					
1.0 TECHNICAL SPECIFICATION					
1.01	Manufacturer		1.09	Wiring style	
1.02	Model No.		1.10	Flash Rate	
1.03	Operating Principle		1.11	Material	
1.04	Protection class of Enclosure		a)	body	
1.05	Sound level intensity		b)	Colour	
1.06	Operating current		1.12	Recommended mounting height	
1.07	Operating Voltage		1.13	Type of mounting	
1.08	Humidity range				
2.0 APPROVALS					
2.01	UL/FM/LPC/OTHERS				
2.02	Listing No.				
3.0 SPECIFIC TECHNICAL CONFIRMATION					
3.01	Whether mounting base with cable gland included	Yes/No			
3.02	Blinking LED Facility	Yes/No			
3.03	Weight				
3.04	Dimension				
4.0 DOCUMENTS ENCLOSED					
4.1	Catalogue		4.2	Approval Certificate	

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DATA SHEET OF ANALOGUE ADDRESSABLE MONITOR MODULE					
1.0	TECHNICAL SPECIFICATION				
1.01	Manufacturer		1.08	Wiring style	
1.02	Model No.		1.09	Operating temperature range	
1.03	Operating Principle		1.10	Material	
1.04	Quiescent current		a)	body	
1.05	Enclosure Protection class of manual call point		b)	Colour	
1.06	Humidity range		1.11	Recommended mounting height	
1.07	Operating Voltage				
2.0	APPROVALS				
2.01	UL/FM/LPC/OTHERS				
2.02	Listing No.				
3.0	SPECIFIC TECHNICAL CONFIRMATION				
3.01	Whether mounting base with cable gland included	Yes/No			
3.02	Blinking LED Facility	Yes/No			
3.03	Weight				
3.04	Dimension				
4.0	DOCUMENTS ENCLOSED				
4.1	Catalogue		4.2	Approval Certificate	

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DATA SHEET OF ANALOGUE ADDRESSABLE CONTROL MODULE					
1.0 TECHNICAL SPECIFICATION					
1.01	Manufacturer		1.08	Wiring style	
1.02	Model No.		1.09	Operating temperature range	
1.03	Operating Principle		1.10	Material	
1.04	Quiescent current		a)	body	
1.05	Enclosure Protection class of manual call point		b)	Colour	
1.06	Humidity range		1.11	Recommended mounting height	
1.07	Operating Voltage				
2.0 APPROVALS					
2.01	UL/FM/LPC/OTHERS				
2.02	Listing No.				
3.0 SPECIFIC TECHNICAL CONFIRMATION					
3.01	Whether mounting base with cable gland included	Yes/No			
3.02	Blinking LED Facility	Yes/No			
3.03	Weight				
3.04	Dimension				
4.0 DOCUMENTS ENCLOSED					
4.1	Catalogue		4.2	Approval Certificate	

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DATA SHEET OF RESPONSE INDICATOR					
1.0	TECHNICAL SPECIFICATION				
1.01	Manufacturer		1.07	Wiring configuration	
1.02	Model No.		1.08	Material	
1.03	Type of mounting		a)	body	
1.04	Protection class of Enclosure		b)	Colour	
1.05	Operating Voltage				
1.06	No. of LED's				
2.0	APPROVALS				
2.01	UL/FM/LPC/OTHERS				
2.02	Listing No.				
3.0	SPECIFIC TECHNICAL CONFIRMATION				
3.01	Weight				
3.02	Dimension				
3.03					
4.0	DOCUMENTS ENCLOSED				
4.1	Catalogue		4.2	Approval Certificate	

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

TECHNICAL SPECIFICATION OF P.A. CONSOLE					
1.0	TECHNICAL SPECIFICATION				
1.01	Manufacturer		1.06	Wiring configuration	
1.02	Model No.		1.07	Amplifier rating	
1.03	Type of mounting		1.08	Mounting arrangement	
1.04	Protection class of Enclosure				
1.05	Operating Voltage				
2.0	APPROVALS				
3.0	CONSTRUCTION CONFIGURATION OF PANEL				
3.01	Thickness of sheet metal		3.04	Approximate dimension	
3.02	Weight & dimension		3.05	Colour Code	
3.03	Earthing arrangement		3.06	Surface Finish	
4.0	TECHNICAL PARTICULARS OF BATTERY				
4.01	Manufacturer		4.04	Stand by time	
4.02	Type		4.05	Output rate	
4.03	Quantity				
5.0	TECHNICAL PARTICULARS OF BATTERY CHARGER				
5.01	Manufacturer		5.04	Charging rate	
5.02	Charger type		5.05	Boost charging time	
5.03	Rating of charger				
6.0	SPECIFIC TECHNICAL CONFIGURATION				
6.01	Whether individual and all call selector switch provided	Yes/No			
7.0	DOCUMENTS ENCLOSED				
7.01	Catalogue		7.02	Approval Certificate	

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DATA SHEET OF SPEAKER					
1.0	TECHNICAL SPECIFICATION				
1.01	Manufacturer		1.08	Wiring configuration	
1.02	Model No.		1.09	Material	
1.03	Operating Principle		a)	body	
1.04	Protection class of Enclosure		b)	Colour	
1.05	Operating current		1.10	Recommended mounting height	
1.06	Operating Voltage		1.11	Type of mounting	
1.07	Humidity range		1.12	Sound level	
2.0	APPROVALS				
3.0	SPECIFIC TECHNICAL CONFIRMATION				
3.01	Whether mounting base with cable gland included	Yes/No			
3.02	Weight				
3.03	Dimension				
4.0	DOCUMENTS ENCLOSED				
4.1	Catalogue		4.2	Approval Certificate	

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

SCHEDULE OF SHOP TEST & INSPECTION

Test & Inspection as per Specification shall be performed. Detailed list of test including result of prototype tests shall be included in this schedule.

COMPANY SEAL

Name of Firm_____

Signature_____

Designation_____

Date_____

<p>SCHEDULE OF TRAINING OF PURCHASER PERSONNEL</p>

During Installation, Testing and Commissioning Purchaser's Personnel shall be trained thoroughly by Contractor's Engineers to acquaint with the system maintenance and operation without any extra cost.

COMPANY SEAL

Name of Firm_____

Signature_____

Designation_____

Date_____

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

LIST OF RECOMMENDED SPARE PARTS FOR MAINTENANCE

Contractor has to submit list of spares required for two years trouble free maintenance.

SL. No.	DESCRIPTION	QUANTITY NUMBERS

COMPANY SEAL

Name of Firm_____

Signature_____

Designation_____

Date_____

SCHEDULE FOR COMMISSIONING AND HANDING OVER

A. TESTS TO BE CONDUCTED AFTER INSTALLATION OF CABLES AND PANELS

- All cables shall be Meggered and tested for continuity.
- All annunciation in the panel to be achieved by actual operation.
- All tests as described in the specification to be carried out.
- Any other tests required by purchaser Fire Services.
- Installed cables are as per approved material submittal.--- Declaration
- Installed cables accessories (Saddle, screw etc) are as per approved material submittal.- Declaration.
- Routing of cables are as per approved shop drawing submittal----- Declaration.
- Installed cables are free from any damages and the routing is coordinated with other services.- Declaration.
- Spacing of Saddles/clamps as per specification(3 saddle in 1 Mtr.) ----- Declaration
- Proper fittings are used for change in directions and offsets ----- Declaration
- Installation is carried out as per manufacturer's instructions, approved drawings.- Declaration
- All screws are tightened and secured ----- Declaration
- Riser diagram (all detectors and devices) to be submitted
- AHU and fire damper tripping report.

B. TEST TO BE CONDUCTED AFTER INSTALLATION OF FIRE ALARM POINTS

After installation each loop shall be tested for

- Insulation and continuity check module and loop check along with of each detector.
- Actuation of relay for shutting off A/C system/ventilation system.
- Alerting security/fire personnel by siren.
- The contractor to the satisfaction of Client and Consultant will conduct PAT
- Report for each Detector & device checking.
- Trouble list.
- Isolation status checking through isolation module.
- Random device checking (higher officials) report.

Proper records counter signed by Client for actual works executed shall be maintained and submitted to Client.

C. SCHEDULE OF TEST

1. All cables shall be meggered before energising.
2. Performance test to be conducted at site after installation.

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D. COMMISSIONING

Before integrated commissioning of FAS a stage called pre-commissioning activities will be conducted to trial run of a particular module/remote panel in order to check the related functional check for systems like A/C / Ventilation system switch off etc. The entire integrated commissioning of FAS will be the responsibility of this contractor. This Contractor will depute able personnel to handle this job in full co-operation with other Contractors, Client and Consultant.

- Commissioning report by factory trained engineer.
- O & M manuals with As-built drawings.
- Training to site people/ FM team including basic trouble shooting list to site FM team.
- Training schedule for clients representative.

H. HANDING OVER

The installation shall be taken over only after the Contractor has satisfactorily demonstrated performance to WBFES and FINAL NOC has been obtained from WBFES by Contractor

COMPANY SEAL

Name of Firm_____

Signature_____

Designation_____

Date_____

<p>SCHEDULE OF GUARANTEE FOR MATERIALS AND SYSTEM</p>
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All materials to be supplied for this project shall be guaranteed for 18 months from receipt at site or 12 months from receipt at site or 12 months after commissioning.

Any defects if found during this period shall be supplied, erected and commissioned without any extra cost within the specified time stipulated by purchaser.

SYSTEM shall be guaranteed up to 12 after commissioning.

Any defect raised during this period shall be rectified without any extra cost within the specified time stipulated by Purchaser.

COMPANY SEAL

Name of Firm_____

Signature_____

Designation_____

Date_____

SCHEDULE OF DEVIATION FROM TECHNICAL SPECIFICATION

In this schedule, the Contractor shall set out all deviations, Clause by clause from the Technical Specification. Unless specifically mentioned in this schedule, the bid shall be deemed to conform to this Schedule, the bid shall be deemed to the Purchaser's specification.

COMPANY SEAL

Name of Firm_____

Signature_____

Designation_____

Date_____

<p>SCHEDULE OF DEVIATION FROM GENERAL CONDITIONS</p>

In this schedule, the Contractor shall set out all deviations, Clause by clause from the General Condition. Unless specifically mentioned in this schedule, the bid shall be deemed to conform to this Schedule, the bid shall be deemed to the Purchaser's specification.

COMPANY SEAL

Name of Firm_____

Signature_____

Designation_____

Date_____

FIRE PROTECTION SYSTEM

GENERAL

A. SCOPE

1.00 Work under this scope shall cover residual engineering, manufacture, procurement, test and inspection at works, packing for transportation, delivery to site, unloading, storage, erection, testing, commissioning, performance, demonstration at site and handing over to purchaser of Fire Protection as indicated in the Schedule of Requirement and scope of work and as required for reliable and effective fire protection of **'OITIKA HOUSING' Proposed 6 Nos. G+XII Storied Residential Building. At New Town, Kolkata, West Bengal.**

2.00 This specification makes it obligatory for the contractor to arrange and obtaining necessary clearance/approval from all statutory authorities wherever specified and in compliance with the requirement of **LOCAL FIRE AUTHORITY**

3.00 This specification also includes complete earthwork, i.e. excavation and back filling for the buried piping for hydrant and sprinkler system.

4.00 The Contractor should include the following in his scope:

- a) Insurance Policy.
- b) Workmen Compensation Policy.
- c) Labour license.
- d) Any other prevailing statutory requirement policy as per West Bengal & Central Government act.

5.00 Wherever material or article is specified or described by the name of particular brand, manufacturer or vendor, the specific item mentioned shall be understood as established type, function and quality desired. Other manufacturer's product shall not be accepted unless the owner / consultant prior to award of the contract has approved them.

6.00 It is not the intent to completely specify all the details of design and construction herein. Nevertheless the equipment and installation shall conform to high standard of engineering, design and workmanship in all respect and shall be capable of performing continuous satisfactory operation and acceptable to the PURCHASER / CONSULTANT as well as to the various authorities like LOCAL FIRE AUTHORITIES / ANY OTHER

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STATUTORY AUTHORITIES. In case of any violation of the above the purchaser reserves the right to change/reject/modify at no extra cost the equipment/system during execution stage of the contract.

7.00 The entire system shall be erected by the Contractor based on the approved construction drawing guidelines furnished in the specification, various codes/standards, Contractor's experience and also good engineering practice.

8.00 The proposed Fire Detection & Protection systems shall combat any outbreak of fire to reduce the consequential damage by containing and extinguishing the fire.

9.00 Supplies and services to be covered under this tender specification and the conditions thereof are detailed in the subsequent sections of the specifications. In case of conflict among various sections, subsequent, documents, drawings, the same shall be referred to purchaser/consultant whose decision shall be final and binding to the Contractor. In all cases, the best advantages will go to the purchaser.

10.00 Before quoting, the Contractor must visit the site and acquaint himself with the site condition and the scope of work of the Fire Protection Systems, as specified hereinafter.

B. Power supply shall be available

- i) For AC motors below 150 KW : 415 volts 3-phase, 3-wire 50 Hz non effectively earths.
- ii) AC control & Productive devices : 230 volts phase, 2-wire 50 Hz supply with center point earthed. Aux. power supply listed against this item shall be derived by contractor from owner's 415V supply by providing adequately rated dry type control transformers + 10% of circuit taps on 415V side switch and HRC fuses and Lind on secondary side. Central point of the secondary shall be earthed through an isolating link.
- iii) Lighting fixtures space heaters : 240V, 1-Phase, 2-wire 50 Hz AC supply with neutral lead earthed.

All electrical equipment against this specification shall be suitable for the above supply system:

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C. Scope of Supply of Vendor

- 1.00 The equipment and items to be furnished under the scope of this specification are outlined hereinafter. Any additional equipment, material, service which are not specifically mentioned but required to make the system complete and acceptable to the acceptance committees of **Engineer-in-Charge** and LOCAL FIRE AUTHORITY shall be deemed to be included in the scope and be furnished.
- 2.00 All specialized equipment/services necessary for proper erection, commissioning and performance testing of the complete system covered under this contract shall be provided by contractor and as such the cost of such equipment/services shall be included in the quoted prices.
- 3.00 The terminal points of the scope of work are specified in Clause **F**. The items of work which are specifically excluded from the scope have been indicated in clause **F**. Tentative Bill of Materials have been furnished in the Bidding Schedule under the schedule of work and rates to this subsection. All the equipment/items to be supplied under this specification shall have approval from statutory authorities like TAC/UL/FM/FOC and conform to applicable codes. All indigenous equipment shall have ISI mark on them wherever available.
- 4.00 The parameters of different equipment as indicated in the specification and various bid drawings enclosed are for Contractor's guidance only. Contractor shall check the adequacy of all parameters of the equipment and indicate any changes required in the parameters as specified.
- 5.00 The extent of supply under the contract includes all items shown in the bid drawings notwithstanding the fact that the items may have been omitted from the specification or schedule. Similarly, the extent of supply also includes all items mentioned in the specification notwithstanding the fact that such items omitted in the drawings. All such items which are not specifically mentioned in the specification and drawings but which are required to complete the contract are deemed to be provide by the contractor at no additional cost.
- 6.00 Fire water Pumping system complete with pump motor set, piping, valves etc.
- 7.00 Pressurisation system comprising of electric motor driven horizontal centrifugal Jockey pumps, with all accessories.
- 8.00 Complete set of piping, valves, fittings, specialties instruments etc. as required for the complete hydrant system.

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- 9.00 Automatic Sprinkler system consisting of Installation control valves, sprinklers, piping work, fittings, hangers, anchor, supporting structures, along with isolation valves and all other accessories as required as specified elsewhere for the above system.
- 10.00 Outdoor stand post type hydrants and indoor type landing valves complete with all accessories.
- 11.00 63mm (2 ½") 15M long rubber lined hose complete with all fittings.
- 12.00 Hose reels with drum, isolation valve, pressure reduction valve with all accessories.
- 13.00 Hose cabinets complete with spanner and instantaneous rubber (IR) ring shall be provided.
- 14.00 All instrumentation and controls for the entire hydrant, Sprinkler system as indicated in P & I diagram including erection and commissioning and as required for the safe and trouble free operation of the entire Fire Detection and Protection system.
- 15.00 Complete erection materials and accessories for control and instrumentation like root valves, impulse pipe, control cables, junction boxes, etc
- 16.00 Motor Control Center including cabling from instrument to panel to prime movers.
- 17.00 All bolts, foundation bolts, nuts, gaskets, packing, pipe hangers, support/thrust block etc. as needed for complete erection and commissioning be provided.
- 18.00 All paints and materials for anticorrosive treatment on pipes/equipment/structures.
- 19.00 Various test reports, test certificates, erection manual, operation and maintenance manual of equipment.
- 20.00 Necessary quantities of pressure break down devices for hydrant system.
- 21.00 All pedestal type concrete supports for the pipe at various points as necessary depending on the earth condition, diameter of piping and route of piping.
- 22.00 Protective Hume pipes for buried piping at all road crossings.
- 23.00 Supply, fabrication and erection of steel sections and plates wherever necessary.
- 24.00 All supports including the supply of all auxiliary steel members as necessary for over ground piping.
- 25.00 First fill of all fuel and lubricants required for commissioning and performance demonstration to **Engineer-in-Charge / LOCAL FIRE AUTHORITY.**
- 26.00 All spare parts and tools and tackles required for erection, testing and commissioning.

D. Scope of Services by Vendor

- 1.00 Residual engineering of the entire Fire Protection system.

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- 2.00 All specialized equipment/services necessary for proper erection, commissioning and performance testing of the complete system covered under this contract shall be provided by contractor and as such the cost of such equipment/services shall be included in the quoted prices.
- 3.00 Transportation to site, unloading and intermediate storage at site, complete work of erection including final grouting, testing and commissioning and putting into operation of entire Fire Protection system.
- 4.00 All final dressing of foundations, grouting of equipment and patch work during erection.
- 5.00 Excavation and back filling of earth for all buried piping, cabling and foundation work. The surplus earth shall be disposed of at a lead from work site as per instruction of OWNERS Engineer.
- 6.00 Application of primer and final painting for equipment, piping and structure.
- 7.00 Transportation to site, unloading of free issue materials (if indicated in schedule of work) and rates, complete work of erection including final grouting, testing and commissioning and putting into operation.
- 8.00 Arranging water for hydro testing of pipeline segment wise & for flushing, and commissioning and performance demonstration shall be provided by **Engineer-in-Charge**.

E. TERMINAL POINT AND EXCLUSION

a. TERMINAL POINTS:

1.00 Mechanical

- i) Up to Hydrant valves for Hydrant system.

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- ii) Up to Sprinkler heads for sprinkler system
- iii) All drain pipes up to purchaser's drain are however included in the Contractor's scope.

2.0 Electrical

- i) Fire Fighting panel
(However one no. 415V, Hz, 3-phase, 4-wire incomer feeder shall be provided by purchaser to supply power to the Fire Fighting Panel in the firewater pump house).
- ii) Equipment Grounding
(However, grounding bus shall be provided by the purchaser around the Fire water pump house).

b. EXCLUSION

1.00 Civil Works

Civil work related to pump house building construction equipment foundation and concrete trench (if any) will be carried out by a separate agency and is excluded from the scope of this specification. Such civil works will be arranged by the purchaser based in the detailed dimensional drawing, specification and load data to be furnished by the Contractor. Dressing & Chipping of foundation however is included in the scope of Contractor.

2.00 Mechanical Works

Provision in water reservoir for outlet connection and inlet water connection for filling the tanks with nozzles for connection of recirculation/test piping. However, the Contractor has to carry out piping connections for supply header and recirculation/test pipeline.

3.00 Electrical Works

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Fire water pump house illumination and ventilation system (if necessary) as well as lighting protection and underground earthing bus system.

B. TYPES OF FIRE PROTECTION SYSTEM TO BE INSTALLED

a. **PORTABLE FIRE** : These are meant for very small fire and detected at the incipient **EXTINGUISHERS** stage. Such fire would be considered by the occupants using portable extinguishers.

b. **FIRST- AID** : These are meant for small fire which would not be extinguished **HOSE REEL** by using portable extinguishers. These comprises of Hose reel which would also be operated by the occupants.

c. **WET RISER WITH** : These are meant for fire which have gone out of control of the **YARD HYDRANT** occupants. These comprises of landing valves mounted on every floor. This would be operated by trained fire fighters.

d. **AUTOMATIC** : These comprises of automatic sprinklers which gets shattered **SPRINKLER** automatically and starts sprinkling water on the surface under **SYSTEM** fire & control the fire till it is attended by trained fire fighters

NOTE : The risk shall also be provided with 'AUTOMATIC DETECTION & FIRE ALARM SYSTEM' and special gaseous fire extinguishing system for electrical risks which would be executed by others through another package.

C. FIRE HYDRANT SYSTEM WITH WET RISER & FIRST- AID HOSE REEL

1.00 General

The system envisaged is independent system i.e. Hydrant system, Sprinkler System are to be fed by independent pumping sets.

The system comprises of network of underground and aboveground piping throughout the complex provided with hydrants at strategic location. The system is fed by pumping sets as identified in the 'Operation Philosophy'.

2.00 Description of the System

A well designed and well laid hydrant service is the backbone of the entire firefighting equipment as it fights fire of serious proportions in all classes of risk and continues to be in full operation even if part of effected building and/or structures have collapsed and also keep cool the adjoining properties, thereby minimising the exposure hazards.

The entire building premises shall be provided with Wet Riser type Fire Hydrant system. Hydrant ring main shall be installed inside the Basement at ceiling level & hydrant to be provided at strategic location in the the entire building area. Risers shall be provided along with the staircases. One no. landing valve & One no. hose reel shall be installed at each floor from each riser. Hose boxes to be mounted near each hydrant /landing valve. Each hose box shall consist of two nos. hose with coupling & one no branch pipe with nozzle & one no. spanner. Isolation valves in above ground piping network shall be provided.

3.00 Operation Philosophy of Hydrant System

The system from the non-return valve on the pump headers to the hydrant valves will remain pressurised at 7.0 Kg/Cm² through a pressurisation system comprising of Jockey Pump, which would make up the system leak if any.

In case of leakage in the system the pressure in the header will fall resulting in auto start of the Jockey pump and as soon as the pressure is build up the Jockey pump will stop automatically.

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In case of fire, hoses have to be fitted with branch pipes and nozzles or dual purpose fog nozzle/universal branch pipe, connected to the hydrant valves through instantaneous couplings and hydrant valve to be opened for directing water to the seat of fire.

This would result in drop of pressure in the network and the Jockey pump will come into operation automatically but owing to excess water demand it would not be able to meet the water demand resulting in further drop of pressure, causing the fire pump to start automatically.

The control and operation would be achieved through panels located in firewater pump house.

The scheme is indicated in the drawings enclosed with this tender document.

4.00 Major Equipment and Material for Fire Hydrant System.

- | | |
|-------------------------------|---------------------------------|
| i) Main & stand-by fire pump. | viii) Branch pipes with nozzles |
| ii) Jockey Pump | ix) First – Aid Hose Reel |
| iii) Fire Water Piping | x) Hose Box |
| iv) Isolation Valves | xi) Fire Brigade Connection |
| v) Non- Return Valve | xii) MCC Cum Control |
| vi) Hydrant Valves | xiii) Panel, Instrumentation |
| vii) Hose pipe with couplings | xiv) Panel & Control |

D. AUTOMATIC SPRINKLER SYSTEM

1.00 General

The Sprinkler system consists of installation control valve mounted on sprinkler header and the system beyond installation control valve consists of piping which would be wet

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water piping network around the protected risk on which Sprinklers would be mounted at suitable locations to Sprinkler water on all the surfaces. The system is fed by pumping sets identified in the 'Operation Philosophy'.

The entire building shall be provided with Sprinkler system.

Sprinkler head shall also be provided in void exceeds 800 mm.

2.00 Description of the Sprinkler System

The Sprinkler header shall be installed inside Basement at ceiling level. The complete risk shall be provided with sprinklers strategically located and fed through pipeline by number of Installation control valves which are mounted on a network fed by automatically actuated Sprinkler pump.

The pipeline up to the sprinklers shall be kept pressurized by water. In the event of fire, the glass bulb of the sprinkler will shatter causing water to be discharged through the shattered sprinkler thus bringing the fire pump into automatic activation.

3.00 OPERATIONAL PHILOSOPHY OF SPRINKLER SYSTEM

The system from the non-return valves on the pump delivery header to the sprinklers will remain pressurised at 7.0 Kg/Cm² through a pressurisation system comprising of Jockey Pump which would make up the system leakage, if any.

Each Sprinklers riser is provided with installation control valves feeding the Sprinkler system. All the valves are automatically operated.

In the event of fire outbreak in any area Sprinklers will get shattered resulting in opening of respective installation control valve causing pressurised water to flow to sprinkler and get discharged in the pattern of uniform spray on the surface for extinguishing of fire.

The scheme is indicated in the drawings enclosed with this tender document:

4.00 Major Equipment and Material for Sprinkler system

- | | |
|---------------------------------|----------------------------|
| i) Main & standby Fire pump | viii) MCC Cum Control |
| ii) Jockey pump | ix) Instrumentation |
| iii) Fire water piping | x) Panel & Control & Cable |
| iv) Isolation valves | |
| v) Non- Return Valve | |
| vi) Sprinkler | |
| vii) Installation Control valve | |

E. SPACING OF SUPPORTS FOR SPRINKLER SYSTEM

Sprinkler piping shall be supported from the roof / beam / column after providing insert plates fixed through anchor bolts

The spacing of support will not exceed the following:

PIPE DIAMETER		SPACING
i) 25 mm NB to 40mmNB	:	1.5M
ii) 50 mm NB to 65mm NB	:	2.0M
iii) 80 mm NB to 100mm NB	:	3.0M
iv) 150 mm NB to 200mm NB	:	4.0M

F. OPERATION PHILOSOPHY OF FIRE PUMPS

1.00 PREAMBLE

The complete system remains pressurized up to Hydrant valve, and sprinklers by two (2) Jockey pumps. The Jockey pumps are auto start/stop type.

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The hydrant, and sprinkler systems are independent system fed by 2 (Two) pumps (One main & One Standby) which would come in operation automatically in the event of fire, but would be stopped only manually.

In the event of fire outbreak and when hydrant valve is opened, the Jockey pump come into operation automatically but since the water demand would be more, the Jockey pump would not be able to meet the demand and pressure would fall further, resulting in bringing the respective fire pump in operation automatically.

Similarly, in the event of fire outbreak and when sprinkler shatters the Jockey pump come into operation automatically but since the water demand would be more, the Jockey pump would not be able to meet the demand and pressure would fall further, resulting in bringing the respective fire pump in operation automatically.

The third pump is standby pump and would remain as emergency pump and would come into operation automatically in the event of any of the working pumps failing to come in operation as per interlock design.

2.00 DETAILS OF EQUIPMENT & INSTRUMENT

There will be a water reservoir & Fire Pump House. Consisting of the following pumping units.

A) PUMPING SETS IN PUMP HOUSE

2.01 FIRE WATER PUMP HOUSE

A) Underground Water Reservoir: As per FSR – 1,00,000 Ltrs.

B) Overhead Water Reservoir : As per FSR – 5,000 Ltrs.
On each Tower.

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2.02 DETAILS OF FIRE PUMPING SET FOR FIRE HYDRANT SYSTEM

A) PUMPING SETS

i) FIRE PUMP

Electrical motor driven fire pump : FP201(Cap. 2850 Lpm. at 88 MWC)

ii) STAND BY FIRE PUMP

1) Electrical motor driven fire pump: FP202(Cap. 2850 Lpm. at 88 MWC)

iii) PRESSURIZING PUMP

1) Electrical motor driven jockey pump: JP101 for Hydrant System (Cap. 180 Lpm. At 88 MWC)

B) PANELS

1) Composite power cum Control Panel : CC P-01

For all the above pump sets.

b) Equipment's

i) Composite panel : 1 no. (CAP 100)

c) Instruments

i) Level Switch

ii) Pressure Switch

iii) Annunciator / Indicator : Please refer P & I Diagram

iv) Recirculation valve Enclosed

C) ELECTRICAL CONNECTED LOAD

1) Fire Pump Motor Rating 75 KW

3.00 DETAILS OF CONTROL CUM ANNUNCIATION REQUIREMENT OF COMPOSITE PANEL (CAP 100)

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4.00 CONTROL PHILOSOPHY

- 1) Jockey pump (JP101) can be started & stopped manually through push button when mode selector switch is in manual mode.
- 2) Fire pumps (FP201 & FP202) can be started and stopped manually through push buttons when mode selector switch is in manual mode.
- 3) Jockey pump (JP101) will start and stop automatically through pressure switches provided on header.
- 4) Fire pump (FP201) for hydrant system would start automatically through pressure switch provided on Hydrant header, but stopping would be manual only.
- 5) Fire Pump (FP202) common Standby Pump would start automatically through pressure Switch provided on Hydrant header when main fire pump fails to start, but stopping would be manual only.

5.00 Fire Water Storage to be Provided : As per NBC Part-IV / Provisional NOC issued by WBFES.

6.00 RECIRCULATION SYSTEM.

The delivery header will have pressure switches mounted for annunciating high pressure resulting out of low flow.

One branch pipe will be provided for each system, connected to the firewater reservoir having re-circulation valve. The recalculation valve is to be open manually when the pressure is high allowing water to flow to the reservoir and ensuring operation of the pump above the minimum flow recommendation.

7.00 CONTROL FEATURES ENVISAGED

In addition to above, the following additional feature have been envisaged which are necessary for improvement of system performance.

i) Since it is not necessary to run Jockey pump, when the fire pump has started the pumps have been provided with interlock so that Jockey pump would be automatically stopped when any of the fire pump come in operation.

ii) Fire pump P-202 is identified as standby pump and would start automatically in the event of failure of respective system fire pumps through timers provided in the panel.

8.00 INDICATION FEATURES ENVISAGED

In order to provide summarized information of the system to the operator of the firewater pump house, following indication lamps are provided:

PUMP NOT IN DEMAND (One for each)	This identifies that the situation is healthy.
--------------------------------------	--

PUMP IN DEMAND (One for each)	This identifies that fire situation has arisen and pump should start.
----------------------------------	---

An audible hooter is provided common to all pumps which would sound the moment impulse has come from any pressure switch warranting the respective pump to start.

However, the moment "PUMP RUNNING" indication lamp has glown; the hooter would cut out automatically.

In any case only one indication lamp would glow at any time i.e. under healthy condition of the system only 'NOT IN DEMAND' indication lamp will glow which will automatically cut out when impulse has come from the respective pressure switch (PSL) and 'IN DEMAND' indication lamp glows which will further cut out automatically when pump

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starts and RUNNING indication lamp glows which will further cut out automatically if the prime mover fails to start and 'FAILS TO START' indication lamp glows

9.00 ADDITIONAL INDICATION FEATURE ENVISAGED

1) VISUAL ALARM

- i) HYDRANT HEADER PRESSURE HIGH
- ii) SPRINKLER HEADER PRESSURE HIGH
- iii) SYSTEM DEMAND
- iv) SPARE

2) AUDIBLE ALARM

One hooter shall be provided to alert the operator in the event of any of the above faults conditions and one hooter shall be provided (different tone), in the event of fire condition i.e. SYSTEM DEMAND.

10.00 DETAILS OF COMPOSITE PANEL

One composite power-cum-control panel is envisaged which would receive power from emergency bus of PMCC of adequate rating of 415V, 3 phase 50 Hz AC power supply. The panel will house all the power and control modules of all the equipment and will control operation of the system according to design logic and system philosophy. The panel will have the following sections:

SECTION - 1 : This is incomer section receiving power from MCC and will have the following:

- a) Circuit Breaker
- b) All protection relays
- c) Ammeter with selector switch
- d) Voltmeter with selector switch

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- e) Indication lamp for power supply healthy - R, Y, B

SECTION - 2 : The control voltage would be 24V DC and such this section is meant for D.C. Power supply and will have the following:

- a) Battery
- b) Battery charger
- c) Rectifier
- d) Ammeter and Voltmeter
- e) Mode selection switch
- f) Isolator switch (AC & DC)

SECTION - 3,4,5,6 : These are meant for electrical motor driven Jockey pumps & fire pumps and will house power as well as control modules and will comprise of the following:

- i) Switch Fuse unit. / Breaker
- ii) Auto/manual Selector switch.
- iii) Ammeter for Jockey pump and Fire Pump.
- iv) DOL starter and control hardware for Jockey pump.
- v) STAR / DELTA starter and control hardware for Fire pump.
- vi) Indication lamp as per Operation Philosophy.

SECTION -7 : This is meant for housing the additional indicators and should include all the indication as specified in Operation Philosophy.

Note: - An Auxiliary Relay on Motor Contractor shall be provided for each fire & jockey pumps to transmit Pump Running/Fails to Start Indication to BMS Panel

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G. DESIGN BASIS OF FIRE PROTECTION SYSTEM TO BE FOLLOWED:

- | | | |
|----|--|---|
| a) | Wet riser type Fire Hydrant System- | IS 3844 / NBC Part-IV / As per Local Fire Service Requirement |
| b) | Automatic Sprinkler Systems | - TAC / IS: 15105 |
| c) | Gas based total Flooding System | - NFPA 2001 |
| d) | Fire Alarm System | - IS: 2189 |
| e) | Portable Fire Extinguishers | - IS: 2190 |
| f) | Fire Notice/ Order | - NBC Part-IV / Local Fire Service Requirement. |
| g) | Fire Exit Sign/Floor No. Evacuation Sign | - NBC Part-IV / Local Fire Service Requirement. |

ERECTION OF PUMP SETS

1.0 TYPE OF PUMP SETS & ERECTION PROCEDURE

- a)** The type of Pump set covered in this specification include but not limited to the following:
- i) Fire Pumps with motors
 - ii) Jockey Pumps with Motors.
- b)** The contractor shall be responsible for checking levels and orientation plan of all foundation, diameter, length and disposition of anchor bolts in accordance with the supplier's booklet and literature for installation, well in advance of taking up the actual erection of machinery. Contractor shall carry out minor rectification such as chipping of surface of foundation etc., where necessary. After completion of the pre-erection work to

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the satisfaction of the Engineer-in-charge the contractor shall commence erection of machinery on foundation.

- c)** The Erection of machinery shall be such that installation and operation instructions supplied by manufacturers shall be adhered to before final grouting is taken in hand.
- d)** After erection and alignment in accordance with the drawing, specifications and instruction the work shall be shown to the Engineer-in-charge for checking and approval before taking up grouting of foundation, dressing of foundation base. Grouting shall be as per drawings, specifications and instructions of Engineer-in-charge.
- e)** For all machinery, drilling of holes in the base plates for fixing motors fixing of couplings on shafts etc. and doweling including provision of dowel pins or similar arrangements for retaining the alignments shall be carried out by the contractor as a part of retaining the alignment shall be carried out by the contractor as part of erection work.
- f)** The contractor may have to open some of the parts of the equipment for cleaning and fitting it in its original condition. No extra payment shall be made for such work.
- g)** The grouting materials shall solidly fill the spaces to be grouted and permanently retain its original volume so that the base plate will be held firmly in the set position. The amount of water used in mixing shall be kept to a minimum such that the grout shall have a consistency too stiff to flow.
- h)** The top of foundation shall be clean and free of all laitance, loose particles, oil or grease and shall be wetted thoroughly leaving no puddles prior to grounding.
- i)** All trapped pockets shall be properly vented to show full penetration of grout.
- j)** The grout shall cover all shims, which are to be retained.
- k)** All anchor bolts holes be completed filled with grout.

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- l)** Care is to be taken during grouting so that the base plate level and alignment is not disturbed.

2.0 TRIAL RUNS OF THE PUMPS

The duration of trial run for pumps will generally the contractor shall provided at his own cost as part of erection, charge hands, fitters, mechanics, helpers etc. necessary for maintaining the machinery during the test period.

a) Painting

After the mechanical completion and testing of the work, painting work shall be done in accordance with the Standard Specification for shop and field painting.

3.0 ITEMS TO BE SUPPLIED BY CONTRACTOR

- a) All nuts, Bolts & Gasket for pipe connection.
- b) Casing drain piping with Valves
- c) Pressure gauge in delivery with valves
- d) Packing plate, seems for final alignment & leveling
- f) Pipe cross over and valves operating platform

4.0 SERVICE TO BE PROVIDED BY CONTRACTOR

- a) Erection of all items
- b) Alignment, leveling, final grouting.
- c) Pipe cross over and valve operating platform
- d) Testing & Commissioning
- e) Final Dressing and painting

GENERAL ELECTRICAL WORKS

1.00.00 INTENT OF SPECIFICATION

The scope of work shall cover Design & Engineering, manufacturing, testing at shop, packing, forwarding, unloading at site storage & rending assistance during commissioning at site

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incorporating circuit breakers switch fuse, bus bars, earthing etc. meeting the requirement Indian Electricity Act & rules & WBFES rules.

The design, material construction, manufacturing, inspection, testing & commissioning shall conform with al latest applicable Indian standard.

2.00.00 CODES AND STANDARDS

All equipment & materials shall be designed, manufactured & tested in accordance with the latest applicable Indian Standard (IS).

Equipment and materials conforming to any other standard which ensure equal or better quality may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

The electrical installation shall meet the requirement of Indian electricity rules as amended upto date, relevant IS Code of Practice for respective equipment, National Electricity Code of Indian and regulations applicable to the work shall be binding.

3.00.00 SITE CONDITIONS

3.01.00 The equipment will be installed in a hot, humid and tropical atmosphere. All equipment, accessories and wiring shall be provided with tropical finish to suit the environment and to prevent fungus growth.

3.02.00 Unless otherwise stated in the equipment specification, the reference ambient temperature shall be taken as 50 deg. C, relative humidity 100%.

3.03.00 For equipment installed outdoor and exposed to direct sun rays, the effect of solar heat shall be considered in the design.

4.00.00 SITE DATA

Site data to be considered in design of equipment under the specification are:

a)	Average grade level	
b)	Ambient humidity	

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c) Ambient air temperature	Contractor must visit site prior to submitting offer to obtain the date.
d) Seismic zone	

5.00.00 RATING OF EQUIPMENT

5.01.00 Equipment shall be rated for the load and duty cycle of the intended service. Circuit breakers and fuses shall be rated to withstand and interrupted the maximum fault current at the point of application in the circuit

6.00.00 ENCLOSURE

Unless otherwise stated, enclosure of electrical equipment intended for indoor service shall be dust-tight, vermin proof with gasket doors/covers, generally conforming to degree of protection IP-54.

6.02.00 Equipment enclosure intended for outdoor service shall be of weatherproof construction generally conforming to degree of protection IP-55.

7.00.00 SPECIFIC REQUIREMENTS - SERVICES

7.01.00 Responsibility of erection

7.01.01 The contractor shall be fully and finally responsible for proper erection necessary to ensure safe and satisfaction of the plant & equipment under his scope of work to the entire satisfaction of the Purchaser.

7.01.02 The work shall be executed in accordance with the directions, instructions, drawings and specifications issued/ approved by the Purchaser by time to time.

M.S. PIPING WORK

1.00 GENERAL

This specification is intended to cover the technical requirements for the execution of piping pre-fabrication assembly and erection of the entire pipe work define hereunder.

2.0 EXECUTION OF WORK

2.1 The work shall be carried out in conformity with the fire drawings and within the requirements of Architectural, HVAC, Electrical Structural and other specialized services drawings.

2.2 The Contractor shall cooperate with all trades and agencies working on the site.

3.0 SCOPE

The scope of work of the contractor is generally described below:

- a) Fabrication and erection of all piping systems from piping materials supplied in accordance with this specification and applicable drawings & standards.
- B) Construction of RCC sleepers inclusive of supply of all materials and in compliance with the specification and drawings and application of cement based paint where ever required. (Snowcem or equivalent).
- c) Fabrication and erection of supporting elements i.e. shoes, clips, cradles etc. including applying one coat of red oxide zinc chromate primer.
- d) Fabrication and erection of supporting fixtures.
- e) Fabrication and erection of all drain piping and vent piping assembly, instrument tapping piping.
- f) Testing, flushing, and drying.
- g) All piping systems shall be fabricated, installed, flushed, tested in accordance with specification and applicable codes/drawings. Any deviation from the specification

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and drawing shall be permitted only after obtaining the written approval of the Engineer-in-charge.

Notes On Supports

- i) Supports guide and anchors for piping shall be fabricated and provided.
- ii) Fabrication and erection of supporting elements and structural fixtures wherever required and pointed out by the Engineer-in-charge, whether in drawing or not to prevent vibration excess sag etc. shall be carried out by the contractor. No separate payment will be made for erection of these additional support and it will be deemed as part of piping erection work.

4.0 FABRICATION PIPING

4.1 Pre-fabrication

The contractor shall fabricate all piping work in conformity with the requirements of pertinent general arrangement drawings and specifications.

The contractor shall be responsible for working to the exact dimensions as shown on the drawings irrespective of individual tolerance permissible. Where errors found it is contractor's responsibility to notify the Engineer-in-charge prior to fabrication or erection.

4.2 Joints & Welding

- a) All pipes shall have ends beveled for welding. The joints for welding shall be made properly and carefully using line-up clamps, with a uniform root spacing to facilitate the production of sound welds and to avoid misalignment. Tack welds may be used to hold the edge to welded in line.

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- b) Welded branch connections shall be used as indicated on the drawings. The center line of the branch shall intersect the centerline of the header. All cuts shall be carefully beveled and accurately matched to form a good V to permit full penetration of weld at all points.
- c) Root run shall be made with respective electrodes/filler wires. The size of the electrodes shall not be greater (12 SWG) and should preferably be 2:64 mm (12 SWG). Welding shall be done with direct current values recommended by the electrodes manufacturers.
- d) Upward technique shall be adopted for welding pipes to horizontally fixed position. For pipes with wall thickness less than 3 mm oxyacetylene welding is recommended.
- e) On completion of each run craters, weld irregularities, slag etc. shall be removed by grinding or chipping.
- f) During the process of welding, all movements, shocks, vibration or stresses shall be carefully avoided in order to prevent weld cracks.
- g) Fillet weld shall be made by shielded metal arc process regardless of thickness and class of piping. Electrodes size shall not exceed 10 SWG (3.25mm). At least two runs shall be made on socket weld joints.

4.3 The pipes, to be joined by welding shall be aligned correcting the existing tolerance on diameters, wall thickness and out of roundness. The same alignment shall be preserved during welding. For the internal misalignment due to difference in wall the component with higher wall thickness shall be internally machined/ground as per standards so that adjoining surfaces are approximately flushed.

4.4 Layout and Cutting of Pipes

- a) Machine cut levels to form the welding groove are preferred in carbon steel pipe. However, smooth, clean, slag free, flame cut bevels are acceptable.

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- b) Tack welds with full penetration shall be used and shall become a part of the finished weld. Defective welds with lack of penetration are not acceptable and shall be chipped/ground out.
- c) No temporary weld attachment shall be with the extended clamps/attachment.
- d) All flanges facing shall be true and perpendicular to the axis of the pipe to which they are attached.

4.5 Pipe Joints

In general joining for pipe sizes above 50 NB by butt-welding connections & 50 NB and below shall have socket welded/screwed joints as specified in the line materials specifications.

4.6 Erection of Piping

- a) All piping shall be erected as shown in piping drawings keeping in view the piping specifications. No deviations from the arrangement shown shall be permitted without the written consent of the Engineer-in-charge.
- b) All pipes laid underground shall be at a minimum depth of one meter below finish ground level.
- c) Pipes shall run inside a concrete pipe at all road crossings.
- d) Vents and drains are intended, for releasing the trapped air and draining out the fluid. The contractor shall provide vents and drains connections even when these are not shown in the drawings and are found necessary by the Engineer-in-charge.

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- e) After the piping is erected in final position, it shall be cleaned, tested for tightness and kept dry.
- f) The valve spindle positions shall be at accessible location.

5.0 Inspection

5.1 General

- a) Owner inspector shall have free access in all places where the work is being done or any other thing and place concerned with the work.
- b) Owner is entitled to send his own inspector to field or shops where pre-fabricated and erection of pipe lines being done, with the following functions but not limited to:
 - i) To check that the welding performance and welding equipment used on the job are suitable and conform to relevant standards.
 - ii) To supervise welding procedure qualification.
 - iii) To supervise welder performance qualification.
 - iv) To check whether welding is conforming to relevant specification and the practice followed is in accordance with good pipeline construction practice.
 - v) To check any other performance to ensure quality of work.
- c) Contractor shall provide the Owner's Inspector with all facilities necessary for carrying out his work at no extra cost to the owner.
- d) Approval from the Owner's Inspector shall not relieve the contractor partially or fully of his responsibilities and guarantees under this contract.

5.2 Visual Inspection

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Inspection of all welds shall be carried out as per relevant IS standards. Finished welds shall be visually inspected for parallel and axial misalignment of the work, cracks, inadequate penetration, unprepared burn through, dimensions and other surface defects.

5.3 Repair of removal of Defects

- a) Defects which are not within the acceptable limits shall be removed from the joint completely by chipping or grinding & shall be restored once again.

5.4 Hydraulic Testing & Inspection

5.4.1 General

- a) All pipes shall be tested for leakage to a hydrostatic test pressure at 150% of maximum working pressure for two hours.
- b) The testing shall be carried out in convenient sections approved by the Engineer-in-charge.
If some defects are noticed during the hydrostatic testing, the same shall be brought to the notice of Engineer-in-charge and shall be rectified as per the welding specifications and instructions of Engineer-in-charge and tested to the satisfaction of Engineer-in-charge at no extra cost to the owner.
- c) The Engineer-in-charge shall be notified in advance by contractor of all testing the hydrostatic testing/flushing of all the piping shall be carried out by the contractor at his own cost.
- d) Contractor shall make his own arrangement for flushing at suitable points as per the instructions of the Engineer-in-charge. Any extra modification on this account shall be done by the contractor at his own cost.
- e) Soft water shall generally be used as the testing medium for the hydrostatic testing of piping system.
- f) All systems shall be cleaned and flushed free of all dirt, debris or loose foreign material after testing.
- g) Open ends of piping systems such as at pumps or wherever equipment has been removed or disconnected prior to hydrostatic testing, or at termination point of piping branch connection shall be blinded off by temporary blind flange made out of 6 mm thick M.S. Plate.

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- h) All piping system and equipment shall be properly vented to remove air from the system during filling.
- i) Pressure shall be applied by means of a suitable test pump which shall not be connected to the system until ready to test. A pressure gauge shall be provided at the pump discharge for guidance in bringing the system up to pressure. The pump shall be attended to constantly during the test by an authorized operator. The pump shall be disconnected immediately after the test pressure is reached.

The test pressure is to be maintained for sufficient time to permit complete inspection of the system under test but in no case shall the time be less than two hours. Test shall be considered complete only when approval is given by the Engineer-in-charge.

- j) Contractor's own test gauge shall be installed as close as possible to the lowest point in the system being tested. Prior to installation, the test gauge shall be checked against a standard gauge or calibrated. Calibration of test gauge shall be the responsibility of the contractor.
- k) All lines and equipment shall be completely drained after the hydrostatic test of a system has been completed.

If it comes necessary to leave the pipe filled with the testing medium for any abnormal length of time suitable arrangement such as venting shall be made to provide for possible liquid expansion with change in ambient temperature.

5.4.2 Records

Records in triplicate shall be made by the contractor for each system as follows:

- a) In case of underground piping, layouts giving actual elevations of pipeline as laid.
- b) Test certificates containing date of test, identification of the piping system, date of flushing.

CORROSION PROTECTION OF UNDERGROUND PIPING

1.0 GENERAL

For corrosion protection of underground M.S. pipes shall consist of coating and wrapping with cool tar based anticorrosive pipe coat as per IS 15337.

2.0 PROCEDURE

2.1 PREPARATION & CLEANING OF PIPES

The pipeline shall be cleaned of all rust, grease, dirt, weld burs etc. It shall be scrubbed manually with stiff wire bruised and scrapped where necessary. Pipe coat primer should be applied immediately after the cleaning of pipes. The entire pipe length shall be cleaned but the ends of the pipe shall be left without coating and wrapping for a distance of 230 mm for joints which shall be coated and wrapped manually at site after lying welding and testing of pipes.

2.2 Approved primer shall be applied immediately after cleaning of pipes.

2.3 WRAPPING

Two coat of 2 mm thick Cool tar based corrosion protection tape to be applied after primer.

Entire underground piping shall be tested by holyday detector, if Engineer-in-Charge / WBFES/ Any locate authority desired to conduct the test. Any defect found to be reinstalled by the vender free of cost.

PAINTING OF PIPING, EQUIPMENT AND STRUCTURE

1.0 PAINTING OF OVERGROUND PIPING / EQUIPMENT / VALVES ETC.

- 1.1** The scheme of painting to be followed for various equipment are furnished hereinafter. The Contractor may suggest any alternative painting scheme if the same is superior to the suggested scheme. The final scheme of painting to adopted shall be subjected to purchaser's approval.
- 1.2** When material or paint is specified or described by the name of a particular brand, manufacturer or vendor, the specific time mentioned shall be understood as indicating the

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function and quality desired. Other manufacturer's product shall be approved provided specific information is given to allow the purchaser to evaluate the product proposed.

1.3 Surface Preparation

- a) All surfaces shall be manually cleaned of rust/mill scale by wire brush
- b) Special care shall be taken to remove grease and oil by means of soluble solvents. In case paint manufacturer's recommendation dictates any special requirement from surface preparation the same shall also be provided.

c) Primer Coat

i) Type : Two (2) coats of Red oxide primer suitable for corrosive environment to be applied immediately after received at site.

ii) No. of Coat : Two (2)

a) 1st Coat immediately after erection

b) 2nd coat before application of Signal Red

d) Finish Coat

i) Type : Signal Red enamel paint

ii) No. of Coat : No. of coat = 2

NOTE : All supporting Structure, Frames, Hangers shall also to be painted with two coats of primer & two coats of Black Enamel paint.

STRUCTURAL PIPE SUPPORT

1.0 GENERAL

This specification covers the fabrication, transportation to site and erection of structural steel pipe supports. This specification also covers supply, where supply by contractor is involved as listed.

2.0 MATERIAL

a) Steel structural and plates shall conform to IS 2062. All other materials shall conform to their respective standards specification.

b) Bolts and nuts shall conform to IS 1367.

1) For Underground piping - G.I

2) For Above ground piping - M.S

3.0 SPECIFICATION

a) Fabrication shall be as per standard fabrication practices as approved by the Engineering-in-charge in addition to the following:

- Fabrication shall be done as per standards/drawings adhering strictly to work points and work lines are the same. The connections shall be welded or bolted as per design drawings.
- Any defective material used shall be replaced by the contractor at his own expenses, care must be taken to prevent any damage to the structure during removal.
- Welding should be carried out only by fully trained and experienced welders.

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SUPPLY AND LAYING OF HUME PIPES

1.0 GENERAL

This specification covers the supply and laying of RCC Hume pipes as per drawings and instruction of the purchaser. The entire work shall be carried out as per latest editions of Indian Standards IS: 450 and IS: 783.

2.0 SUPPLY OF PIPES

The contractor shall supply the RCC Hume Pipe of various diameters along with complete fittings required for carrying out the work. All RCC Hume pipes should conform to class NP3 of IS: 456 and should be in good condition. The contractor must furnish, on being demanded by the EIC manufacturer's certificate from recognized authorities.

3.0 ALIGNMENTS, LEVEL AND GRADE

The work shall be carried out in conformance to the alignments, levels and grades specified in the drawings. The layout and levels shall be made by him at his own cost from one preference grid and bench mark given by the Engineer-in-charge. He shall give all help in instruments, materials and men to the Engineer-in-charge for checking and detailed layout levels as and when required.

Making or reference layout and level pillars along with pipeline route and maintaining them upto completion work shall be the responsibility of the contractor.

No extra claim shall be made for these.

4.0 LAYING OF PIPES

4.1 General

The laying of RCC shall conform to the clause-9 of IS : 783.

4.2 Condition for Laying

The conditions for laying of pipes to suit the conditions at site and/or as per drawings and instructions of the purchaser shall be as below.

i) Culvert Condition

In this condition the pipe is laid under embankment and may project wholly or partly above the original ground surface.

ii) Trench Condition

In this condition the pipe is laid in a trench excavated for the purpose. The trench shall be refilled with thoroughly tamped earth after laying and joining of pipes in approved manner.

iii) Open Condition

In this condition the pipe is laid such it projects wholly or partly above original ground surface, there being no superimposed over burden on the pipe.

4.3 Bedding & Supports

i) Culvert Condition

In this condition the pipes shall be laid generally on “First Class Bedding” as per clause No. 4.3.3 of IS : 783, unless directed otherwise.

ii) Trench Condition

In this condition the pipes shall be laid generally on “First Class Bedding” as per clause No. 4.2.3 of IS : 783, unless directed otherwise.

iii) Concrete Cradle Bedding

If required by the drawing or so instructed by the Engineer-in-charge the pipes shall be laid concrete cradle, conforming to clause No. 4.2.3 of IS:783 in case of trench condition and conforming to clause 4.3.4 of IS:783 in case of culvert condition.

iv) Open Condition

In open condition the pipe line shall be supported over rigid pedestal constructed at intervals not greater than the length of one individual piece of pipe, as per drawings and instructions of the pipe as per drawings and instructions of the Engineer-in-charge. In no case shall the joint between two pieces of pipe shall lie at center of the span between two supports. The pedestals shall be of rubble masonry, or brick masonry of plain/reinforced concrete with a property shaped out top to receive the pipe.

4.4 Handling of Pipes

The pipes shall be handled with all possible care while loading, unloading, transporting and lowering them in position. The method of handing during all the stages of the work should be to the approval of the purchaser and should preferably employ mechanical means like use of chain pulley block and the like.

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SAFETY SIGNAGE

(EXIT SIGN, ARROW, FLOOR NUMBER & FIRE ORDER)

1.0 GENERAL

This specification covers the fabrication, transportation to site and erection of Signage. This specification also covers supply, where supply by contractor is involved as listed.

2.0 MATERIAL

The “Exit” Board & “Arrow” making to indicate direction of escape route shall be of size **150 mm x 300 mm & 150 mm x 150 mm** respectively and Floor Number shall be of size **150 mm x 200 mm**. The signage shall be of Photo luminescent nature. The signage shall get charged from the existing light present in the area and shall come alive to glow as soon as the light goes out by the luminous crystals containing mainly zinc supplied in protective glass-like shell which is non toxic & non radioactive or non hazardous. The intensity of glow in the dark of the said signage shall decrease continuously but should last not less than 4 hours and strongest glow should produce during first 30 minutes of darkness. The Fire Order should be on Acrylic sheet of size **450 mm x 300 mm** approx. by bright lettering.

3.0 SPECIFICATION

Fabrication shall be as per standard fabrication practices as approved by the Engineering-in-charge in addition to the following:

- Fabrication shall be done as per standards / drawings adhering strictly to work points and work lines are the same.
- Any defective material used shall be replaced by the contractor at his own expenses care must be taken to prevent any damage to the structure during removal.

FIRE SMOKE CHECK DOOR

(Brief Specification)

A.0 GENERAL

This specification covers the fabrication, transportation to site and erection of Signage. This specification also covers supply, where supply by contractor is involved as listed.

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B.0 MATERIAL

1. The Fire & Smoke Check Door Assembly should be as per the guideline of NBC (2016)

a) Any combination of fire door, frame, hardware and other accessories that together provide a specific fire resistant rating to the opening in terms of its stability, integrity and insulation properties.

b) Fire doors in exits shall have fire rating as required to meet the requirement of integrity and stability; and the insulation criteria shall be 20 min.

c) Fire doors in exits shall be provided with intumescent seal.

d) Fire doors in exits shall not be allowed to be on hold open position and kept closed and to close by 'door closure-spring mechanism'.

2. The Fire & Smoke check door assembly should comply the following requirements.

a) Fire doors shall be constructed of non-combustible material having appropriate fire resistance, and two fire doors may be fitted in an opening if each door by itself is capable of closing the opening and the two doors together achieve the required level of fire resistance.

b) All fire doors shall be fitted with an automatic self-closing device, of same fire rating as of the door, which is capable of closing the door from any angle and against any latch fitted to the door.

c) Any fire door fitted within an opening which is provided as a means of escape shall be capable of being opened manually, not be held open by any means other than by an electromagnetic or electro-mechanical device which can be activated by the presence of smoke and/or the fire alarm system, provided that this shall not apply in the case of fire doors opening into pressurised exit staircases.

C.0 SPECIFICATION

1. Besides above the following measures to be considered.

a) To be manufactured as per I.S: 3614 part – II & suitably certified.

b) Should be supported with CBRI Roorkee test certificate with Drawing.

c) Fire doors shall be labeled properly with: -

i) Name of Manufacturer

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ii) Door details viz. door type, Serial/Batch No, Month & Year of Manufacturer, Fire resistance rating, Approval / Listing of hardware certificate, Vision Panel fire rating certificate, etc.

2. Sample drawing of Fire & Smoke Check Door to be submitted with offer for reference.

3. Actual drawing as per site to be submitted for approval of Client & Consultant.

4. Stage inspection may be carried out by **Engineer-in-Charge** at works at any time.

FIRE PUMPS AND JOCKEY PUMP

1.00.00 INTENT OF SPECIFICATION & SCOPE FOR FIRE PUMPS AND JOCKEY PUMP

1.01.00 The specification covers the design, construction features, manufacturing, performance testing and delivery of horizontal centrifugal pumps to site in good condition, supervision during erection, pre-commissioning check up and commissioning.

2.00.00 CODES AND STANDARDS

The design, manufacturing and performance of the horizontal centrifugal pumps and specified hereinafter shall comply with the requirements of the latest editions of the applicable codes and standards, in particular the following:

2.01.01 IS-1520 : Horizontal Centrifugal pumps for clear, cold and fresh water.

2.01.02 IS-12469 : Pumps for fire fighting system

2.02.00 Fire Protection manual, latest revision issued by TAC

3.00.00 DESIGN & PERFORMANCE REQUIREMENT

3.01.00 Pumps shall be A.C. Electric Motor driven.

3.02.00 Pumps shall preferably be designed to have the best efficiency at the rated duty point.

The pumps shall be suitable for continuous operation at any point within 'Range of Operation'.

3.03.00 Pumps shall have continuously rising head characteristics from the rated duty point towards shut-off point. Fire pumps shall be capable of discharging not less than 150% of rated capacity at a head of not less than 65% of rated head.

3.04.00 Pumps shall be suitable for parallel operation. The head vs. capacity, the BHP vs. capacity characteristics etc. shall be identical to ensure equal load sharing and trouble free operation of any pump when the other pumps working in parallel.

3.05.00 The pump set along with the drive motor shall run smooth without undue noise and vibration.

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3.06.00 The manufacturer/contractor under this specification shall assume full responsibility for the operation of the pump and motor as one unit and the set shall be designed in such a manner to prevent any damage due to reverse flow arising out of system maloperation such as loss of power to the drive or failure of non-return valve etc.

3.07.00 Pumps shall be horizontal centrifugal type considering the required number of stages to perform satisfactory operation as stipulated in this specification.

3.08.00 The pumps offered have continuously rising head capacity curves from the rising head capacity curves from the point.

3.09.00 The pumps offered have stable rising H-Q curves within the Range of Operation only.

4.00.00 CONSTRUCTION FEATURES

4.01.00 Pump casing

4.01.01 Pump casing shall be axially or radially split type having robust construction with finished smooth liquid passages.

4.02.00 Impeller

4.02.01 Impeller shall be of closed type dynamically balanced.

4.03.00 Wearing Rings

4.03.01 Wearing ring shall be renewable type.

4.04.00 Shaft

4.04.01 Shaft size shall be finished to closed to close tolerance to the impeller, coupling & bearing size.

4.05.00 Shaft Sleeves

4.05.01 Replicable type fine finished shaft sleeves shall be provided at the stuffing boxes / mechanical seats.

4.05.02 Shaft sleeves shall be properly fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation.

4.06.00 Bearing

Bearing shall be easily accessible. A drain plug shall be provided at the bottom of each bearing housing.

4.06.02 Heavy-duty sleeve/ball/roller type bearings shall be provided to take care of the radial loads.

4.06.03 The bearing shall be oil/greases lubricated.

4.07.06 Stuffing Boxes

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Stuffing box design shall be such that replacement of packing can be done without removing any part other than the gland.

4.07.07 Base plate

The base plate shall be common for pump & motor.

4.08.00 Drive Data

The pump shall be driven by electrical motor directly coupled as specified in the data sheets. A heavy duty coupling along with coupling guard shall be provided between the pump and drive unit.

5.00.00 INSPECTION AND TESTING

The manufacturer shall conduct all tests and inspections (including stage inspections, as necessary) required to ensure that the equipment offered by him conforms to the requirement of this specification, in particular, the data specification sheets.

5.01.00 Material Test

All materials used for pump construction shall be of tested quality. Physical and chemical tests on materials shall be done to ensure the quality of the material offered. Test procedure and sampling shall be guided by the applicable test codes and standards.

5.03.00 Dynamic Balancing

All rotating components of the pumps shall be static and dynamically balanced. Dynamically balancing tests shall be carried out at a speed not less than the rated RPM of the pump. Test procedure and acceptance limits shall be guided by the testing codes and standards.

5.04.00 Performance tests

5.04.01 Each pump shall be tested at manufacturer's work in presence of purchaser's representative with the prime mover specified in Data Specification Sheets to determine pump performance. Prior to performance tests, the pump supplier shall furnish the procedure and methods of testing to the purchaser for approval.

5.04.02 Performance tests are to be conducted over the entire 'Range of Operation' of the pump including the shut off condition for minimum one hour. A minimum five sets of reading shall be taken covering the shut off point, rated point and the two extremities of Range of Operation, to establish the performance curves.

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- 5.04.03 Tests shall be conducted with actual drive motors being furnished and at the rated speed. Noise and vibration test shall be repeated at site after installation apart from shop testing.
- 5.04.04 NPSH test at show shall be conducted in presence inspection agency/consultant.
- 5.04.05 After installation and commissioning pumps shall be offered for performance guarantee test as per agreed procedure. The supplier shall furnish all necessary instruments, accessories and personnel for site testing. The calibration curves of all instruments, permissible tolerance limit of instruments and test procedure shall be mutually agreed between the Purchaser and Supplier/Contractor. If the site performance test and results are unsatisfactory, the manufacturer/contractor shall rectify the pump at his own cost.

6.00.00 DRAWINGS, DATA, CURVES AND MANUALS

The Contractor shall submit the following documents in four sets to purchaser/consultant for approval after award.

6.01.01 Drawings

- i) G. A. of pump set drawings showing the dimensions, weight and location of the suction and discharge connections of the pumps to be furnished.
- ii) Typical cross-section drawing showing various components of the pumps with materials of construction etc.
- iii) Pump foundation details along with all design loads, direction to be furnished.
- iv) Drawing showing the lubrication system and sealing arrangement to be furnished.

6.01.02 Data & Curves

- i) Anticipated performance curves showing the following characteristics:
 - a) Capacity Vs. head
 - b) Capacity Vs. Power

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- c) Capacity Vs. Efficiency
- d) Capacity Vs. NPSH required
- ii) Completely filled in Technical particulars enclosed with this specification for final approval.
- iii) A comprehensive write-up or brochure on the details of manufacturing and testing facilities in the shop of the manufacturer.
- iv) Complete descriptive and illustrated literature on the pump and accessories offered.
- v) Any other data / information related to the erection and operation of the pump
- vi) Quality Assurance Plan.
- vii) Shop / Site test procedure.

6.02.00 Instruction Manuals

(To be submitted along with pump set)

- a) The Instruction Manuals shall present the following basic categories of information in a comprehensive manner prepared for use by operating and/or maintenance personnel.
 - i) Instruction for erection.
 - ii) Instruction for pre-commissioning checkup, operation, abnormal conditions, maintenance and repair.
 - iii) Write-up on controls and interlocks provided.
 - iv) Recommended inspection points and period of inspection
 - v) Schedule of preventive and shut down maintenance indicating activity details, frequency, duration, consumables/spares required, manpower/tools & tackles necessary etc.
 - vi) Ordering information for all replaceable spare parts with code number of parts etc.
 - vii) Recommendation for type of lubricating points, frequency of lubricant changing schedule.
 - viii) Assembly / disassembly sequence for capital maintenance of each component / sub – assembly.
- b) The information shall be organized in a logical and orderly sequence. A general description of the equipment including significant technical characteristics shall

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be included to familiarise operating and maintenance personnel with the equipment.

- c) Necessary drawings and/or other illustrations shall be included and copies of appropriate final drawings for the overall assembly as well as all sub-assembly component shall be bound in the manual. Test, adjustment and calibration information as appropriate shall be included and shall be identified to the specific equipment. Safety and other warning notice and installation, maintenance and operating cautions shall be emphasized.
- d) A parts list shall be included showing part nomenclature, manufacturer's part number and/or other information necessary for accurate identification and ordering of replacement parts.
- e) Instruction manuals shall be securely bound in durable folder.
- f) The instruction Manual shall include the list of spare parts that have to be procured along with the equipment. It shall also include list of all special tools and tackle furnished with complete drawings and instruction for use of such tools tackles.
- g) The instruction Manual will need approval of Purchaser / Consultant in the same fashion as that for drawings.

6.03.00 Copies of documents

- a) Four copies of documents and drawings for approval.
- b) Two copies of finally approved documents and two reproducible for distribution prior to offering materials for inspection.
- c) Two sets of instruction manual along with supply.

MOTOR OF FIRE PUMPS AND JOCKEY PUMP

1.00.00 INTENT OF SPECIFICATION & SCOPE FOR MOTOR OF FIRE PUMPS AND JOCKEY PUMP

- 1.01.00 This specification covers the general requirement of the drive motors.
- 1.02.00 Motors shall be furnished in accordance with both this general specification and the accompanying driven equipment specification.
- 1.03.00 In case on any discrepancy, the driven equipment specification shall govern.

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2.00.00 STANDARD

All motors shall conform to the latest applicable IS Standard / Publications except when other wise stated herein or in the driven equipment specification.

3.00.00 SERVICE CONDITIONS

3.01.00 The motors shall be installed in hot, humid, tropical and highly polluted atmosphere.

3.02.00 unless otherwise stated in the equipment specification the reference ambient temperature shall be taken as 40°C relative humidity 100%.

4.00.00 TYPE AND RATING

A.C. Motors.

4.01.00 Motors shall be general purpose, constant speed, Sq. cage, three phase induction type. Fire pump motors shall be rated for continuous duty (S1). They shall also be suitable for long period of inactivity and intermittent start. Jockey pump motors to be of suitable duty (S4) considering its operational requirement of intermittent start and stop.

4.02.00 The motor characteristic shall match the requirement of the driven equipment so that adequate starting, accelerating, pull up, break down and full load troques are available for the service.

4.01.03 Motors shall be rated for use on a 415V, 3 phase, 50 Hz effectively grounded system.

5.00.00 PERFORMANCE

5.01.01 Running requirements:

Motor shall run continuously at rated output with the following variations in voltage and frequency:

Voltage : ± 10

Frequency : $\pm 5\%$

Combined voltage & : $\pm 10\%$

Frequency

5.01.02 Motor shall be capable or operating satisfactory at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.

5.02.00 Starting requirements:

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5.02.01 Motor shall be designed for direct on line / start delta starting specified elsewhere. Starting current shall not exceed 6 times full load current at full voltage for all auxiliaries subject to IS tolerance.

5.02.02 The motor shall be capable of withstanding the stresses imposed it started at 110% rated voltage.

5.02.03 Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminals.

5.02.04 Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilizing motor rated capacity.

6.00.00 SPECIFIC REQUIREMENT

6.01.00 Enclosure

6.01.01 All motors enclosures shall conform to the degree of protection IP-55 unless otherwise specified. Motor for outdoor or semi-outdoor service shall be of weatherproof construction.

6.02.00 Cooling

6.02.01 The motor shall be self-ventilated type, totally enclosed fan cooled (TEFC)

6.03.00 Winding and Insulation

6.03.01 All insulated winding shall be of copper.

6.03.02 All the motors shall have class-B insulation.

Winding shall be vacuum impregnated to make them non-hydroscopic and oil resistant.

Heating apparatus

Heating apparatus shall also be provided since motors shall be located below ground level.

6.04.00 Tropical Protection:

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6.04.01 All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

6.04.02 All fittings and hardware shall be corrosion resistant.

7.00.00 TESTS

7.01.00 All shop inspection tests and site test shall be conducted as per the standard.

7.02.00 Four (4) copies of routine test certificate shall be submitted for approval prior to the dispatch of the motors from works.

8.00.00 SPARES

Recommended spares for three (3) years operation shall be quoted along with the bid clearly identifying the part nos. with recommended quantities. Also the Contractor shall quote for commissioning and O & M spares.

9.00.00 DRAWINGS, DATA & MANUAL

To be submitted with the bid in quantities and procedure as indicated elsewhere in this document.

9.01.00 Along with the Bid

List of the motors

Individual motor data sheet as per annexure.

9.02.00 After award of the Contract (Four sets for approval and four sets along with one reproducible of finally approved document for distribution).

Dimensional General Arrangement drawing

Foundation Plan & Loading

Cable and Box details

Space requirement for motor removal

Complete Motor data

Erection & maintenance Manual.

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10.00.00 INSTALLATION AND MAINTENANCE MANUAL (2 SETS)

(To be submitted along with pump set)

The installation and maintenance manual of motor shall contain the following:

Technical Data

Salient constructional Features

Instructions to be followed on receipt of motors at site

Handling and Storage

Instructions for foundation.

Erection procedure and checks

Earthing

Commissioning procedure and site tests

Routine, period and preventive inspection and maintenance procedure

Assembly & disassembly of terminal box, motor, stations, bearings

Possible faults, their causes and remedies

Catalogues, literatures and drawings

ENGINE OF FIRE PUMPS AND JOCKEY PUMP

1.00.00 INTENT OF SPECIFICATION & SCOPE FOR ENGINE OF FIRE PUMPS AND JOCKEY PUMP

1.01.00 INTENT OF SPECIFICATION

This specification covers the design, performance, manufacturing, construction features and testing of compression ignition diesel engine, to drive centrifugal pumps, used for purpose of firefighting.

CODES AND STANDARDS

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The design manufacturing, shop testing, erection, testing and commissioning of compression ignition diesel engines shall conform to the latest revision of followings standards and codes, in addition to other relevant standards and manufacturer's own standard, nothing in this specifications shall be construed to relieves the Contractor's responsibility.

BS-649 : performance of reciprocating compressing-ignition diesel engines for general purpose.

IS: 10000 (Pt 1 to 12) : code for type testing of constant speed IC engines.

ASME. PTC-17: performance test code for reciprocating IC engines.

FIRE PROTECTION MANUAL : Issued by advisory committee.

CODES AND STANDARDS REQUIREMENT

1.04.1 General

a) The diesel engine shall be of :

- i) Multi cylinder type
- ii) Direct injection.
- iii) Four stroke cycle.
- iv) Water Cooled
- v) Cold starting type.

Considering all auxiliary power consumption, the continuous engine b.h.p. rating shall be at latest 20% greater than the requirements at the /duty point of pump at rated r.p.m. at the 150% site conditions, in any case, shall not be less than the maximum power requirement at any condition of operation of pump.

b) De-rating factors, considered by the manufacturer to arrive at the shaft power of the diesel engine at site, shall not be less than the

- i) 3% for each 305 meter elevation above MSL.
- c) 1% for each 5.6° C rise in air temperature above 15.6° C

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- d) Since the fire –pumping unit is not required to run continuously for long period and operation will not be very frequent, special features shall be built into the engine to allow it to start instantaneously against full load, even if it has remained idle for long period.
- e) the engine shall have an integral positive displacement pump to provide normal pressure lubrication to the engine bearing; big end bearings; valves gear etc, the pump shall be driven by main engine camshaft. Additional splash lubrication shall be provided to protect the cylinder walls when engine starts after an idle period.
- f) The engine shall be designed considering case of maintenance, repair, cleaning and inspection.
- g) Every part should be subjected to substantial temperature changes and shall be designed and supported to permit free expansion and contraction without resulting in leakage, harmful distortion or mis-alignment.
- h) The engine shall be designed for continuous operation at full load for a period of at least eight (8) hours.
- i) The cooling water system for the diesel engine shall be once through type and radiator shall not be used. The cooling water shall be taken from the pump delivery and after circulation through the cooling jackets; it shall be discharged above the engine level into an open drain duct. The rate of flow shall be regulated through an adequately sized orifice.

1.04.2 START-UP

- a) The engine shall be able to start quickly from cold condition. The starting system shall include a DC motor having high starting torque to overcome full engine compression. The engine shall be provided with two (2) sets of 24 volts heavy duty, stationary type lead acid batteries encased in hard rubber container. The batteries shall have ample capacity to start the engine several times in succession. One (1) set of battery shall be used for automatic starting of the engine and the other shall be used for manual starting. The battery charger should be with provision of battery voltage monitoring at appropriate location as suggested by consultant.

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- b) The diesel engine driven pumping set shall be started automatically by a switch mounted on the cover of the starting motor, which shall be coupled to the engine pump shaft. The starting motor shall be left burning the engine for an indefinite period without any danger of damage from overheating. The weighted switch arm shall be normally held in a raised position by spring catch. In the event of fire, owing to the fall of pressure in the main header up to a pre-determined value, the spring catch shall be released against a diaphragm connected to it. When the switch arm falls, the switch shall close and the starting motor shall cause the diesel engine to start. The engine shall run up to full speed automatically and the switch shall remain closed during the operation of the set as the motor shall be so designed that when the diesel engine reaches full speed, it takes no current from the battery but actually recharges at rate
- c) The engine shall be capable of both automatic and manual start. The normal of starting in automatic but in the event of failure of automatic start the engine can be started.
- d) The battery capacity shall be adequate for ten (10) consecutive starts without recharging with a cold engine under full compression.

1.04.3 Engine stop mechanism.

Engine stop mechanism shall be manually operated and return automatically to the starting position after use

1.04.4 Governing.

- a) The engine shall be fitted with a speed control device, which will control the speed under all condition of load.
- b) There should be an over speed alarm mechanism which will give an alarm at a certain speed above the rated speed.
- c) The governor shall be suitable for operation without external power supply.

1.04.5 Fuel System

- a) The engine will be run on light diesel oil.

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- b) The feed shall be fed by gravity from an adequately sized storage tank mounted separately close to the pumping unit. The fuel storage tank shall be lead coated steel having sufficient capacity to run the engine at full load a minimum period of eight (8) hours. As per the statutory regulations, any valve in that pipe between the tank and the engine shall be such that it can be locked in the open position. The tank shall be fitted with all required accessories including magnetic level indicator etc. a sludge and sediment trap shall also be provided.
- c) The fuel tank shall be construction of welded steel. The tank shall be above the tank to the injection pump of the diesel engine to ensure adequate pressure at suction of injection pump.
- d) Fuel oil pipelines shall be independent for each engine and gradually slopped from the tank to the injection pump. Valves in this line shall be kept near to the tank and kept locked in open position.
- e) A filter shall be incorporated in this pipeline, in addition to other filters in the fuel oil system and shall be mounted in an accessible position for cleaning.
- f) Fuel oil system shall be designed to avoid any air pocket in any part of the pipe work, fuel pump, sprayers/injection, filter system etc.

1.04.6 Cooling Water System

The type of cooling system shall confirm to TAC rule no. 7.4.5.3 as follows:

Cooling by water from the discharge of pump (taken off prior to the pump discharge valve) direct into the engine cylinder jackets via a pressure reducing device to limit the applied pressure to a safe value as specified by the engine manufacturer. The outlet connection from this system shall terminate at 150 mm. above the engine water outlet pipe and be directed off from the discharged line of fire pump then the capacity of fire pump shall be increased so that net capacity meant for fire extinguishments meets the specification requirements.

1.04.7 Accessories

- a) Steel guards for coupling, flywheel and other moving parts shall be provided.

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- b)** The pump and engine shall be mounted on a steel fabricated base plate. Adequate access shall be provided on the base plate to the big and main bearings, water jacket etc.
- c)** Indicator cocks on the cylinder head the engine shall also be provided with the following.
 - i)** Inlet filter and silencer.
 - ii)** Outlet muffler.
 - iii)** Expansion joints.
 - iv)** Dampers etc. as necessary for efficient operation, intake air should be taken from inside the buildings in which the engine is located.
 - v)** Other accessories necessary for efficient operation.
 - vi)** The exhaust should be discharged outside the buildings (a minimum of 15 M route length envisaged) and the exhaust duct shall be adequately sized for minimum pressure drop.
 - vii)** The exhaust pipe shall be routed clearing man height.
 - viii)** The exhaust system shall be suitable designed to prevent condensate following into the engine.

1.04.8 Instrumentation

Adequate instrumentation to be provided which will be located in panel. These shall include, but not limited to the following:

Speed indicator.

Lubricating oil sump level indicator.

Fuel oil tank level indicator.

Voltmeter and ammeter in battery charging circuit.

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Temperature indicator in cooling water inlet outlet.

Temperature indicator in lubricating oil out let from the oil cooler.

Pressure gauges for lubricating oil system.

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TECHNICAL PARTICULAR, CONFIRMATIONS & DECLARATIONS

PART - A			
TECHNICAL PARTICULAR OF THE MATERIAL / EQUIPMENT			
Sl. No.	DOCUMENT TITLE	DOCUMENT NUMBER	NO OF. SHTS
1.0	DATA SHEET FOR FIRE PUMP (Electric Motor Driven)	SDFC - FP - DS -101	1
2.0	DATA SHEET FOR JOCKEY PUMP	SDFC - JP - DS -103	1
3.0	DATA SHEET FOR COMPOSITE CONTROL PANEL	SDFC - MCC - 103	2
4.0	DATA SHEET FOR PIPES	SDFC - P - DS -201	1
5.0	DATA SHEET FOR PIPE FITTINGS	SDFC - PF - DS -201	1
6.0	DATA SHEET FOR CAST IRON SLUICE VALVE	SDFC - V - DS -301	1
7.0	DATA SHEET FOR CAST IRON BUTTERFLY VALVE	SDFC - V - DS -302	1
8.0	DATA SHEET FOR CAST IRON NON RETURN VALVE(WAFER TYPE)	SDFC - V - DS -304	1
9.0	DATA SHEET FOR GUN METAL GLOBE VALVE	SDFC - V - DS -308	1
10.0	DATA SHEET FOR PRESSURE RELIEF VALVE	SDFC - V - DS -309	1
11.0	DATA SHEET OF HYDRANT VALVE	SDFC - HY - DS -401	1
12.0	DATA SHEET OF HOSE WITH COUPLING	SDFC - HY - DS -402	1
13.0	DATA SHEET OF BRANCH PIPE & NOZZLE	SDFC - HY - DS -403	1
14.0	DATA SHEET OF HOSE REEL	SDFC - HY - DS -404	1
15.0	DATA SHEET OF HOSE CABINET	SDFC - HY - DS -405	1

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16.0	DATA SHEET OF FIRE BRIGADE CONNECTION (4 WAY)	SDFC - HY - DS -406	1
17.0	DATA SHEET FOR SPRINKLER HEAD	SDFC -WS-DSS-701A - 701C	2
18.0	DATA SHEET OF PRESSURE GAUGE	SDFC - I - DS -501	1
19.0	DATA SHEET OF PRESSURE SWITCH	SDFC - I - DS -502	1
20.0	DATA SHEET OF FLOW SWITCH	SDFC - I - DSS -804	1
21.0	DATA SHEET OF CO2 EXTINGUISHER	SDFC - EXT - DS -701	2
22.0	DATA SHEET OF ABC TYPE EXTINGUISHER	SDFC - EXT - DS -702	2
23.0	DATA SHEET OF MACHANICAL FOAM TYPE EXTINGUISHER	SDFC - EXT - DS -703	2

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DATA SHEET FOR PRESSURE GAUGE

DOCUMENT NUMBER - SDFC-I - DS - 501 (1 OF 1)		
DATA SHEET OF PRESSURE GAUGE		
A	DESIGN PARTICULARS	
	i) Type	Bourdon / Bellows
	ii) Dial size	150 mm
	iii) Accuracy	+ 1" FSDFC
	iv) Accessories	Micrometer zero adjusting screw
	v) Over range protection	25% of span
	vi) Applicable standard	IS : 3624, 1987
	vii) Entry	Bottom / Back
	viii) Process connection	1/2" NPT (M)
	ix) Range	0 - 16 kg/cm ²
B	MATERIAL OF CONSTRUCTION	
	i) Sensing element material	AISI 316
	ii) Movement material	AISI 304
	iii) Code & Bezel	Die Cast aluminium weather proof as per IP : 66 of IS:2147 stove enamelled, black finish.
	iv) Window cover	Colourless transp-arent glass of 3 mm thickness.
C	PAINTING	
	i) Painting	As per IS : 3624
D	TESTING PARAMETER	
	i) Calibration test	100%
E	MARKING	
	The equipment shall be clearly and permanently marked with the following :	i) Manufacture's name & trade mark
		ii) Year of manufacture
		ii) Certification mark
F	NOTES	
	i) Pressure gauge to be supplied with 25 mm NB root valve(Globe) & vibration dampner (SS).	
	ii) Calibration Certificate	

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DATA SHEET FOR PRESSURE SWITCH

DOCUMENT NUMBER - SDFC-I - DS - 502 (1 OF 1)		
DATA SHEET OF PRESSURE SWITCH		
A	DESIGN PARTICULARS	
	i) 'Type	Diaphragm type
	ii) Switch Type	Micro
	iii) Accuracy / Repeatability	+ 0.5%
	iv) Connection	1/2" NPT Bottom / Back
	v) Accessories	25mm NB Root Valve(Globe type) Vibration dampner.
	vi) Applicable standard	Relevant IS
	vii) Contact rating	5A, 230 V AC
	viii) Over range protection	130% of range or maximum pressure which is higher.
	ix) Range	Upto 16 kg/cm ²
x) Model	RT-116/ Equivalent	
B	MATERIAL OF CONSTRUCTION	
	i) Sensing element material	AISI 316 SS
	ii) Movement material	AISI 304 SS
	iii) Code & Bezel	Die Case aluminium weather proof to IP : 66
iv) Enclosure	Weather proof/Flame proof	
C	TESTING PARAMETER	
	i) Calibration test	100%
D	MARKING	
	The equipment shall be clearly and permanently marked with the following :	i) Manufacture's name & trade mark
		ii) Year of manufacture
		iii) Certification mark
E	NOTES	
	i) Pressure switch to be supplied with 25 mm NB root valve(Globe) & vibration dampner (SS).	

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA**DATA SHEET OF CO₂ EXTINGUISHER**

DOCUMENT NUMBER - SDFC- EXT - DS - 701 (1 OF 2)		
DATA SHEET OF CO₂ EXTINGUISHER		
	CARBON DI OXIDE TYPE FIRE EXTINGUISHER OF CAPACITY 4.5 KG	
1.00	GENERAL	
1.01	Standard	: IS:15683 : 2006
1.02	Type	: Portable - High Pressure type
1.03	Whether Seal is provided to indicate that Extinguisher has not been used	: Yes
2.00	MATERIAL OF CONSTRUCTION	
2.01	Extinguishing Medium	: CO ₂ - Of purity 99.5 %
2.02	Boby	: Seamless Manganese Steel - ISI Marked confirms to IS:7285
2.03	Discharge Valve (sq. Grip type)	: Confirms to IS:3224
2.04	Discharge Horn	: Non-conductor of Electricity - Pollyethylene
2.05	Syphon tube	: Aluminium
2.06	Discharge Hose	: Wire Braided of length 1 m. ID 10 mm.
2.07	Wall mounting Bracket	: Mild steel (Powder Coated)
3.00	GUARANTEED PERFORMANCE	
3.01	Capacity	: 4.5 Kg. (Tolerance 0 to 5 % by mass)
3.02	Minimum effective Discharge Time	: Minimum : 8 sec.

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

3.03	Bulk Range of Discharge	: Minimum : 2 Meter
3.04	Percentage of Discharge	: Not less than 95 %
3.05	Fire Rating	: 21 B
3.06	Temperature Range	: -30°C to + 55 °C
3.07	Working Pressure	: 60 - 70 kgf / cm ²
4.00	ROUTINE TESTS	
4.01	Retention of charge	
	a) Routine checks	: By Dipping in water leakage to be checked
	b) Partial discharge	: The second pressure or weight shall not be less than 75 % of the first after interruption of the discharge.
4.02	Burst Test of Hose	Minimum Burst pressure 275 kgf / cm ²
5.00	EXTINGUISHERS ALSO PASS THROUGH THE FOLLOWING TESTS (TYPE TESTS)	
5.01	Resistance to Temperature charges	
5.02	Resistance to impact test	
5.03	Tapping Test	
5.04	Special test for Horn	
5.05	Intermittent Discharge test	

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DOCUMENT NUMBER - SDFC- EXT - DS - 701 (2 OF 2)		
DATA SHEET OF CO2 EXTINGUISHER		
CARBON DI OXIDE TYPE FIRE EXTINGUISHER OF CAPACITY 4.5 KG		
6.00	DIMENSIONS	
6.01	Maximum Diameter of Fire Extinguisher	: 140 mm.
6.02	Overall Hieght of Extinguisher	: 700 mm. (Approx)
6.03	Shell Thickness	: 4.5 mm.
6.04	Full Weight of Cylinder	: 16.9 kg (Approx)
7.00	COLOR OF EXTINGUISHER BODY	:Painted with durable Enamel P0 red shade No. 538 of IS : 5
8.00	ACCESSORIES (BRACKETS & SCREWS)	: Provided
9.00	MISCELLANEOUS	
9.01	Inspection & Test	: 140 mm.
9.02	Finish	: P0 Red as per IS: 5 (shade 538)
9.03	Marking	: As per IS 15683 : 2006
9.04	Approvals	: Under Approval
9.05	Maintenance, Care and Refilling	: As per IS 2190
9.06	Packing	: Corrugated boxes

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DATA SHEET OF ABC EXTINGUISHER

DOCUMENT NUMBER - SDFC- EXT - DS - 702 (1 OF 2)		
DATA SHEET OF ABC EXTINGUISHER		
ABC POWDER (STORED PRESSURE) TYPE FIRE EXTINGUISHER OF CAPACITY 6 KG		
1.00	GENERAL	
1.01	Standard	: IS:15683 : 2006
1.02	Type	: Portable Stored Pressure
1.03	Whether Seal is provided to indicate that Extinguisher has not been used	: Yes
2.00	MATERIAL OF CONSTRUCTION	
2.01	Extinguishing Medium	: Mono Ammonium Phosphate based dry powder (Confirms to IS 14609)
2.02	Boby	: Mild Steel Sheet having 0.25 % Carbon, 0.05 % Phosphorous and 0.05 % Sulphur.
2.03	Nick Ring	: M.S. Pipe
2.04	Valve	: Brass Forging
2.05	Syphon tube	: Brass
2.06	Discharge Nozzle	: Brass
2.07	Pressure Guage / Indicator	: As per IS 15683 : 2006
2.08	Discharge Hose	: Rubber Braided (Length 450 mm.)
2.09	Wall mounting Bracket	: Mild steel (Powder Coated)
3.00	GUARANTEED PERFORMANCE	
3.01	Capacity	: 6.0 Kg. (Tolerance 0 to 5 % by mass)
3.02	Effective Discharge Time	: Minimum : 13 sec.
3.03	Bulk Range of Discharge	: Minimum : 2 Meter
3.04	Percentage of Discharge	: Not less than 95 %
3.05	Fire Rating	: 3A : 21 B
3.06	Temperature Range	: +5°C to + 55 °C
3.07	Service Pressure	: 15 kgf / cm ²
3.08	Maximum Service Pressure	: 18 kgf / cm ³
4.00	ROUTINE TESTS	
4.01	Pressure test (Pt)	: 35 bar (3.5 MPa)
4.02	Minimum Burst Pressure test (Pb)	: 55 bar (5.5 MPa)
4.03	Retention of charge	
	a) Routine checks	: By applying soap solution leakage to be checked.
	b) Partial discharge	: The second pressure or weight shall not be less than 75 % of the first after interruption of the discharge.
4.04	Crushing test	: After the crushing test at Pt extinguisher shall not exhibit sign of crack or leak.
4.05	Pressure cycling test	: After the test cylinder subjected for burst test and it shall comply burst pressure test.
4.06	Burst pressure test for Discharge Hose	: Not less than 55 bar (5.5 MPa)

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DOCUMENT NUMBER - SDFC- EXT - DS - 702 (2 OF 2)		
DATA SHEET OF ABC EXTINGUISHER		
	ABC POWDER (STORED PRESSURE) TYPE FIRE EXTINGUISHER OF CAPACITY 6 KG	
5.00	EXTINGUISHERS ALSO PASS THROUGH THE FOLLOWING TESTS (TYPE TESTS)	
5.01	Resistance to Temperature charges	
5.02	Resistance to impact test	
5.03	Resistance to Vibrations test	
5.04	Resistance to Corrosion test - External	
5.05	Resistance to Corrosion test - Internal	
5.06	Tapping test	
5.07	Intermittent Discharge test	
6.00	DIMENSIONS	
6.01	Maximum Diameter of Fire Extinguisher	: 150 mm.
6.02	Overall Hieght of Extinguisher	: 525 mm. (Approx)
6.03	Thickness of sheet	: 1.6 mm.
6.04	Full Weight of Cylinder	: 9.5 kg (Approx)
7.00	ANTI CORROSIVE TREATMENT	:Phosphate Treatment (Seven Tank Hot Process)
8.00	COLOR OF EXTINGUISHER BODY	: Epoxy Powder Coating inside & outside of body (Not less than 50 Microns)
9.00	ACCESSORIES (BRACKETS & SCREWS)	: Provided
10.00	MISCELLANEOUS	
10.01	Inspection & Test	: As per approved GTP
10.02	Finish	: P0 Red as per IS: 5 (shade 538)
10.03	Marking	: As per IS 15683 : 2006
10.04	Approvals	: Under Approval
10.05	Maintenance, Care and Refilling	: As per IS 2190 : 2010
10.06	Packing	: Corrugated boxes

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DATA SHEET OF FOAM EXTINGUISHER

DOCUMENT NUMBER - SDFC- EXT - DS - 703 (1 OF 2)		
DATA SHEET OF FOAM EXTINGUISHER		
FOAM (STORED PRESSURE) TYPE FIRE EXTINGUISHER OF CAPACITY 9 LTR		
1.00	GENERAL	
1.01	Standard	: IS:15683 : 2006
1.02	Type	: Portable Stored Pressure
1.03	Whether Seal is provided to indicate that Extinguisher has not been used	: Yes
2.00	MATERIAL OF CONSTRUCTION	
2.01	Extinguishing Medium	: AFFF Foam Confirms to IS 4989
2.02	Boby	: Mild Steel Sheet having 0.25 % Carbon, 0.05 % Phosphorous and 0.05 % Sulphur.
2.03	Nick Ring	: M.S. Pipe
2.04	Valve	: Brass Forging
2.05	Syphon tube	: Brass
2.06	Discharge Nozzle	: Brass
2.07	Pressure Guage / Indicator	: As per IS 15683 : 2006
2.08	Discharge Hose	: Rubber Braided (Length 500 mm.)
2.09	Wall mounting Bracket	: Mild steel (Powder Coated)
3.00	GUARANTEED PERFORMANCE	
3.01	Capacity	: 9 Lts. (Tolerance 0 to 5 % by mass)
3.02	Effective Discharge Time	: Minimum : 13 sec.
3.03	Bulk Range of Discharge	: Minimum : 2 Meter
3.04	Percentage of Discharge	: Not less than 95 %
3.05	Fire Rating	: 2A : 21 B
3.06	Temperature Range	: +5°C to + 55 °C
3.07	Service Pressure	: 15 kgf / cm ²
3.08	Maximum Service Pressure	: 18 kgf / cm ³
4.00	ROUTINE TESTS	
4.01	Pressure test (Pt)	: 35 bar (3.5 MPa)
4.02	Minimum Burst Pressure test (Pb)	: 55 bar (5.5 MPa)
4.03	Retention of charge	
	a) Routine checks	: By applying soap solution leakage to be check.
	b) Partial discharge	: The second pressure or weight shall not be less than 75 % of the first after interruption of the discharge.
4.04	Crushing test	: After the crushing test at Pt extinguisher shall not exhibit sign of crack or leak.
4.05	Pressure cycling test	: After the test cylinder subjected for burst test and it shall comply burst pressure test.
4.06	Burst pressure test for Discharge Hose	: Not less than 55 bar (5.5 MPa)

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DOCUMENT NUMBER - SDFC- EXT - DS - 703 (2 OF 2)		
DATA SHEET OF FOAM EXTINGUISHER		
	FOAM (STORED PRESSURE) TYPE FIRE EXTINGUISHER OF CAPACITY 6 KG	
5.00	EXTINGUISHERS ALSO PASS THROUGH THE FOLLOWING TESTS (TYPE TESTS)	
5.01	Resistance to Temperature charges	
5.02	Resistance to impact test	
5.03	Resistance to Vibrations test	
5.04	Resistance to Corrosion test - External	
5.05	Resistance to Corrosion test - Internal	
5.06	Tapping test	
5.07	Intermittent Discharge test	
6.00	DIMENSIONS	
6.01	Maximum Diameter of Fire Extinguisher	: 175 mm.
6.02	Overall Hieght of Extinguisher	: 620 mm. (Approx)
6.03	Thickness of sheet	: 1.6 mm.
6.04	Full Weight of Cylinder	: 14.7 kg (Approx)
7.00	ANTI CORROSIVE TREATMENT	:Phosphate Treatment (Seven Tank Hot Process)
8.00	COLOR OF EXTINGUISHER BODY	: Epoxy Powder Coating inside & outside of body (Not less than 50 Microns)
9.00	ACCESSORIES (BRACKETS & SCREWS)	: Provided
10.00	MISCELLANEOUS	
10.01	Inspection & Test	: As per approved GTP
10.01	Finish	: P0 Red as per IS: 5 (shade 538)
10.01	Marking	: As per IS 15683 : 2006
10.01	Approvals	: Under Approval
10.01	Maintenance, Care and Refilling	: As per IS 2190
10.01	Packing	: Corrugated boxes

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

PART - B							
DATA SHEET TO BE FILLED UP BY BIDDER							
Sl.	DOCUMENT TITLE					DOCUMENT	NO OF.
No.						NUMBER	SHTS
1.0	DATA SHEET FOR PUMP (Elec. Motor Driven & Engine driven)					SDFC - BS - DS -201-A	5
1.0	DATA SHEET FOR PUMP (Water Curtain Pump & jockey Pump)					SDFC - BS - DS -201-B	5
2.0	DATA SHEET FOR MOTOR (Fire Pump & Jockey Pump)					SDFC - BS - DS -202-A	2
4.0	DATA SHEET FOR PRIME MOVER SELECTION OF FIRE PUMP					SDFC - BS - T -301	1
5.0	DATA SHEET FOR PRIME MOVER SELECTION OF JOCKEY PUMP					SDFC - BS - T -302	1

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DOC. NO.		SDFC-BS-T-301		SHEET NO.			
				1 OF 1			
DATA SHEET FOR PRIMEMOVER SELECTION OF FIREPUMP							
SL. NO.	DATA PERTICULARS	UNIT	FIREPUMP				
1.0	TYPE OF PUMP						
2.0	MODEL NO.						
3.0	CHARACTERISTIC CURVE ENCLOSED						
4.0	PUMP RATED CAPACITY	(LPM)					
5.0	DISCHARGE HEAD	(MWC)					
6.0	RANGE OF OPERATION	(%)					
7.0	PUMP RATED SPEED	(RPM)					
8.0	EFFICIENCY AT DUTY POINT	(%)					
9.0	DISCHARGE HEAD AT 150% RATED DISCHARGE	(MWC)					
10.0	EFFICIENCY AT 150% RATED DISCHARGE	(%)					
11.0	POWER REQUIREMENT AT DUTY POINT	(BKW)					
12.0	POWER REQUIREMENT AT 150% RATED DISCHARGE	(BKW)					
13.0	MARGIN OVER THEORETICAL POWER REQD. (15% OF DUTY POINT REQMNT)	(BKW)					
14.0	POWER OUTPUT REQD. (10.0+12.0) OF MOTOR	(BKW)					
15.0	CRITICAL REQUIREMENT (HIGHER OF SL. NO. 11.0 & 13.0)	(BKW)					
16.0	MOTOR OFFERED AT 40° C	(KW)					
17.0	RATING OF MOTOR AT 50° C	(KW)					
		BIDDER					
BIDDER SEAL AND SIGNATURE							

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DOC. NO.	SDFC-BS-T-302		SHEET NO. 1 OF 1
DATA SHEET FOR PRIMEMOVER SELECTION OF JOCKEY PUMP			
SL. NO.	DATA PERTICULARS	UNIT	JOCKEY PUMP
1.0	TYPE OF PUMP		
2.0	MODEL NO.		
3.0	CHARACTERISTIC CURVE ENCLOSED		
4.0	PUMP RATED CAPACITY	(LPM)	
5.0	DISCHARGE HEAD	(MWC)	
6.0	RANGE OF OPERATION	(%)	RUN OUT FLOW
7.0	PUMP RATED SPEED	(RPM)	
8.0	EFFICIENCY AT DUTY POINT	(%)	
9.0	EFFICIENCY AT RUN OUT FLOW	(%)	
10.0	POWER REQUIREMENT AT DUTY POINT	(BKW)	
11.0	POWER REQUIREMENT AT RUN OUT FLOW	(BKW)	
12.0	MARGIN OVER THEORETICAL POWER REQD. (15% OF DUTY POINT REQMNT)	(BKW)	
13.0	POWER OUTPUT REQD. (10.0+12.0) OF MOTOR	(BKW)	
14.0	CRITICAL REQUIREMENT (HIGHER OF SL. NO. 11.0 & 13.0)	(BKW)	
15.0	MOTOR OFFERED AT 40° C	(KW)	
16.0	RATING OF MOTOR AT 50° C	(KW)	
		BIDDER	
BIDDER SEAL AND SIGNATURE			

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

TO BE FILLED UP BY BIDDERS		DOC. NO.		SHEET NO.
		SDFC-BS-DS-201-A		1 OF 5
DATA SHEET FOR PUMP				
		Fire Pump		
		Electric Driven	Motor Driven	Engine Driven
A.	GENERAL			
1.00	Manufacturer			
2.00	Model No.			
3.00	Type of Pump			
4.00	Quantity			
B.	GUARANTEED PERFORMANCE			
1.00	Rated capacity. CuM/hr. (Specified tolerance limit also			
2.00	Rated head at rated capacity, MWC			
3.00	Shut off head, MWC			
4.00	Range of operation of the pump (% to % of rated capacity)			
5.00	Pump rated speed, RPM			
6.00	Guaranteed pump efficiency at rated capacity			
7.00	Power Consumption			
	a) Guaranteed pump input power at rated capacity KW / HP			
	b) Guaranteed max. pump input power within range of operation KW / HP			
	c) Pump input power at shut off, KW / HP			
	d) Motor rating recommended			

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

TO BE FILLED UP BY BIDDERS		DOC. NO.		SHEET NO.
		SDFC-BS-DS-201-A		2 OF 5
DATA SHEET FOR PUMP				
		Fire Pump		
C.	DESIGN & CONSTRUCTION FEATURES	Electric Driven	Motor	Engine Driven
1.00	Type of pump casing			
2.00	Pump duty (continuous/intermittent)			
3.00	Location			
4.00	Torque - speed curve of the pump furnished			
5.00	Pumps suitable for parallel operation			
6.00	Number of stage of pump			
7.00	specific speed			
8.00	NPSH required in MWC for pump operation at max. discharge point within the Range			
9.00	Minimum flow the pump ,LPM			
10.00	Type of coupling between pump and drive			
11.00	Bearing			
	a) Type			
	b) Location and No.			
	c) Type of lubricant			
	d) Design life, Hrs.			

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

TO BE FILLED UP BY BIDDERS		DOC. NO.	SHEET NO.
		SDFC-BS-DS-201-A	3 OF 5
DATA SHEET FOR PUMP			
		Fire Pump	
12.00	Shaft sealing Arrangement	Electric Motor Driven	Engine Driven
13.00	a) Type		
	b) Sealing Liquid		
	c) Requirement of external water, if any		
	i) Quality		
	ii) Quantity in Cum/Hr. pump		
	d) In case separate oil/grease/ water pump or any such equipment required for bearing lubrication/stuffing box gland sealing, furnish, full technical details of these equipment and their drive as included in the offer.		
D.	MATERIAL OF CONSTRUCTION (Indicated applicable code/standards)		
1.00	Casing		
2.00	casing Liner		
3.00	Diffuser		
4.00	Impeller		
5.00	Wearring ring (Casing)		
6.00	Wearring ring (Impeller)		
7.00	Shaft		

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

TO BE FILLED UP BY BIDDERS		DOC. NO.	SHEET NO.
		SDFC-BS-DS-201-A	4 OF 5
DATA SHEET FOR PUMP			
		Fire Pump	
8.00	Mechanical seal parts	Electric Motor Driven	Engine Driven
9.00	Shaft sleeves		
10.00	Mechanical seal parts		
11.00	Base plate		
12.00	Bearings (Radial)		
13.00	Bearings (Thrust)		
14.00	Hydraulic balancing device components		
15.00	Stuffing Box		
16.00	Gland		
17.00	Gland Packing		
18.00	Shaft Packing		
19.00	Fasteners		
20.00	Companion Flanges		
E.	DIMENSIONAL DETAILS		
1.00	Suction nozzle O/D mm.		
2.00	Discharge nozzle O/D mm.		
3.00	Suction nozzle flange drilling		
	standard and pressure rating		
4.00	Suction nozzle flange drilling standard and pressure rating		

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

TO BE FILLED UP BY BIDDERS		DOC. NO.		SHEET NO.
		SDFC-BS-DS-201-A		5 OF 5
DATA SHEET FOR PUMP				
		Fire Pump		
5.00	External water connection details	Electric Driven	Motor	Engine Driven
6.00	Pump shaft diameter, mm			
7.00	Impeller diameter, mm			
F.	DRIVE DATA			
1.00	Drive unit output at ambient condition			
2.00	Rated speed, RPM			
G.	INSPECTION AND TESTING			
1.00	Material test and NDT test			
2.00	Hydrostatic test pressure & duration of test min.			
3.00	Static and Dynamic balance test			
H.	WEIGHT AND LOADING DATA			
1.00	Wt. of the pump and drive assembly for foundation design kg.			
2.00	Wt. of the pump assembly kg			
3.00	Wt. of the drive unit			
4.00	Wt. of drive heaviest piece to be handled, hg.			
5.00	Drawing/Literature enclosed			

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

TO BE FILLED UP BY BIDDERS		DOC. NO.	SHEET NO.
		SDFC-BS-DS-201-B	1 OF 5
DATA SHEET FOR PUMP			
		Jockey Pump	
		Electric Motor Driven	
A.	GENERAL		
1.00	Manufacturer		
2.00	Model No.		
3.00	Type of Pump		
4.00	Quantity		
B.	GUARANTEED PERFORMANCE		
1.00	Rated capacity. CuM/hr. (Specified tolerance limit also		
2.00	Rated head at rated capacity, MWC		
3.00	Shut off head, MWC		
4.00	Range of operation of the pump (% to % of rated capacity)		
5.00	Pump rated speed, RPM		
6.00	Guaranteed pump efficiency at rated capacity		
7.00	Power Consumption		
	a) Guaranteed pump input power at rated capacity KW / HP		
	b) Guaranteed max. pump input power within range of operation KW / HP		
	c) Pump input power at shut off, KW / HP		
	d) Motor rating recommended		

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

TO BE FILLED UP BY BIDDERS		DOC. NO.	SHEET NO.
		SDFC-BS-DS-201-B	2 OF 5
DATA SHEET FOR PUMP			
		Jockey Pump	
		Electric Motor Driven	
C.	DESIGN & CONSTRUCTION FEATURES		
1.00	Type of pump casing		
2.00	Pump duty (continuous/intermittent)		
3.00	Location		
4.00	Torque - speed curve of the pump furnished		
5.00	Pumps suitable for parallel operation		
6.00	Number of stage of pump		
7.00	specific speed		
8.00	NPSH required in MWC for pump operation at max. discharge point within the Range		
9.00	Minimum flow the pump ,LPM		
10.00	Type of coupling between pump and drive		
11.00	Bearing		
	a) Type		
	b) Location and No.		
	c) Type of lubricant		
	d) Design life, Hrs.		

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

TO BE FILLED UP BY BIDDERS		DOC. NO.	SHEET NO.
		SDFC-BS-DS-201-B	3 OF 5
DATA SHEET FOR PUMP			
		Jockey Pump	
		Electric Motor Driven	
12.00	Shaft sealing Arrangement		
13.00	a) Type		
	b) Sealing Liquid		
	c) Requirement of external water, if any		
	i) Quality		
	ii) Quantity in Cum/Hr. pump		
	d) In case separate oil/grease/ water pump or any such equipment required for bearing lubrication/stuffing box gland sealing, furnish, full technical details of these equipment and their drive as included in the offer.		
D.	MATERIAL OF CONSTRUCTION (Indicated applicable code/standards)		
1.00	Casing		
2.00	casing Liner		
3.00	Diffuser		
4.00	Impeller		
5.00	Wearring ring (Casing)		
6.00	Wearring ring (Impeller)		
7.00	Shaft		

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

TO BE FILLED UP BY BIDDERS		DOC. NO.	SHEET NO.
		SDFC-BS-DS-201-B	4 OF 5
DATA SHEET FOR PUMP			
		Jockey Pump	
		Electric Motor Driven	
8.00	Mechanical seal parts		
9.00	Shaft sleeves		
10.00	Mechanical seal parts		
11.00	Base plate		
12.00	Bearings (Radial)		
13.00	Bearings (Thrust)		
14.00	Hydraulic balancing device components		
15.00	Stuffing Box		
16.00	Gland		
17.00	Gland Packing		
18.00	Shaft Packing		
19.00	Fasteners		
20.00	Companion Flanges		
E.	DIMENSIONAL DETAILS		
1.00	Suction nozzle O/D mm.		
2.00	Discharge nozzle O/D mm.		
3.00	Suction nozzle flange drilling		
	standard and pressure rating		
4.00	Suction nozzle flange drilling standard and pressure rating		

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

TO BE FILLED UP BY BIDDERS		DOC. NO.	SHEET NO.
		SDFC-BS-DS-201-B	5 OF 5
DATA SHEET FOR PUMP			
		Jockey Pump	
		Electric Motor Driven	
5.00	External water connection details		
6.00	Pump shaft diameter, mm		
7.00	Impeller diameter, mm		
F.	DRIVE DATA		
1.00	Drive unit output at ambient condition		
2.00	Rated speed, RPM		
G.	INSPECTION AND TESTING		
1.00	Material test and NDT test		
2.00	Hydrostatic test pressure & duration of test min.		
3.00	Static and Dynamic balance test		
H.	WEIGHT AND LOADING DATA		
1.00	Wt. of the pump and drive assembly for foundation design kg.		
2.00	Wt. of the pump assembly kg		
3.00	Wt. of the drive unit		
4.00	Wt. of drive heaviest piece to be handled, hg.		
5.00	Drawing/Literature enclosed		

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

TO BE FILLED UP BY BIDDERS		DOC. NO.	SHEET NO.
		SDFC-BS-DS-202-A	1 OF 2
DATA SHEET FOR MOTOR			
		Fire Pump	Jockey Pump
6.00	Application / Designation		
7.00	Manufacturer		
8.00	Applicable Standards		
9.00	Rated output, KW / HP		
10.00	Rated speed, RPM		
11.00	Duty Designation (IS : 325 or equivalent)		
12.00	Supply conditions		
13.00	Rated voltage, V		
14.00	No. of phase		
15.00	Frequency, Hz		
16.00	Allowable variations in		
	a) Voltage %		
	b) Frequency, %		
	c) Combined, %		
17.00	Permissible unbalance in supply voltage %		
18.00	Current		
19.00	Full load, amps		
20.00	Starting, % FL		
21.00	Full load efficiency, %		

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

TO BE FILLED UP BY BIDDERS		DOC. NO.	SHEET NO.
		SDFC-BS-DS-202-A	2 OF 2
DATA SHEET FOR MOTOR			
		Fire Pump	Jockey Pump
21.00	Full load power factor		
22.00	Method of starting		
23.00	Torque		
24.00	Starting, % FLT		
25.00	Maximum, % FLT		
26.00	Class of Insulation		
27.00	Ref. Ambient Temp. Deg. C		
28.00	Temp. rise by res. method Deg. C		
29.00	Type of enclosure		
30.00	Degree of Protection		
31.00	Suitable for outdoor operation	Yes/No	Yes/No
32.00	Normal winding connection		
33.00	Type & No. of terminals brought out		
34.00	Winding voltage suitable for space heating		
35.00	Shaft orientation		
36.00	Dimensional Drg. enclosed	Yes/No	Yes/No

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A. INTENT OF SPECIFICATION

The specification is intended to ensure that the system / equipment to be supplied under this specification shall have assured quality and workmanship. The Contractor after award of contract shall submit manufacturers QUALITY ASSURANCE PLAN containing quality assurance program and quality assurance documents for purchaser's approval. The contractor shall be bound to conduct all stage inspections on various equipment / materials during manufacturing process in accordance with the approved copy of this document. Purchaser shall have the right to carry out QUALITY Audit and Quality Surveillance by witnessing any or all such tests to be carried at manufacturers / associates works as and when desired. The procedure applicable to contractor's work shall also apply to the works of sub-contractors. For items coming under the purview of any Indian Statutory Regulation during the course of manufacture, all stage inspection and test shall be witnessed by the inspecting authority recognized under the guarantee and responsibility shall wholly be confined on the Contractor. Quality Audit would be carried out by the Purchaser or his authorized representative.

Tests/inspection shall be carried out during and after the completion of manufacture of different components and assembly as applicable in accordance with relevant codes and standards. Tests certificates for all such tests / inspections shall be made available to the purchaser.

After erection at site, the complete hydrant and medium velocity water spray system shall be subjected to tests to show satisfactory performance in line with the requirements of OISD or other equivalent international standards.

Purchaser or his authorized representative shall have full access to witness any or all tests / inspection to be carried to at manufacturer's shop. In case the job is sub-contracted; it will be contractor's responsibility to make all arrangement so that purchaser or his authorised representative can attend such tests at sub-contractor's premises.

Inspection (including inter stage inspection) and tests shall be done as per the approved Quality Plan.

GUIDELINE FOR PROCUREMENT OF MATERIALS

The specification indicates 'APPROVED VENDORS' for every equipment. It is the responsibility of the Contractor to ensure from the manufacturers prior to submission of the bid that the specified materials will be supplied since deviation from approved vendors will not be permitted by the

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purchaser. The vendor however has the option to select any one manufacturer from the approved vendors for the particular item.

The specification indicates 'DATA SHEETS OF EQUIPMENT'. It is the responsibility of the Contractor to ensure from the manufacturers prior to submission of the bid that the equipment shall be supplied in total conformity with the specification since deviation from specification will not be permitted by the purchaser.

The modality of procurement would be as follows:

The successful Contractor on receipt of order will obtain all necessary documents from the approved manufacturer and shall submit to CLIENT for approval.

The document approved by CLIENT would be submitted to third party and the same shall be the basis for carrying out inspection.

The documents developed by the manufacturers as indicated in data specification sheet and QAP shall be submitted to the third party during inspection for review.

The third party shall review all such documents and endorse the same.

The third party shall witness the tests and test records shall be duly signed by the manufacturer and the third party.

Material release note to be issued by the third party would indicate that the material is found satisfactory and released for despatch. The note shall also indicate the following:

Data specification sheet number.

Quality assurance plan reference number.

Cross-sectional drawing number.

Purchase order number.

Tag number of equipment.

Co-relating symbol as punched on the equipment.

GUIDELINE FOR EXECUTION

THE SPECIFICATION INDICATES 'specification for packages' which would be the basis for execution.

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The specification also indicates 'DATA SHEET OF EQUIPMENT' identifying the erection requirement.

The modality of execution would be as follows:

General

Welders have to be qualified by third party at the cost of the successful Contractor.

Welding procedure has to be approved by third party at the cost of the successful Contractor.

Execution to be done as per approved drawing released for construction by CLIENT.

Fire Water Piping from pump to Hydrant valves & Sprinkler head

100% of above ground piping joints will be D.P. Tested.

20% of field joints provided/located underground shall be radio graphed

The radiography results and films shall be reviewed and accepted by third party at the cost of the successful Contractor.

All underground piping shall be provided with anti-corrosive treatment and holiday test conducted in presence of CLIENT Site In charge.

All pipelines shall be hydro tested in segments without any valves and instruments in presence of CLIENT Site In charge at a pressure of 14 Kg. / cm² for 24 hours.

All pipeline shall be flushed at a minimum pressure of 4 Kg. / cm² as per flushing scheme to be submitted by the successful Contractor and approved by CLIENT

Complete network with valves and instruments in position shall be loop tested in presence of CLIENT site in charge at a pressure of 14 Kg. / cm² for eight hours.

Sprinkler Piping beyond Installation Control valve

All joints shall be butt welded (above 50 mm NB) and socket welded (50 NB & below) connection. No threading is permitted unless specifically mentioned in the drawings released for construction.

All pipelines shall be hydro tested in presence of CLIENT Site In charge at a pressure of 14 Kg. / cm² for 24 hours.

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All pipelines shall be flushed at a minimum pressure of 4 Kg. / cm² as per flushing scheme to be submitted by the successful Contractor and approved by CLIENT.

Rotating equipment

These are to be grouted after leveling and alignment is certified by the equipment manufacturer.

The sets to be commissioned in presence of equipment manufacturer and endorsement to be obtained for satisfactory operation and maintenance.

Electrical Installation

To be executed as per the drawings released for construction and vendor's drawings approved by CLIENT.

Manufacturer's engineers to be present at site during 'PRECOMMISSIONING CHECK UP' by CLIENT.

Complete electrical installation to be audited by inspector holding electrical license and acceptance certificate obtained. Expenses to be borne by the Contractor.

GUIDELINE FOR SELECTION OF APPROVED VENDOR

The primary requirement is that all equipment would bear ISI mark or UL/FM certified and as such successful Contractor shall obtain copies of such certificate from the manufacturers and submit to CLIENT along with QAP documents.

In case there is not even a single manufacturer bearing ISI mark or UL/FM certification, the vendor selection basis would be as follows:

1) For 'MECHANICAL ITEMS'

The manufacturer has to get its product 'TYPE TESTED & ACCEPTED' by either LLOYDS or BUREAU VERITUS and the same shall include design verification, assessing quality assurance standards and performance of the final product. Preference to be given to those manufacturers who are accredited with ISO 9000.

2) For 'ELECTRICAL & INSTRUMENTATION ITEMS'

The manufacturer has to get its product 'TYPE TESTED & ACCEPTED' by either competent agency or the same shall include design verification, assessing quality assurance standards and performance of the final product. Preference to be given to those manufacturers who are

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accredited with ISO 9000. However, for panels CPRI approval certificate valid till completion of the installation shall be considered as the basis for approval of vendor.

The names of approved vendors are indicated in Doc. No.SD-Q-S-102 and the successful Contractor would have the option to select any one manufacturer from the approved vendors for the particular item meeting the above requirement.

PRE-COMMISSIONING CHECK UP

The installation shall be subjected to 'PRECOMMISSIONING CHECK UP' according to the details enclosed herewith. The committee will furnish a checklist identifying the areas to be rectified / attended which the Contractor has to attend at no additional cost.

FINAL ACCEPTANCE TEST

The installation shall be subjected to 'FINAL ACCEPTANCE TEST' according to the details enclosed hereinafter.

PERFORMANCE TEST BY LOCAL FIRE SERVICES

The installation shall be subjected to all tests for compliance with the requirement of the LOCAL FIRE SERVICES & any other authority having jurisdiction

I. PROGRESS REPORT

The successful Contractor shall submit Progress Report as indicated below on 15th day of every month.

PROCUREMENT STATUS REPORT

The report shall be prepared as per format enclosed.

ERECTION STATUS REPORT

The report shall be prepared as per format enclosed.

The report shall be reviewed once a month.

PRE - COMMISSIONING CHECK UP

1.00.00 The installation executed shall be checked in accordance with the following:

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List of Pre-commissioning check up to be submitted by successful Contractor for approval Engineer-in-Charge.

The installation shall be physically checked for compliance with the drawings released for construction.

Test protocol for segment wise hydro test jointly signed by PURCHASER & CONTRACTOR.

Test protocol for entire piping hydro testing jointly signed by PURCHASER & CONTRACTOR.

Hydro test report jointly signed.

Cross sectional drawing test certificate for all materials/equipment used with valid ISI license, warranty certificate.

Welders' Test Certificates certified by third party to be submitted.

Identification mark for all valves and equipment.

Extinguishers distribution chart.

Certificate from electrical concern person to ensure the availability of emergency Electric supply during fire situation for electrical installation part at pump house, other emergency equipment & system.

Report on Sequential operation of Pumping system.

Full flow test report for wet riser and hydrant system.

Display of exit sign age / fire notice and emergency plan.

2.00.00 CHECKING OF THE SYSTEM

Start and stop of Jockey pump manually as well as automatically.

Start of Main Fire pump manually as well as automatically.

Start of Stand by Fire pump manually as well as automatically.

All the system shall be tested for full flow for checking compliance with design calculation and accordingly all instruments (pressure gauge) to be mounted in position wherever required.

To check pressure at remotest / highest landing valve is 3.5 Kg/cm² when Four Nos.

Hydrant/Landing Valve are in operation as follows:

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Two Nos. Landing Valves at Fire affected Floor.

One No. Landing Valves at above Fire affected Floor (Immediate below highest level)

One No. Landing Valves at below Fire affected Floor (Highest Level)

Other test as required by Fire & Local Authority.

COMMISSIONING CHECK UP BY CLIENT/CONSULTANT

A) Hydrant System

All testing listed in pre-commissioning checklist.

Full flow test after putting Fire pumps in Auto condition.

Effective throw, discharge & pressure at the remotest / highest Hydrant / Landing valve.

SOP of pumping system at pump house.

O & M manuals and AS Built drawings.

Training to site people/ FM team including basic trouble shooting list to site FM team.

Training schedule for client's representative

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DOCUMENT NUMBER - SDFC- Q -S -100 (1 OF 2)			
QUALITY ASSURANCE PLAN FOR PUMPS			
1.0	ITEM DESCRIPTION	FIREPUMP	JOCKEYPUMP
2.0	DATA SHEET	SDFC-FP-DS-101 SDFC-T-S-101	SDFC-JP-DS-102 SDFC-T-S-101
3.0	RECOMMENDED VENDOR	Refer to ANNEXURE - A	Refer to ANNEXURE - A
4.0	MANUFACTURER'S DOCUMENTS TO BE SUBMITTED FOR APPROVAL PRIOR TO PROCUREMENT	a) Data Sheet (SDFC-FF-BS-DS-201) b) Characteristic Curve & NPSH calculation c) Dimensional drawing of set d) Cross sectional drawing of pump e) Quality Assurance Plan	a) Data Sheet (SDFC-FF-BS-DS-201) b) Characteristic Curve & NPSH calculation c) Dimensional drawing of set d) Cross sectional drawing of pump e) Quality Assurance Plan
5.0	TEST TO BE CARRIED OUT BY MANUFACTURER AT WORKS	a) Material Test (physical) and chemical b) Dynamic balancing c) Hydrotest d) Performance test with job motor establishing duty point'	a) Material Test (physical) and chemical b) Dynamic balancing c) Hydrotest d) Performance test with job motor e) Coupled test at rated RPM for establishing duty point
6.0	SERVICES TO BE RENDERED BY MANUFACTURER AT SITE	a) Checking of alignment & issuance of certificate for acceptance b) Commissioning of the set at rated RPM and certifying satisfactory operation c) To intimate name & address of servicing agency to enable client to finalise AMC, if necessary	a) Checking of alignment & issuance of certificate for acceptance b) Commissioning of the set at rated RPM and certifying satisfactory operation c) To intimate name & address of servicing agency to enable client to finalise AMC, if necessary

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DOCUMENT NUMBER - SDFC- Q -S -100 (2 OF 2)			
QUALITY ASSURANCE PLAN FOR MOTOR			
1.0	ITEM DESCRIPTION	ELECTRIC MOTOR	
2.0	DATA SHEET	SDFC-FP-DS-101,SDFC-JP-DS-102 SDFC-T-S-102	
3.0	RECOMMENDED VENDOR	Refer to ANNEXURE - A	
4.0	MANUFACTURER'S DOCUMENTS TO BE SUBMITTED FOR APPROVAL PRIOR TO PROCUREMENT	a) Data Sheet (SDFC-FF-BS-DS-202 b) Characteristic Curve c) Dimensional drawing d) Quality Assurance Plan	
5.0	TEST TO BE CARRIED OUT BY MANUFACTURER AT WORKS	a) Material test b) Dynamic Balancing c) Routine test	
6.0	SERVICES TO BE RENDERED BY MANUFACTURER AT SITE	a) Checking of alignment and issuance of certificate for acceptance b) Commissioning of the set at rated RPM and certifying satisfactory operation	

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DOCUMENT NUMBER - SDFC- Q -S -101 (1 OF 6)			
QUALITY ASSURANCE PLAN FOR MATERIALS & EQUIPMENT			
1.0	ITEM DESCRIPTION	VALVES	PIPES & FITTINGS
2.0	SPECIFICATION REQUIREMENT	SDFC-V-DS-301/302/303/304	SDFC-PF-DS-201
3.0	APPROVED VENDOR	Refer to specification sheet	Refer to specification sheet
4.0	MANUFACTURER'S DOCUMENTS TO BE SUBMITTED FOR APPROVAL PRIOR TO PROCUREMENT	a) Cross sectional drawing b) Data sheet c) Quality Assurance Plan d) ISI license / UL listing certificate e) Type test certificate	a) ISI license copy b) Data sheet c) Dimensional details d) Quality Assurance Plan
5.0	TEST TO BE CARRIED OUT BY MANUFACTURER AT WORKS	a) Material test b) Hydro test	As per relevant code
6.0	DOCUMENTS TO BE SUBMITTED TO PURCHASER/CONSULTANT	a) Material test certificate b) Hydro test certificate c) Guarantee certificate	a) Material test certificate b) Hydrotest certificate c) Guarantee certificate
7.0	INSPECTION TO BE DONE BY PURCHASER/CONSULTANT	a) Review test certificate b) Physical verification c) Hydro test	a) Physical verification b) Review of test certificate c) Hydro test as indicates in Quality Assurance Plan
8.0	DOCUMENTS TO BE SUBMITTED ALONG WITH SUPPLIES DULY ENDORSED BY PURCHASER/CONSULTANT	a) Material test certificate b) Hydro test certificate c) Details of inspection carried out and test results d) Material release note	a) Test Certificate b) Details of test done and test results c) Material release note
9.0	SERVICES TO BE RENDERED BY MANUFACTURER AT SITE	a) Servicing of the valve inclusive of lubrication, replacement of glands prior to handing over the installation to LML	NIL

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DOCUMENT NUMBER - SDFC- Q -S -101 (2 OF 6)			
QUALITY ASSURANCE PLAN FOR MATERIALS & EQUIPMENT			
1.0	ITEM DESCRIPTION	HYDRANT VALVE	HOSE WITH COUPLING
2.0	SPECIFICATION/ REQUIREMENT	SDFC-HY-DS-401	SDFC-HY-DS-402
3.0	APPROVED VENDOR	Refer to specification sheet	Refer to specification sheet
4.0	MANUFACTURER'S DOCUMENTS TO BE SUBMITTED FOR APPROVAL PRIOR TO PROCUREMENT	a) ISI license copy b) Cross sectional drawing c) Data sheet d) Quality Assurance Plan	a) ISI license copy b) Cross sectional drawing c) Data sheet d) Quality Assurance Plan
5.0	TEST TO BE CARRIED OUT BY MANUFACTURER AT WORKS	a) Material test b) Hydro test c) Performance test	a) Material test b) Hydrotest
6.0	DOCUMENTS TO BE SUBMITTED TO PURCHASER/CONSULTANT	a) Material test certificate b) Hydrotest certificate c) Guarantee certificate	a) Material test certificate b) Hydrotest certificate c) Guarantee certificate
7.0	INSPECTION TO BE DONE BY PURCHASER/CONSULTANT	a) Physical verification b) Hydrotest c) Performance test d) Review of test certificate	a) Physical verification b) Hydrotest c) Review of test certificate
8.0	DOCUMENTS TO BE SUBMITTED ALONG WITH SUPPLIES DULY ENDORSED BY PURCHASER/CONSULTANT	a) Test certificates b) Details of test done and test results c) Material release note	a) Test certificate b) Details of test done and test results c) Material release note
9.0	SERVICES TO BE RENDERED BY MANUFACTURER AT SITE	NIL	NIL

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DOCUMENT NUMBER - SDFC- Q -S -101 (3 OF 6)			
QUALITY ASSURANCE PLAN FOR MATERIALS & EQUIPMENT			
1.0	ITEM DESCRIPTION	BRANCH PIPE AND NOZZLE	HOSE REEL
2.0	SPECIFICATION/ REQUIREMENT	SDFC-HY-DS-403	SDFC-HY-DS-404
3.0	APPROVED VENDOR	Refer to specification	Refer to specification
4.0	MANUFACTURER'S DOCUMENTS TO BE SUBMITTED FOR APPROVAL PRIOR TO PROCUREMENT	a) ISI license copy b) Cross sectional drawing c) Data sheet d) Quality Assurance Plan	a) ISI license copy b) Cross sectional drawing c) Data sheet d) Quality Assurance Plan
5.0	TEST TO BE CARRIED OUT BY MANUFACTURER AT WORKS	a) Material test b) Hydrotest	a) Material test b) Hydrotest
6.0	DOCUMENTS TO BE SUBMITTED TO PURCHASER/CONSULTANT	a) Material test certificate b) Hydrotest certificate c) Guarantee certificate	a) Material test certificate b) Hydrotest certificate c) Guarantee certificate
7.0	INSPECTION TO BE DONE BY PURCHASER/CONSULTANT	a) Physical verification b) Hydrotest c) Review of test certificate	a) Physical verification b) Hydrotest c) Review of test certificate
8.0	DOCUMENTS TO BE SUBMITTED ALONG WITH SUPPLIES DULY ENDORSED BY PURCHASER/CONSULTANT	a) Test certificate b) Details of test done and test results c) Material release note	a) Test certificate b) Details of test done and test results c) Material release note
9.0	SERVICES TO BE RENDERED BY MANUFACTURER AT SITE	NIL	NIL

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DOCUMENT NUMBER - SDFC- Q -S -101 (4 OF 6)			
QUALITY ASSURANCE PLAN FOR MATERIALS & EQUIPMENT			
1.0	ITEM DESCRIPTION	PRESSURE GAUGE	PRESSURE SWITCH
2.0	SPECIFICATION REQUIREMENT	SDFC-I-DS-501	SDFC-I-DS-502
3.0	APPROVED VENDOR	Refer to specification sheet	Refer to specification sheet
4.0	MANUFACTURER'S DOCUMENTS TO BE SUBMITTED FOR APPROVAL PRIOR TO PROCUREMENT	a) Type test certificate b) Cross sectional drawing c) Data Sheet d) QAP e) Instrument mounting diagram	a) CCOE & CMRS approval certificate b) Type test certificate c) Cross sectional drawing d) QAP e) Instrument mounting diagram
5.0	TEST TO BE CARRIED OUT BY MANUFACTURER AT WORKS	a) Performane b) Callibration c) Matrial test	a) Performane b) Callibration c) Material test
6.0	DOCUMENTS TO BE SUBMITTED TO PURCHASER/CONSULTANT	a) Material test certificate b) Calibration certificate c) Guarantee certification	a) Material test certificate b) CCOE & CMRS approval certificate c) Calibration certificate d) Guarantee certificate
7.0	INSPECTION TO BE DONE BY PURCHASER/CONSULTANT	a) Physical verification b) Review of test certificate	a) Physical verification b) Review of test certificate
8.0	DOCUMENTS TO BE SUBMITTED ALONG WITH SUPPLIES DULY ENDORSED BY PURCHASER/CONSULTANT	a) Material test certificate b) Calibration certificate c) Details of test done and test results d) Material release note	a) Material test certificate b) Calibration certificate c) CCOE & CMRS approval certificate d) Details of test done and test results e) Material release note
9.0	SERVICES TO BE RENDERED BY MANUFACTURER AT SITE	NIL	NIL

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DOCUMENT NUMBER - SDFC- Q -S -101 (5 OF 6)			
QUALITY ASSURANCE PLAN FOR MATERIALS & EQUIPMENT			
1.0	ITEM DESCRIPTION	POWER CABLE	CONTROL CABLE
2.0	SPECIFICATION REQUIREMENT		
3.0		Refer to specification sheet	Refer to specification sheet
4.0	MANUFACTURER'S DOCUMENTS TO BE SUBMITTED FOR APPROVAL PRIOR TO PROCUREMENT	a) ISI license copy b) QAP c) Data sheet (To be developed by manufacturer)	a) ISI license copy b) QAP c) Data sheet (To be developed by manufacturer)
5.0	TEST TO BE CARRIED OUT BY MANUFACTURER AT WORKS	a) Material test b) As per IS:1554 (Part-1) latest amendment	a) Material test b) As per IS:1554 (Part-1) latest amendment
6.0	DOCUMENTS TO BE SUBMITTED TO THIRD PARTY FOR INSPECTION	a) Material test certificate b) Guarantee certificate c) Finished cable test certificate	a) Material test certificate b) Guarantee certificate c) Finished cable test certificate
7.0	INSPECTION TO BE DONE BY PURCHASER/CONSULTANT	a) As per IS:1554 (part-1)	a) As per IS:1554 (part-1)
8.0	DOCUMENTS TO BE SUBMITTED ALONG WITH SUPPLIES DULY ENDORSED BY THIRD PARTY	a) Material test certificate' b) Finished cable test certificate c) Details of test done and test results d) Material release note	a) Material test certificate' b) Finished cable test certificate c) Details of test done and test results d) Material release note
9.0	SERVICES TO BE RENDERED BY MANUFACTURER AT SITE	NIL	NIL

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

DOCUMENT NUMBER - SDFC- Q -S -101 (6 OF 6)			
QUALITY ASSURANCE PLAN FOR MATERIALS & EQUIPMENT			
1.0	ITEM DESCRIPTION	JUNCTION BOX	
2.0	SPECIFICATION REQUIREMENT		
3.0	APPROVED VENDOR		
4.0	MANUFACTURER'S DOCUMENTS TO BE SUBMITTED FOR APPROVAL PRIOR TO PROCUREMENT	a) Type test certificate b) Drawing with terminal details c) QAP	
5.0	TEST TO BE CARRIED OUT BY MANUFACTURER AT WORKS	a) Degree of protection b) Material test	
6.0	DOCUMENTS TO BE SUBMITTED TO THIRD PARTY FOR INSPECTION	a) Guarantee certificate	
7.0	INSPECTION TO BE DONE BY PURCHASER/CO	a) Physical verification b) Deg. of protection c) Review of certificates	
8.0	DOCUMENTS TO BE SUBMITTED ALONG WITH SUPPLIES DULY ENDORSED BY THIRD PARTY	a) Material test certificate b) CCOE & CMRS approval certificate c) Details of test done and test results d) Material release note	
9.0	SERVICES TO BE RENDERED BY MANUFACTURER AT SITE	NIL	

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

FINAL ACCEPTANCE TEST

Following test to be witnessed by Engineer-in-Charge:

Phase - I

A) Hydrant System

- a) Full flow test after putting Fire pumps in Auto condition.
- b) Effective throw, discharge & pressure at the remotest / highest Hydrant / Landing valve.

B) Fire Alarm System related to Protection System

Functional test of all field equipment & Fire Alarm Panel

All tests to be conducted shall be as per specification / IS:3844 / IS:2189/ WBFES/ Local Authority.

Phase - II

ALL TESTS TO BE CONDUCTED IN PRESENCE OF WBFES / LOCAL INSPECTION TEAM AS PER THEIR REQUIREMENT / IS: 3844 / NBC / LOCAL NORMS.

NOTE: Third Party Inspection if required before handing over the system to operation & Maintenance team shall be Carried out by the Contractor without any financial implication to the client.

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

SCOPE CONFIRMATION		DOC. NO.	SDFC-BS-C -101	SHT NO. 1 OF 2
SCOPE CONFIRMATION				
	We confirm the following :			
1.0	On completion of work all surplus materials/equipment etc. will be cleared from site and a clean job shall be handed over.			
2.0	All materials including cement, structural steel, reinforcement rods shall be arranged by us.			
3.0	All transport, handing and storage cost/charge shall be borne by us.			
4.0	The rates offered are inclusive of works contract tax and all other taxes applicable			
5.0	We will not claim reimbursement of any amount paid by us as Excise duty for any contract job including fabrication and erection.			
6.0	Our scope includes supply of all equipment along with all accessories since we have been entrusted the order for complete system.			
7.0	ALL MATERIALS/EQUIPMENTS/ACCESSORIES/CONSUMABLES REQUIRED FOR SATISFACTORY OPERATION OF THE SYSTEM WOULD BE SUPPLIED AND INSTALLED BY US AND ARE INCLUDED IN THE RATES/PRICES OFFERED BY US. THE MAKE/QUALITY OF THE ABOVE MATERIALS WILL BE AS APPROVED BY CLIENT.			
8.0	The unit rates quoted against each item is for total completion of work commencing from residual engineering to commissioning and obtaining approval from LFS and also include all necessary inspection charges claimed by the manufacturer, statutory authorities. The unit rate are also inclusive of conducting satisfactory demonstration of the system to PURCHASER/CONSULTANT acceptance committee and LFS and carryout rectification as to be advised by them.			
9.0	No extra claim would be raised on account of non visiting the site.			
10.0	Inclusion of drain piping for riser upto the nearest surface drain at no extra cost.			
11.0	We have noted that Power and water will be supplied by CLIENT			
	-- Water free at one point.			
	-- Power @ 6.50/Kw/Hr. at one point			
BIDDER SEAL AND SIGNATURE				

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

SCOPE CONFIRMATION		DOC. NO.	SDFC-BS-C -101	SHT NO. 2 OF 2
SCOPE CONFIRMATION				
12.0	To provided all commissioning tools & tackles and material/equipment reqd for pre commissioning , commissioning and acceptance test by CLIENT/CONSULTANT/LFS			
13.0	Provision of orifice plates on Hydrant / Landing valve (if reqd.).			
14.0	Provision of pressure gauge at hydraulically remotest point as per SPN/LFS requirement.			
15.0	Provision of instruction boards at field at various locations as to be directed by PURCHASER/CONSULTANT.			
16.0	Provision of maintenance flange joint at all road crossing at no additional cost.			
17.0	Prices offered by them includes supply of all materials required for the job.			
BIDDER SEAL AND SIGNATURE				

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

SCOPE CONFIRMATION		DOC. NO.	SDFC-BS-C -102	SHT NO. 1 OF 1
CHECK LIST ON CONTRACT OPERATING PARAMETER				
SL. NO.	REQUIREMENT OF OWNER	CONFIRMATION / CLARIFICATION BY		
1.	The quantities indicated in PRICE BID are for evaluation purpose. However the successful Bidder/ Contractor after award has to carry out total job as per the construction drawings prepared by vendor & approved by PURCHASER/CONSULTANT.			
2.	Successful bidder would be paid as per agreed rate for the actual job executed on the basis of the drawings released by PURCHASER/CONSULTANT and to suit site requirement. There would be no ceiling in quantity variation irrespective of increase or decrease in the scope of work.			
3.	Bidder to confirm that for all items where unit has been indicated as LOT, no quantity variation would be considered for additional payment.			
4.	Bidder to confirm acceptance of scope confirmation, basis of measurement and payment, sign and seal the same as a token of acceptance and submit to owner which will form part of the contract.			
BIDDER SEAL AND SIGNATURE				

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

SCOPE CONFIRMATION		DOC. NO.	SDFC-BS-C -103	SHT NO. 1 OF 1
CHECK LIST ON APPROVAL FROM LFS AND PURCHASER'S FINAL ACCEPTANCE COMMITTEE				
SL. NO.	REQUIREMENT OF OWNER	CONFIRMATION / CLARIFICATION BY BIDDER		
1.	Successful bidder to develop and submit all necessary drawings & documents as advised by PURCHASER / CONSULTANT for submission to LFS and final acceptance committee of PURCHASER / CONSULTANT at no additional cost			
2.	Successful bidder to ensure presence of commissioning crew during inspection by LFS and final acceptance committee of PURCHASER / CONSULTANT and demonstrate satisfactory performance of the system at no additional cost.			
3.	Bidder to attend to all checklists furnished by LFS and PURCHASER/CONSULTANT's acceptance committee at no extra cost and submit compliance report.			
BIDDER SEAL AND SIGNATURE				

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

SCOPE CONFIRMATION		DOC. NO.	SDFC-BS-C -104	SHT NO. 1 OF 1
CHECKLIST FOR QUALITY ASSURANCE PLAN				
SL. NO.	REQUIREMENT OF OWNER	CONFIRMATION / CLARIFICATION BY BIDDER		
1	Bidder to confirm that all materials shall be as per specification requirement			
2	Bidder to confirm that all documents shall be furnished as indicated in the specification, after award of contract.			
3	Bidder to note that all equipment shall be inspected by PURCHASER/CONSULTANT as per approved quality plan.			
4.	Bidder to confirm that all data sheets for all material along with all relevant documents shall be submitted for approval of owner/ consultant within 30 days of receipt of LOI.			
5	Bidder to confirm that after mechanical completion, the pipeline shall be flushed at 4 kg/sq.cm Accordingly all vents and drains shall be provided by Bidder at no extra cost.			
6	Bidder to confirm that after flushing system leak test at 12.0 kg/sq.cm. will be carried out with valves and specialities in position.			
9	Bidder to confirm conducting performance test as per LFS requirement and operation philosophy.			
10	Bidder to note that during precommissioning check up all relevant documents would be scrutinised and operation shall be tested as per specification requirement.			
	Thereafter a checklist shall be submitted by PURCHASER/CONSULTANT which will be attended by the bidder and system has to offered for performance test as per specification requirement.			
	Bidder to note that during commissioning check up The system shall be tested for operation and performance as per specification requirement and a check list will be furnished by PURCHASER/CONSULTANT which has to be attended by the bidder at no additional cost. The system shall be offered to LFS and final acceptance committee for performance test only after the system is ready in all respect.			
BIDDER SEAL AND SIGNATURE				

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

SCOPE CONFIRMATION		DOC. NO.	SDFC-BS-C -106	SHT NO. 1 OF 1
DECLARATION BY BIDDER				
I sri _____ have been authorised by my BIDDER through power of attorney executed in my favour (Copy enclosed) and hereby confirm having put my signature on the Price Schedule with the consent of the management and declare as follows.				
1.	The extent of supply and execution under this contract includes all items for satisfactory Operation of the system and in compliance with LFS requirements not even anything which may have been omitted from the specification or schedule of work and rates. specifcation or schedule of work and rates.			
2.	The operational requirement of the system and different equipments have been checked for adequacy and I undertake the total responsibility for satisfactory operation and NOC from LFS. (LOCAL FIRE SERVICE)			
3.	Manufacturer's name/Model No. indicated in the bid document will not be changed unless the manufacturer has stopped manufacturing or the system needs better material.			
4.	All prices quoted are inclusive of all taxes and duties and are firm.			
5.	No extra taxes, duties and levis will be paid			
6.	Price quoted are inclusive of Obtaining NOC from LFS /PURCHASER /CONSULTANT'S acceptance committee on the installation is our total responsibility.			
	Date :	Signature :		
		Name :		
		Designation:		
		Company Seal :		
BIDDER SEAL AND SIGNATURE				

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

SPECIFICATIONS FOR INSTRUCTIONS		DOC. NO.	SDFC-BS-C -107	SHT NO. 1 OF 3
INSTRUCTIONS				
(TO PROVIDED IN GROUND FLOOR)				
ALERT THE OCCUPANTS BY USING PUBLIC ADDRESS SYSTEM AND GIVE THEM PROPER GUIDANCE FOR SAFE EVACUATION FROM BUILDING.				
OPERATE THE GROUNDING SWITCH TO BRING FIRE ELEVATOR TO GROUND FLOOR LEVEL.				
SWITCH OFF THE POWER SUPPLY OF THE BUILDING EXPECTING EMERGENCY LIGHT / FIRE ALARM PANEL, & TALK BACK PANEL.				
FIGHT THE FIRE USING NEAREST SUITABLE EXTINGUISHER OR WATER FROM NEAREST HOSE REEL / HYDRANT POINT DEPENDING ON SIZE OF FIRE.				
EVACUATE THE OCCUPANTS BY USING FIRE EXITS AND EMERGENCY EXITS ONLY AND ASSEMBLE AT SAFE PLACE.				
	Date :		Signature :	
			Name :	
			Designation:	
			Company Seal :	
BIDDER SEAL AND SIGNATURE				

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

SPECIFICATIONS FOR INSTRUCTIONS		DOC. NO.	SDFC-BS-C -107	SHT NO. 2 OF 3
INSTRUCTIONS				
(TO PROVIDED INSIDE CONTROL ROOM)				
INFORM THE LOCAL FIRE BRIGADE THROUGH ANY ONE OF THE FOLLOWING NUMBERS.				
XXXX-XXXX- OR XXXX-XXXX				
IN CASE OF CASUALTIES, CALL THE AMBULANCE BY DIALING NUMBER:-351				
ENSURE THAT THE DIASABLED, UNCONSIIOUS AND PHYSICALLY CONTRAINED PEOPLE ARE EVACUATED				
GUIDE THE FIRE FORCE ON THEIR ARRIVAL TO THE SEAT OF FIRE.				
	Date :	Signature :		
		Name :		
		Designation:		
		Company Seal :		
BIDDER SEAL AND SIGNATURE				

WBCS OFFICER'S HOUSING SCHEME AT PLOT NO - IID / 37, NEW TOWN, KOLKATA

SPECIFICATIONS FOR INSTRUCTIONS		DOC. NO.	SDFC-BS-C -107	SHT NO. 3 OF 3
INSTRUCTIONS				
(TO PROVIDED IN EACH FLOOR)				
DO NOT USE LIFT INCASE OF FIRE.				
BE CLAIM & DO NOT CREATE ANY PANIC. DO NOT RUN . START WALKING TOWARDS STAIRCASE.				
USE NEAREST STAIRCASE FOR EVACUATION				
ALERT THE SECURITY STAFF AT CONTROL ROOM BY ACTUATING MANUAL CALL POINT LOCATED NEAR THE STAIRCASES OR REPORT USING THE TALKBACK SYSTEM LOCATED IN LOBBY.				
EVACUATE THROUGH THE NEAREST SAFE EXIT & ASSEMBLE AT SAFE PLACE				
IF POSSIBLE TRY TO EXTINGUISH THE FIRE BY USING NEAREST SUITABLE EXTINGUISHER OR WATER FROM THE NEAREST HOSE REEL.				
IF ENCOUNTER SERIOUS DIFFICULTY IN EVACUATION TAKE SHELTER IN REFUGE AREA TRY TO ATTRACT ATTENTION TO THE RESCUE TEAM.				
	Date :	Signature :		
		Name :		
		Designation:		
		Company Seal :		
BIDDER SEAL AND SIGNATURE				

ANNEXURE 1

LIST OF MANUFACTURERS

PART -A

A. CIVIL WORKS - FINISHES			
Sl. No	Material/Product	Brief description	Make /Manufacturer/Origin
1	Adhesive for Vitrified, Ceramic tiles/ Stone/ Stone Sealers	To be used for fixing Floor Tiles, Wall Tiles	Cico / Pidilite / Ardex Endura / MYK Laticrete/ Fosroc
2	Adhesive Tape	*	3M/Norton/ BOPD/ TESA
3	Ceramic Tile	Floor Tiles, Wall Tiles	Johnson / Kajaria / Somany
4	Black stone	Kadapa(Cuddapah)	Local supplier-For Slabs/Tiles of Indian origin
5	Chemical /Silicon Paint	Shade as per selection from standard range	SIKA/ Asian/ Berger/ ICI
6	Chemical Waterproofing	Elastomeric membrane coating, Cementitious Slurry, fibre reinforced elastomeric membrane etc.	Fosroc/SIKA/Pidilite
7	Epoxy Paint	Shade as per selection from standard range	Fosroc/SIKA/Pidilite
8	Fibre Cement Board	Regular & Fire rated boards- False Ceiling, Partition wall	SHERA India/Bison panel/ USG-Boral
9	Granite	Black, Gray & Multi-coloured, Pink Granites as per selection	Local supplier-For Slabs/Tiles of Indian & Foreign origin
10	Gypsum board	Regular & Fire rated boards- False Ceiling, Partition wall	Armstrong/ Gyproc /SHERA/ USG-Boral Gypsum
11	Laminates/ Veneers	Face fixing on door	Century/ Archidply /Greenlam/Formica/ Merino
12	Marble	Makrana, Doongri, as per selection	Local supplier-For Slabs/Tiles of Indian & Foreign origin
13	Mild Steel	Hand rails, Balusters, Gates	Tata Steel/SAIL/RINL
14	Paint	Washable acrylic emulsion, External paint	Asian/ Berger/ ICI
15	Paver Blocks	60 mm, 80 mm thick for	Local supplier- KK / Uni Stone Products (India) Pvt. Ltd/ Hindustan Tiles/ NITCO/ PAVIT

		pedestrian & Vehicular traffic	
16	Putty Punning	Exposed Plastered Internal Surface	Birla/JK/Asian Paints/ Ferroscrete
17	Stainless Steel	Grade 304/304 L	Tata Steel/ JSW Steel/SAIL/Salem Steel
18	Vitrified Tile s (Double / Multi Charged)/ Germ free/Full body etc.)	Floor tiles, Wall Tiles	Johnson / Kajaria / Somany

B. STRUCTURAL INSTALLATIONS

Sl. No	Material/Product	Brief description	Make /Manufacturer/Origin
19	Aggregate (Stone chips)	As per design mix	Pakur Varity
20	Anchor Fastner/Dash Fastner	*	Hilti / Fischer /Bosch
21	Cement	OPC/ PPC/PSC	ACC/UltraTech /Dalmia
22	Cement: White	*	Birla White / JK / Ultratech/Lafarge
23	Chemical Admixtures	Accelerators, Retarders, Water-reducing agents, Air-entraining admixtures, etc.	Fosroc/SIKA/Pidilite
24A	Concrete Block	Grade –A, Blockwork in cement mortar adhesive	ACC/Nuvoco/ACE
24B	AAC BLOCKS		Koncrete/ Nuvoco/ TATA-Tisco build
25	Curing Compound	*	Pidilite / Fosroc / Sika/ Cico
26	Reinforcement steel	Corrosion Resistance Steel - CRS	Tata / SAIL/RINL
27	Sand	As per design mix	Local supplier-River sand

C. DOOR , WINDOW & GLASS INSTALLATIONS

Sl. No	Material/Product	Brief description	Make /Manufacturer/Origin
28	Adhesive for Wood Work		Fevicol/ Vamicol/ Dunlop/ 3M
29	Aluminium Window	Colour Anodized Aluminium single glazed window	Jindal /Tostem /Lingel /Schueco/Eternia
30	Architectural Hardware	Door handle, Lock case, Hinges etc.	GODREJ/DORSET/ Hettich/Yale/ Hafele/Assaabloy / Geze
31	Glass	Window glazing	Modifloat/ SAINTGOBAIN/AGC
32	Roller shutters	MS shutter, MS Grill Shutter	Local supplier

33	Steel doors	Fire rated door	Tata Pravesh/ JSW Avantee
34	Silicon sealants /Weather Sealant /Structural Glazing Sealant	Weather sealing	GE- Silicon / Pidilite / Forsoc /Sikka/ Cico
35	Wooden doors	Flush door , Panel door	Greenply/ Durian/Century

D. SANITARY INSTALLATIONS

Sl. No	Material/Product	Brief description	Make /Manufacturer/Origin
36	CP Fittings	Mixture tap /Water mixer/Pillar Cock/ Stop Cock/Push type Pillar Cock etc.	JAQUAR/KOHLER/ HIND WARE
37	CP Accessories	Towel Rail/Soap Tray/Paper Holder/ Robe Hook/Bottle Trap etc.	JAQUAR/KOHLER/ HIND WARE
38	Porcelain Fittings	Concealed Cistern, Flushing mechanism, Wall/Floor mounted WC, Wash Hand Basin etc.	JAQUAR/KOHLER/ HIND WARE

E. WATER SUPPLY & PLUMBING WORKS

Sl. No	Material/Product	Brief description	Make /Manufacturer/Origin
39	Ball Cock	*	Sant / L&T/Audco/GPA
40	E.P.D.M Gaskets	*	Anand Reddiplex / Enviro Seals /
41	Gratings: SS	*	Camry/Glacier/Gem/ Jaquar/Grohe
42	HDPE Pipes / Moulded Fittings	*	Emco /Polyefins/Pioneer Plyfab/Jain
43	Insulation of Hot water pipes	*	Vidoflex insulation / Superion insulation Kaiflex -Kaimann/Armoflex/Thermaflex
44	Manhole Covers [C.I.]	*	NECO/B.I.C./R.I.F./ HEPCO/SKF/KAJECO/ RPMF
45	Pipes & fitting: PVC for Type B PVC	SWR Soil, Waste & Vent Pipes and fittings, Casing & Screen Pipes	Supreme / Finolex/Oriplast
46	Pipes & Fittings: CPVC	Internal Water Supply, External Water Supply	Astral/Ashirvad/ Supreme / Oriplast

47	Pipes & fittings: UPVC	Internal Water Supply, External Water Supply	Finolex /Supreme / Astral/Ashirvad/ Oriplast
48	Pipes & Gully Trap: Stone ware	*	Perfect / S.K.F/ R.K/ Hind / Anand
49	Pipes: M.S./GI	*	Jindal / TATA/SAIL
50	Pipes: R.C.C	*	Indian Hume Pipe / Pragati Concrete Udyog Daya/ KK / JSP
51	Sluice Valve &Non Return Valve [C.I.]	*	Kirloskar /Leader /Annapurna
52	Valve: Flush	*	Gem/ Jaquar / Marc
53	Valve: Pressure Relief	*	Annapurna/Leader/ Kirloskar
54	Valve: Sluice / NRV	*	Kirloskar/IVC/Kilburn/ Castle/ Leader / L&T
55	Valve: Solenoid	*	Rain Bird, USA/Toro/Nelson,
56	Valves [C.I.]	Full way, Check and Globe Valves	Leader / Kirloskar / Castle

ANNEXURE 1

LIST OF MANUFACTURERS

PART -B

F. LIFT INSTALLATIONS			
Sl. No	Material/Product	Brief description	Make /Manufacturer/Origin
57	Passenger Lift/ Service Lift/ Bed lift	High speed lift , Fire lift	Mitsubishi/ Schindler/KONE
G. ELECTRICAL WORKS			
Sl. No	Material/Product	Brief description	Make /Manufacturer/Origin
58	VCB/SF6 CB	*	Siemens/ABB(33V &11 KV)/Areva(11KV) / Biecco lawrie Ltd
59.A	Transformer 33KV/433V Dry Type	*	Bhel/Voltamp/Kirloskar/ Raychem
59.B	Transformer 11KV/433V Dry Type	*	Universal Magnetic/Voltamp/Kirloskar/ CGL
59.C	Oil cooled 33/11 KV grade Transformer	*	Voltamp/ Kirloskar/ Hitachi / CGL
59.D	Oil cooled 11/0.433 KV grade Transformer	*	Voltamp/ RTS / CGL/ABB
60 (i)	LT Panel	*	Approved OEM with CPRI certificates
60 (ii)	Non-phase Segregated Busduct	*	Approved OEM with CPRI certificates
60 (iii)	Sandwich Bus Ways / Bus Duct	*	Legrand /C&S /Siemens/ABB
61	ACB	*	Siemens / L&T/ABB/Schneider
62	MCCB	*	Siemens / L&T/ABB/Schneider
63	MCB		Legrand/L&T/Havells/Siemens/ABB
64	MCB DB	*	Legrand/L&T/ Havells /Siemens/ABB
65	SFU	*	Siemens/L & T/ABB/C &S /Legrand
66	Isolator / C/o Switch	*	Siemens/L & T/ABB/HPL/ Havells
67	CT	*	Kappa/AE/ Precise
68	PT	*	Kappa/AE
69	Contactor	*	Siemens/L & T / ABB /BCH
70	Relay	*	GE/Siemens/ER/L&T/ Schneider
71	KWH Meter	*	Secure / Schneider/ ELmeasure/ L&T
72	Ammeter	*	AE / IMP
73	Voltmeter	*	AE / IMP
74	Indicating Lamps	*	L & T/Siemens/Vinay /Vaishnu/Technic
75	Selector Switch	*	Kaycee/Recom/Salzar

76	Push Button	*	L & T/Siemens/ Vaishnu/Technik
77	APFC Relay	*	L&T/Neptune/Datar
78	Power Capacitor	*	L&T / Neptune/Apcos (Siemens)
79 (i)	ACCL		Elmeasure / L&T / Muller
79 (ii)	ATS	*	L&T / Havells
80	LT XLPE / PVC Cables	*	Polycab / Havell's / Gloster/ Finolex/Universal
81	HT XLPE Cables 33/11 KV	*	CCI / Universal/ Polycab/ RR/ Havell's /Gloster
82	Gland/Socket/Lug	*	Commet/Dowel/Jaison
83	Terminal Block	*	Elmex/Connectwell
84	FRLS Wire	*	Finolex/Polycab/Havell's / RR
85	Battery Charger	*	Caldyne/Sabnife/Amraraja / micro ware/ Chabbi/ IEE
86	Battery		Exide/Standard / Amraraja
87	HT Termination Kit /Straight through Jt	*	Raychem/3M
88	LT Straight through Jt	*	Raychem/3M
89	GI / Cu Strip	*	ISI marked
90	Light Fixture	*	Philips /Wipro/Thorn/K-lite / CGL/Havells
91	Exhaust Fan	*	ECE/CGL/Havell's/Orient
92	Switch, Socket, Plug	*	Legrand / Siemens/ABB/ L&T/Anchor
93	Grouting Bolt	*	Hilti
94	Fire Resistant Slab/Wall Seal	*	Promat /3M
95	Multi-Function Meter(MFM) with RS 485 port	*	Secure / Schneider/Elmeasure/L&T
96	PVC Tape	*	Steelgrip
97	PVC rigid Conduit	*	Precision/AKG/Polycab/Kinjal
98	MS /GI Conduit	*	Precision/Econ/BEC/AKG
99.A	Cable Tray	*	Econ/AMCO Electricals
99.B	Cable Tray with Mesh	*	Legrand / OBO
100.A	Floor Race Ways	*	
	i) PVC	*	Legrand /MK
	ii) MS/GI/AL	*	Reputed Make to be approved by EIC
101	Switch, Socket, Plug (all modular)	*	Legrand /Siemens/ABB/Schneider
102	UPS	*	Emerson/Numeric/APC/ABB/Eaton
103	Inverter	*	DEECEE/MICROWARE/APLAB/MICROTECH/ LUMINOUS

104	ESE – Lighting Protection System	*	Conventional system only ABB
105	GI Pipe	*	Tata / Jindal
106	Light Pole	*	Calcutta Pole/Jindal/K-Lite/ Utkarsh
107	MS Steel	*	Tata /Sail /Jindal
108	Communication Cable /Patch Cord	*	Molex /Polycab/Lucent
109	RJ45/11 Terminal Connector	*	Legrand /Molex/ABB/Avaya
110	Telephone MDF BOX	*	Any Good JB with Krone Terminal
111	OUTDOOR JB	*	HENSEL/SINTEX

H. FIRE FIGHTING-FDA SYSTEM

Sl. No	Material/Product	Brief description/ Compliances	Make /Manufacturer/Origin
112	FIRE ALARM PANEL	UL / FM	HONEYWELL (NOTIFIRE) / SIEMENS / UTC / SIMPLEX/ Cerberuspro/Johnson Control/Edward/Secutron/Apollo/Morley/ Eaton/GST/Ravel
113	MULTI CRITERIA DETECTOR	UL / FM	HONEYWELL (NOTIFIRE) / SIEMENS / UTC / SIMPLEX /Cerberuspro/Johnson Control/Edward/Secutron/Apollo/Morley/ Eaton/GST/Ravel
114	HEAT DETECTOR	UL / FM	HONEYWELL (NOTIFIRE) / SIEMENS / UTC / SIMPLEX/ Cerberuspro/Johnson Control/Edward/Secutron/Apollo/Morley/ Eaton/GST/Ravel
115	DUCT DETECTOR	UL / FM	HONEYWELL (NOTIFIRE) / SIEMENS / UTC / SIMPLEX
116	MANUAL CALL POINT	UL / FM	HONEYWELL (NOTIFIRE) / SIEMENS / UTC / SIMPLEX/ Cerberuspro/Johnson Control/Edward/Secutron/Apollo/Morley/ Eaton/GST/Ravel
117	RESPONSE INDICATOR	UL / FM	HONEYWELL (NOTIFIRE) / SIEMENS / UTC / SIMPLEX/ Cerberuspro/Johnson Control/Edward/Secutron/Apollo/Morley/ Eaton/GST/Ravel
118	HORN CUM STROBE	UL / FM	HONEYWELL (NOTIFIRE) / SIEMENS / UTC / SIMPLEX
119	MONITOR MODULE	UL / FM	HONEYWELL (NOTIFIRE) / SIEMENS / UTC / SIMPLEX /Cerberuspro/Johnson Control/Edward/Secutron/Apollo/Morley/ Eaton/GST/Ravel
120	CONTROL MODULE	UL / FM	HONEYWELL (NOTIFIRE) / SIEMENS / UTC / SIMPLEX/ Cerberuspro/Johnson Control/Edward/Secutron/Apollo/Morley/ Eaton/GST/Ravel

121	CONTROL RELAY MODULE	UL / FM	HONEYWELL (NOTIFIRE) / SIEMENS / UTC / SIMPLEX
122	FAULT ISOLATOR MODULE	UL / FM	HONEYWELL (NOTIFIRE) / SIEMENS / UTC / SIMPLEX
123	PAVA	UL / FM	HONEYWELL (NOTIFIRE) / SIEMENS / UTC / SIMPLEX
124	SPEAKER	UL / FM	HONEYWELL (NOTIFIRE) / SIEMENS / UTC / SIMPLEX
125	POWER CABLE	ISI	POLYCAB / LAPP / RR / KEI / GLOSTER
126	CONTROL CABLE	ISI	POLYCAB / LAPP / RR / KEI / GLOSTER
127	METAL CONDUIT	ISI	ISI APPROVED MANUFACTURER
128	JUNCTION BOX	UL / FM	MANUFACTURER'S STANDARD
129	MASTER HAND SET	UL / FM	HONEYWELL (NOTIFIRE) / SIEMENS / UTC / SIMPLEX
130	FIELD HAND SET	UL / FM	HONEYWELL (NOTIFIRE) / SIEMENS / UTC / SIMPLEX
131	COMPUTER	Latest configuration	IBM/COMPAQ/LENOVO/HCL/HP/DELL
132	PRINTER	Latest configuration	HP/TVSE/SAMSUNG/XEROX/CANON

I. FIRE FIGHTING-FPS SYSTEM

Sl. No	Material/Product	Make /Manufacturer/Origin
133	PIPES	TATA / JINDAL
134	FITTINGS, SUCTION & STRAINER (M.S.)	M.S.FITTINGS / SRIKRISHNA / S. NOMI & COMPANY / NOMAAN BROTHERS / MANNA & HAITH /DECON STEEL.
135	FITTINGS (G.I.) & FORGED	M.S.FITTINGS / SRIKRISHNA / S. NOMI & COMPANY / NOMAAN BROTHERS / MANNA & HAITH /DECON STEEL.
136	FLANGES	M.S.FITTINGS / SRIKRISHNA / S. NOMI & COMPANY / NOMAAN BROTHERS / MANNA & HAITH /DECON STEEL.
137	FIRE PUMP	KIRLOSKAR / MATHER & PLATT / KSB.
138	JOCKEY PUMP	KEC / ABB / SIEMENS / CROMPTON GREAVES / KBL
139	MOTOR	KIRLOSKAR / CUMMINS / GREAVES
140	GATE VALVE	BDK / KBL / KSB / LEADER / AUDCO / KITZ / L & T. / PERFECT VALVES PVT. LTD. (5 Years Warrantee)./ KARTAR (5 Years Warrantee)
141	NON-RETURN VALVE	
142	BUTTERFLY VALVE	
143	GLOBE VALVE	
144	BALL VALVE	
145	STRAINER	
146	HYDRANT VALVE	NEWAGE / ASCO / SEAL FIRE APLNC. P. L.
147	HOSES WITH COUPLING	

148	BRANCH PIPE WITH NOZZLE	
149	Hose Reel IS : 884	
150	HOSE REEL (Thermoplastic) IS 12585, Type- 2 ISI Marked (High Pressure)	
151	HOSE BOX	
152	F.B. INLET CONNECTOR	
153	PRESSURE SWITCH	DANFOSS / (RT- 116 / RT- 5) As per Pressure rating required
154	AIR RELEASE VALVE	MARSHALL / L & T / HAWA / NEWAGE. / I TAP / LEHRY VALVES
155	Glycerine filled PRESSURE GAUGE (S.S. Construction)	H. GURU / OASIS / A. N. INST / MANOMETER / GENERAL INSTRUMENT / WIKA.
156	ANTI CORROSIVE TREATMENT (IS:15337 /IS:10221)	FINLAY INSULATION / CORPO TAPE / IWL / LLOYDS PAPER
157	CABLE (POWER & CONTROL)	UNIVERSAL / FINOLEX / LAPP. / POLYCAB / RR
158	INSTALLATION CONTROL VALVE WITH ALL ACCESSORIES	HD FIRE / VIKING. (UL LISTED).
159	SPRINKLER HEAD	HD / VIKING / TYCO.(UL / FM APPROVED).
160	FLOW SWITCH	POTTER / SYSTEM SENSOR (UL / FM APPROVED)
161	EXTINGUISHER	FIRESHEILD / DEFLAME / GUNNEBO / SAFEX
162	FIRE STOP FOR HORIZONTAL / VERTICAL SHAFT	HILTI / 3M / FISCHER
163	EXIT SIGNAGE	AUTOGLO / GLO LITE / PROLITE

PAYMENT SCHEDULE

PAYMENT SCHEDULE

Milestones	Stages	Description of works	Amount in Cr ESTIMATED COST	Amount in Cr (Estimated)	Total (A to F)	Block 1 (Residential)	Cumulative (A)	Block 2 (Residential)	Cumulative(B)	Block 3 (Residential)	Cumulative (C)	Block 4 (Residential)	Cumulative (D)	Block 5 (Residential)	Cumulative (E)	Block 6 (Residential - Commercial)	Cumulative (F)
M1		Substructure															
	M1.1	10% on Completion of excavation	-	-	0.7800%	0.1300%	-	0.1300%	-	0.1000%	-	0.1300%	-	0.1300%	-	0.1600%	-
	M1.2	40% on Completion of Pile	-	-	3.1800%	0.5300%	-	0.5300%	-	0.4100%	-	0.5300%	-	0.5300%	-	0.6500%	-
	M1.3	50% Completion of foundations including Anciliary buildings	-	-	3.9700%	0.6600%	-	0.6600%	-	0.5100%	-	0.6600%	-	0.6600%	-	0.8200%	-
		To Pay on completion of M1	-	8%			1.32%		1.32%		1.02%		1.32%		1.32%		1.63%
M2		Ground floor					0.30%		0.30%		0.23%		0.30%		0.30%		0.37%
	M2.1	Completion of Floor Slab cast	-	-	0.5300%	0.1000%	-	0.1000%	-	0.0500%	-	0.1000%	-	0.1000%	-	0.0800%	-
	M2.2	Completion of Block work	-	-	0.2000%	0.0300%	-	0.0300%	-	0.0300%	-	0.0300%	-	0.0300%	-	0.0500%	-
	M2.3	Completion of internal Plaster & Putty/Paint	-	-	0.3400%	0.0600%	-	0.0600%	-	0.0400%	-	0.0600%	-	0.0600%	-	0.0600%	-
		50% on completion of internal plaster															
	M2.4	Completion of Floor & wall tile finishes	-	-	0.3300%	0.0500%	-	0.0500%	-	0.0500%	-	0.0500%	-	0.0500%	-	0.0800%	-
	M2.4.1	Installation of Sanitaryware & accessories	-	-	0.0700%	0.0100%	-	0.0100%	-	0.0100%	-	0.0100%	-	0.0100%	-	0.0200%	-
	M2.4.2	Installation of Doors & Windows	-	-	0.3300%	0.0500%	-	0.0500%	-	0.0500%	-	0.0500%	-	0.0500%	-	0.0800%	-
		Floor-1					0.61%		0.61%		0.33%		0.61%		0.61%		0.52%
	M2.5	Completion of 1st Floor Slab cast	-	-	0.7400%	0.1400%	-	0.1400%	-	0.0700%	-	0.1400%	-	0.1400%	-	0.1100%	-
	M2.6	Completion of Block work	-	-	0.3800%	0.0700%	-	0.0700%	-	0.0400%	-	0.0700%	-	0.0700%	-	0.0600%	-
	M2.7	Completion of Internal Plaster & Putty/Paint	-	-	0.4900%	0.0900%	-	0.0900%	-	0.0500%	-	0.0900%	-	0.0900%	-	0.0800%	-
		50% on completion of internal plaster															
	M2.8	Completion of Floor & wall tile finishes	-	-	0.6600%	0.1200%	-	0.1200%	-	0.0700%	-	0.1200%	-	0.1200%	-	0.1100%	-
	M2.9	Installation of Sanitaryware & accessories	-	-	0.3600%	0.0700%	-	0.0700%	-	0.0300%	-	0.0700%	-	0.0700%	-	0.0500%	-
	M2.10	Installation of Doors & Windows	-	-	0.6600%	0.1200%	-	0.1200%	-	0.0700%	-	0.1200%	-	0.1200%	-	0.1100%	-
M3		To Pay on completion of M2	-	5.09%			0.91%		0.91%		0.56%		0.91%		0.91%		0.89%
		Floor-2					0.62%		0.62%		0.35%		0.62%		0.62%		0.54%
	M3.1	Completion of 2nd Floor Slab cast	-	-	0.9200%	0.1800%	-	0.1800%	-	0.0800%	-	0.1800%	-	0.1800%	-	0.1200%	-
	M3.2	Completion of Block work	-	-	0.3800%	0.0700%	-	0.0700%	-	0.0400%	-	0.0700%	-	0.0700%	-	0.0600%	-
	M3.3	Completion of internal Plaster & Putty/Paint	-	-	0.4500%	0.0800%	-	0.0800%	-	0.0500%	-	0.0800%	-	0.0800%	-	0.0800%	-
		50% on completion of internal plaster															
	M3.4	Completion of Floor & wall tile finishes	-	-	0.6600%	0.1200%	-	0.1200%	-	0.0700%	-	0.1200%	-	0.1200%	-	0.1100%	-
	M3.5	Installation of Sanitaryware & accessories	-	-	0.3400%	0.0600%	-	0.0600%	-	0.0400%	-	0.0600%	-	0.0600%	-	0.0600%	-
	M3.6	Installation of Doors & Windows	-	-	0.6200%	0.1100%	-	0.1100%	-	0.0700%	-	0.1100%	-	0.1100%	-	0.1100%	-
		Floor-3					0.63%		0.63%		0.36%		0.63%		0.63%		0.55%
	M3.7	Completion of 3rd Floor Slab cast	-	-	0.9500%	0.1800%	-	0.1800%	-	0.0900%	-	0.1800%	-	0.1800%	-	0.1400%	-
	M3.8	Completion of Block work	-	-	0.4200%	0.0800%	-	0.0800%	-	0.0400%	-	0.0800%	-	0.0800%	-	0.0600%	-
	M3.9	Completion of Internal Plaster & Putty/Paint	-	-	0.4500%	0.0800%	-	0.0800%	-	0.0500%	-	0.0800%	-	0.0800%	-	0.0800%	-
		50% on completion of internal plaster															
	M3.10	Completion of Floor & wall tile finishes	-	-	0.6600%	0.1200%	-	0.1200%	-	0.0700%	-	0.1200%	-	0.1200%	-	0.1100%	-
	M3.11	Installation of Sanitaryware & accessories	-	-	0.3300%	0.0600%	-	0.0600%	-	0.0400%	-	0.0600%	-	0.0600%	-	0.0500%	-

PAYMENT SCHEDULE

	M3.12	Installation of Doors & Windows	-	0.6200%	0.1100%	-	0.1100%	-	0.0700%	-	0.1100%	-	0.1100%	-	0.1100%	-
		To Pay on completion of M3	-	6.80%		1.25%		1.25%		0.71%		1.25%		1.25%		1.09%
M4		Floor-4				0.70%		0.70%		0.40%		0.70%		0.70%		0.40%
	M4.1	Completion of 4th Floor Slab cast	-	1.0000%	0.2000%	-	0.2000%	-	0.1000%	-	0.2000%	-	0.2000%	-	0.1000%	-
	M4.2	Completion of Block work	-	0.4000%	0.0800%	-	0.0800%	-	0.0400%	-	0.0800%	-	0.0800%	-	0.0400%	-
	M4.3	Completion of internal Plaster & Putty/Paint	-	0.4800%	0.0900%	-	0.0900%	-	0.0600%	-	0.0900%	-	0.0900%	-	0.0600%	-
		50% on completion of internal plaster														
	M4.4	Completion of Floor & wall tile finishes	-	0.7200%	0.1400%	-	0.1400%	-	0.0800%	-	0.1400%	-	0.1400%	-	0.0800%	-
	M4.5	Installation of Sanitaryware & accessories	-	0.3600%	0.0700%	-	0.0700%	-	0.0400%	-	0.0700%	-	0.0700%	-	0.0400%	-
	M4.6	Installation of Doors & Windows	-	0.6400%	0.1200%	-	0.1200%	-	0.0800%	-	0.1200%	-	0.1200%	-	0.0800%	-
		Floor-5	-			0.72%		0.72%		0.41%		0.72%		0.72%		0.41%
	M4.7	Completion of 5th Floor Slab cast	-	1.0400%	0.2100%	-	0.2100%	-	0.1000%	-	0.2100%	-	0.2100%	-	0.1000%	-
	M4.8	Completion of Block work	-	0.4400%	0.0900%	-	0.0900%	-	0.0400%	-	0.0900%	-	0.0900%	-	0.0400%	-
	M4.9	Completion of internal Plaster & Putty/Paint	-	0.4800%	0.0900%	-	0.0900%	-	0.0600%	-	0.0900%	-	0.0900%	-	0.0600%	-
		50% on completion of internal plaster														
	M4.10	Completion of Floor & wall tile finishes	-	0.7200%	0.1400%	-	0.1400%	-	0.0800%	-	0.1400%	-	0.1400%	-	0.0800%	-
	M4.11	Installation of Sanitaryware & accessories	-	0.3600%	0.0700%	-	0.0700%	-	0.0400%	-	0.0700%	-	0.0700%	-	0.0400%	-
	M4.12	Installation of Doors & Windows	-	0.6600%	0.1200%	-	0.1200%	-	0.0900%	-	0.1200%	-	0.1200%	-	0.0900%	-
		To Pay on completion of M4	-	7.30%		1.42%		1.42%		0.81%		1.42%		1.42%		0.81%
M5		Floor-6				0.88%		0.88%		0.50%		0.88%		0.88%		0.50%
	M5.1	Completion of 6th Floor Slab cast	-	1.0800%	0.2200%	-	0.2200%	-	0.1000%	-	0.2200%	-	0.2200%	-	0.1000%	-
	M5.2	Completion of Block work	-	0.5200%	0.1000%	-	0.1000%	-	0.0600%	-	0.1000%	-	0.1000%	-	0.0600%	-
	M5.3	Completion of internal Plaster & Putty/Paint	-	0.6400%	0.1200%	-	0.1200%	-	0.0800%	-	0.1200%	-	0.1200%	-	0.0800%	-
		50% on completion of internal plaster														
	M5.4	Completion of Floor & wall tile finishes	-	0.9600%	0.1900%	-	0.1900%	-	0.1000%	-	0.1900%	-	0.1900%	-	0.1000%	-
	M5.5	Installation of Sanitaryware & accessories	-	0.4600%	0.0900%	-	0.0900%	-	0.0500%	-	0.0900%	-	0.0900%	-	0.0500%	-
	M5.6	Installation of Doors & Windows	-	0.8600%	0.1600%	-	0.1600%	-	0.1100%	-	0.1600%	-	0.1600%	-	0.1100%	-
		Floor-7				0.88%		0.88%		0.53%		0.88%		0.88%		0.54%
	M5.7	Completion of 7th Floor Slab cast	-	1.2400%	0.2400%	-	0.2400%	-	0.1400%	-	0.2400%	-	0.2400%	-	0.1400%	-
	M5.8	Completion of Block work	-	0.5600%	0.1100%	-	0.1100%	-	0.0600%	-	0.1100%	-	0.1100%	-	0.0600%	-
	M5.9	Completion of internal Plaster & Putty/Paint	-	0.6000%	0.1100%	-	0.1100%	-	0.0800%	-	0.1100%	-	0.1100%	-	0.0800%	-
		50% on completion of internal plaster														
	M5.10	Completion of Floor & wall tile finishes	-	0.8800%	0.1700%	-	0.1700%	-	0.1000%	-	0.1700%	-	0.1700%	-	0.1000%	-
	M5.11	Installation of Sanitaryware & accessories	-	0.4600%	0.0900%	-	0.0900%	-	0.0500%	-	0.0900%	-	0.0900%	-	0.0500%	-
	M5.12	Installation of Doors & Windows	-	0.8500%	0.1600%	-	0.1600%	-	0.1000%	-	0.1600%	-	0.1600%	-	0.1100%	-
		To Pay on completion of M5	-	9.11%		1.76%		1.76%		1.03%		1.76%		1.76%		1.04%
M6		Floor-8				1.04%		1.04%		0.62%		1.04%		1.04%		0.62%
	M6.1	Completion of 8th Floor Slab cast	-	1.2600%	0.2500%	-	0.2500%	-	0.1300%	-	0.2500%	-	0.2500%	-	0.1300%	-
	M6.2	Completion of Block work	-	0.6600%	0.1300%	-	0.1300%	-	0.0700%	-	0.1300%	-	0.1300%	-	0.0700%	-
	M6.3	Completion of internal Plaster & Putty/Paint	-	0.7600%	0.1400%	-	0.1400%	-	0.1000%	-	0.1400%	-	0.1400%	-	0.1000%	-
		50% on completion of internal plaster														
	M6.4	Completion of Floor & wall tile finishes	-	1.1200%	0.2200%	-	0.2200%	-	0.1200%	-	0.2200%	-	0.2200%	-	0.1200%	-
	M6.5	Installation of Sanitaryware & accessories	-	0.5600%	0.1100%	-	0.1100%	-	0.0600%	-	0.1100%	-	0.1100%	-	0.0600%	-
	M6.6	Installation of Doors & Windows	-	1.0400%	0.1900%	-	0.1900%	-	0.1400%	-	0.1900%	-	0.1900%	-	0.1400%	-
		Floor-9				1.05%		1.05%		0.64%		1.05%		1.05%		0.64%

PAYMENT SCHEDULE

	M6.7	Completion of 9th Floor Slab cast	-	1.3000%	0.2500%	-	0.2500%	-	0.1500%	-	0.2500%	-	0.2500%	-	0.1500%	-
	M6.8	Completion of Block work	-	0.6600%	0.1300%	-	0.1300%	-	0.0700%	-	0.1300%	-	0.1300%	-	0.0700%	-
	M6.9	Completion of internal Plaster & Putty/Paint	-	0.8000%	0.1500%	-	0.1500%	-	0.1000%	-	0.1500%	-	0.1500%	-	0.1000%	-
		50% on completion of internal plaster														
	M6.10	Completion of Floor & wall tile finishes	-	1.1200%	0.2200%	-	0.2200%	-	0.1200%	-	0.2200%	-	0.2200%	-	0.1200%	-
	M6.11	Installation of Sanitaryware & accessories	-	0.5600%	0.1100%	-	0.1100%	-	0.0600%	-	0.1100%	-	0.1100%	-	0.0600%	-
	M6.12	Installation of Doors & Windows	-	1.0400%	0.1900%	-	0.1900%	-	0.1400%	-	0.1900%	-	0.1900%	-	0.1400%	-
		To Pay on completion of M6	-	10.88%			2.09%		2.09%		1.26%		2.09%		2.09%	1.26%
M7		Floor-10					1.09%		1.09%		0.68%		1.09%		1.09%	0.68%
	M7.1	Completion of 10th Floor Slab cast	-	1.3600%	0.2600%	-	0.2600%	-	0.1600%	-	0.2600%	-	0.2600%	-	0.1600%	-
	M7.2	Completion of Block work	-	0.7425%	0.1400%	-	0.1400%	-	0.0925%	-	0.1400%	-	0.1400%	-	0.0900%	-
	M7.3	Completion of internal Plaster & Putty/Paint	-	0.8800%	0.1600%	-	0.1600%	-	0.1200%	-	0.1600%	-	0.1600%	-	0.1200%	-
		50% on completion of internal plaster														
	M7.4	Completion of Floor & wall tile finishes	-	1.1200%	0.2200%	-	0.2200%	-	0.1200%	-	0.2200%	-	0.2200%	-	0.1200%	-
	M7.5	Installation of Sanitaryware & accessories	-	0.5600%	0.1100%	-	0.1100%	-	0.0600%	-	0.1100%	-	0.1100%	-	0.0600%	-
	M7.6	Installation of Doors & Windows	-	1.0600%	0.2000%	-	0.2000%	-	0.1300%	-	0.2000%	-	0.2000%	-	0.1300%	-
		Floor-11					1.33%		1.33%		0.73%		1.33%		1.33%	0.73%
	M7.7	Completion of 11th Floor Slab cast	-	1.4400%	0.2800%	-	0.2800%	-	0.1600%	-	0.2800%	-	0.2800%	-	0.1600%	-
	M7.8	Completion of Block work	-	0.7000%	0.1400%	-	0.1400%	-	0.0700%	-	0.1400%	-	0.1400%	-	0.0700%	-
	M7.9	Completion of internal Plaster & Putty/Paint	-	0.9800%	0.2000%	-	0.2000%	-	0.0900%	-	0.2000%	-	0.2000%	-	0.0900%	-
		50% on completion of internal plaster														
	M7.10	Completion of Floor & wall tile finishes	-	1.5200%	0.3000%	-	0.3000%	-	0.1600%	-	0.3000%	-	0.3000%	-	0.1600%	-
	M7.11	Installation of Sanitaryware & accessories	-	0.7600%	0.1500%	-	0.1500%	-	0.0800%	-	0.1500%	-	0.1500%	-	0.0800%	-
	M7.12	Installation of Doors & Windows	-	1.3800%	0.2600%	-	0.2600%	-	0.1700%	-	0.2600%	-	0.2600%	-	0.1700%	-
		To Pay on completion of M7	-	12.50%			2.42%		2.42%		1.41%		2.42%		2.42%	1.41%
M8		Floor-12 & Above					2.35%		2.35%		1.42%		2.35%		2.35%	1.42%
	M8.1	Completion of 12th Floor Slab cast	-	1.7600%	0.3500%	-	0.3500%	-	0.1800%	-	0.3500%	-	0.3500%	-	0.1800%	-
	M8.2	Completion of Block work	-	1.0000%	0.2000%	-	0.2000%	-	0.1000%	-	0.2000%	-	0.2000%	-	0.1000%	-
	M8.3	Completion of internal Plaster & Putty/Paint	-	1.2000%	0.2300%	-	0.2300%	-	0.1400%	-	0.2300%	-	0.2300%	-	0.1400%	-
		50% on completion of internal plaster														
	M8.4	Completion of Floor & wall tile finishes	-	1.7600%	0.3500%	-	0.3500%	-	0.1800%	-	0.3500%	-	0.3500%	-	0.1800%	-
	M8.5	Installation of Sanitaryware & accessories	-	0.8600%	0.1700%	-	0.1700%	-	0.0900%	-	0.1700%	-	0.1700%	-	0.0900%	-
	M8.6	Installation of Doors & Windows	-	1.5000%	0.2500%	-	0.2500%	-	0.2500%	-	0.2500%	-	0.2500%	-	0.2500%	-
	M8.7	Completion of Roof Slab cast	-	2.3000%	0.4500%	-	0.4500%	-	0.2500%	-	0.4500%	-	0.4500%	-	0.2500%	-
	M8.8	Completion of Block work- including parapet wall	-	0.5600%	0.1000%	-	0.1000%	-	0.0800%	-	0.1000%	-	0.1000%	-	0.0800%	-
	M8.9	Completion of Roof Water Proofing Systems	-	1.3000%	0.2500%	-	0.2500%	-	0.1500%	-	0.2500%	-	0.2500%	-	0.1500%	-
		To Pay on completion of M8	-	12.24%			2.35%		2.35%		1.42%		2.35%		2.35%	1.42%
M9		Commissioning of Building Services - Internal & external					0.39%		0.39%		0.39%		0.39%		0.39%	0.67%
	M9.1	On supply of Lifts	-	2.2100%	0.3300%	-	0.3300%	-	0.3300%	-	0.3300%	-	0.3300%	-	0.5600%	-
	M9.2	On installation of Lifts	-	0.4100%	0.0600%	-	0.0600%	-	0.0600%	-	0.0600%	-	0.0600%	-	0.1100%	-
	M9.3	On commissioning of all building & external services	-	4.8625%												
		To Pay on completion of M9	-	7.50%												
M10	M10.1	On completion of Swimming pool	-	0.9400%												
	M10.2	On completion of Changing rooms for Swimming pool	-	0.3100%												

PAYMENT SCHEDULE

[illegible]

All measurement shall be checked and verified by the concerned Executive Engineer (Engineer – In – Charge) and necessary certificates in this respect shall be issued as per PWD Code, before payment.



GOVERNMENT OF WEST BENGAL
OFFICE OF THE SUPERINTENDING ENGINEER, SOUTH CIRCLE,
HOUSING DIRECTORATE, P- 7 & 8, C.I.T. ROAD, 1ST FLOOR,
KOLKATA-700014

BID DOCUMENTS FOR
CONSTRUCTION OF OITIKA-OWNERSHIP HOUSING
FOR WBCS(EXE) OFFICERS
AT PRE. NO.-44-0676, PLOT NO.-II-D/37 IN AA-IID,
ACTION AREA -IID, NEW TOWN, KOLKATA.
ON TURNKEY BASIS

SECTION 6
GENERAL CONDITIONS OF CONTRACT (GCC)

General Conditions

1. General Provisions

1.1. Definitions

In the Conditions of Contract (“these Conditions”), which include Particular Conditions and these General Conditions, the following words and expressions shall have the meanings stated. Words indicating persons or Parties include corporations and other legal entities, except where the context requires otherwise.

1.1.1.

The Contract

1.1.1.1 **“Contract”** means the Agreement, the Particular Conditions, these Conditions, the Employer’s Requirements, the Tender and the further documents (if any) which are listed in the Agreement.

1.1.1.2 **“Agreement”** means the agreement referred to in Sub-Clause 1.6 [Agreement], including any annexed memoranda/documents.

1.1.1.3 **“Employer’s Requirements”** means the document in Section –5 of the Bidding Documents intituled Employer’s Requirements, as included in the Contract, and any additions and modifications to such document in accordance with the Contract. Such document specifies the purpose, scope, and/or other technical criteria, for the Works.

1.1.1.4. **“Tender/Quotation”** means the Contractor’s signed offer for the Works and all other documents which the Contractor submitted therewith (other than these Conditions and the Employer’s Requirements, if so submitted), as included in the Contract.

1.1.1.5. **“Schedule of Payments”** mean the documents so named (if any), as included in the Contract.

1.1.2.

Parties and Persons

1.1.2.1. **“Party”** means the Employer or the Contractor, as the context requires.

1.1.2.2. **“Employer”** means the Superintending Engineer, South Circle, Housing Dte, Office of the Superintending Engineer, South Circle, Housing Directorate, P- 7 & 8, C.I.T. Road, 1st Floor, Kolkata – 700014 and includes its successors-in-interest and/ or assigns.

1.1.2.3. **“Contractor”** means the person(s) named as contractor in the Agreement and the legal successors in title to this person(s).

1.1.2.4. **“Employer’s Representative”** means the organization named by the Employer as “Design & PMC Consultant” in the Contract or appointed from time to time by the Employer under Sub- Clause 3.1 [The Employer’s Representative], who has the authority to act on behalf of the Employer, including Departmental representatives who acts on behalf of the Department and the Project Implementation Committee (PIC) constituted for overall monitoring of the Project.

1.1.2.5. **“Contractor’s Representative”** means the person named by the Contractor in the Contract or appointed from time to time by the Contractor under Sub- Clause 4.3 [Contractor’s Representative], who acts on behalf of the Contractor.

1.1.2.6. **“Employer’s Personnel”** means the Engineer-in-Charge/Employer’s Representative, the assistants referred to in Sub-Clause 3.2 [Other Employer’s Personnel] and all other staff, labour and other employees of the Employer’s Representative, and any other personnel notified to the Contractor, by the Employer or the Employer’s Representative, as Employer’s Personnel.

1.1.2.7. **“Contractor’s Personnel”** means the Contractor’s Representative and all personnel whom the Contractor utilises on Site, who may include the staff, labour and other employees of the Contractor and any other personnel assisting the Contractor in the execution of the Works.

1.1.3.

Dates, Tests,
Periods and
Completion

1.1.3.1. **“Commencement Date”** means the date notified under Sub-Clause 8.1 [Commencement of Works], unless otherwise defined in the Particular Conditions.

1.1.3.2. **“Time for Completion”** means the time for completing the Works or a Section (as the case may be) under Sub-Clause 8.2 [Time for Completion], as stated in the Particular Conditions (with any extension under Sub-Clause 8.5 [Extension of Time for Completion]), calculated from the Commencement Date.

1.1.3.3. **“Tests on Completion”** means the tests which are specified in the Contract or agreed by both Parties or instructed as a Variation, and which are carried out under Clause 9 [Tests on Completion] before the Works or a Section (as the case may be) are taken over by the Employer.

1.1.3.4. **“Taking-Over Certificate”** means a certificate issued under Clause 10 [Employer’s Taking Over].

1.1.3.5. **“Tests after Completion”** means the tests (if any) which are specified in the Contract and which are carried out under Clause 12 [Tests after Completion] after the Works or a Section (as the case may be) are taken over by the Employer.

1.1.3.6. **“Defects Notification Period”** means the period for notifying defects in the Works or a Section (as the case may be) under Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects], as stated in the Particular Conditions (with any extension under Sub-Clause 11.3 [Extension of Defects Notification Period]), calculated from the date on which the Works or Section is completed as certified under Sub-Clause 10.1 [Taking Over of the Works and Sections]. If no such period is stated in the Particular Conditions, the period shall be 57 months from the date on which the Works or Section is completed as certified under Sub-clause 10.1 [Taking Over of the Works and Sections].

1.1.3.7 **“Performance Certificate”** means the certificate issued under Sub-Clause 11.9 [Performance Certificate].

1.1.3.8 **“Day”** means a calendar day and **“year”** means 365 days.

1.1.3.9 **“Base Date”** shall mean and refer to the date of issue of the Tender/ Bid Documents by the Employer.

1.1.4

Money and Payments

1.1.4.1 **“Contract Price”** means the agreed amount stated in the Agreement for the execution and completion of the Works and the remedying of any defects and includes adjustments (if any) in accordance with the Contract.

1.1.4.2 **“Cost”** means all expenditure reasonably incurred (or to be incurred) by the Contractor, whether on or off the Site, including overhead and similar charges, but does not include profit.

Money and Payments	1.1.4.3 “Final Statement” means the statement defined in Sub-Clause 14.10 [Statement at Completion]./ Sub-Clause 14.11 [Application for Final Payment].
	1.1.4.4. “Currency” means Indian National Rupees (INR).
	1.1.4.5 “Defects Liability Period” means 5 (five) years from the date of Taking Over Certificate.
	1.1.4.6 “Statement” means a statement submitted by the Contractor as part of an application for payment under Clause 14 [Contract Price and Payment].
	1.1.4.7 “EMD/Earnest Money Deposit” shall mean and refer to an amount equivalent to 2% of the Contract Price, submitted by the Contractor, upon being selected as the Selected Bidder, in the manner prescribed under these Conditions.
1.1.5 Works and Goods	1.1.5.1 “Contractor’s Equipment” means all apparatus, machinery, vehicles and other things required for the execution and completion of the Works and the remedying of any defects. However, Contractor’s Equipment excludes Temporary Works, Employer’s Equipment (if any), Plant, Materials and any other things intended to form or forming part of the Permanent Works.
	1.1.5.2 “Goods” means Contractor’s Equipment, Materials, Plant and Temporary Works, or any of them as appropriate.
	1.1.5.3 “Materials” means things of all kinds (other than Plant) intended to form or forming part of the Permanent Works, including the supply-only materials (if any) to be supplied by the Contractor under the Contract.
	1.1.5.4 “Permanent Works” means the permanent works to be executed by the Contractor under the Contract.
	1.1.5.5 “Plant” means the apparatus, machinery and vehicles intended to form or forming part of the Permanent Works.
	1.1.5.6 “Section” means a part of the Works specified in the Particular Conditions as a Section (if any).

mean the Permanent Works and the Temporary Works, or either of them as appropriate.

1.1.5.9 **“Services”** means and include services ancillary to the performance of Works including without limiting to transportation and supply at the point of consignee and such other obligations as required under this Contract.

1.1.5.10 **“Project”** means planning and construction of OITIKA –ownership housing for WBCS(Exe) officers at Premises No.-44-0676, Plot No.-II-D/37 in Action Area -IID, New Town, Kolkata, on Turnkey Basis.

1.1.6.1 **“Contractor’s Documents”** means the calculations, computer programs and other software, shop-drawings, manuals, models and other documents of a technical nature supplied by the Contractor under the Contract; as described in Sub-Clause 5.2 [Contractor’s Documents].

1.1.6.2 **“Country”** means India.

1.1.6.3 **“Force Majeure”** is defined in Clause 19 [Force Majeure].

1.1.6.4 **“Laws”** means all national (or state) legislation, statutes, ordinances and other laws, and regulations and by-laws of any legally constituted public authority.

1.1.6.5 **“Performance Guarantee/ Performance Security”** means the security (or securities, if any) under Sub-Clause 4.2 [Performance Security].

1.1.6.6 **“Site”** means the places where the Permanent Works are to be executed and to which Plant and Materials are to be delivered, and any other places as may be specified in the Contract as forming part of the Site.

1.1.6.7 **“Variation”** means any change to the Employer’s Requirements or the Works, which is instructed or approved as a variation under Clause 13 [Variations and Adjustments].

1.1.6

Other Definitions

1.1.5.7 **Temporary Works**

means all temporary works of every kind (other than Contractor’s Equipment) required on Site for the execution and completion of the Permanent Works and the remedying of any defects.

1.1.5.8 **“Works”**

SIGNATURE & ADDRESS OF
QUOTATIONER

SIGNATURE OF
TENDER ACCEPTING AUTHORITY

1.2

Interpretation

In the Contract, except where the context requires otherwise:

- (a) words indicating one gender include all genders;
- (b) words indicating the singular also include the plural and words indicating the plural also include the singular;
- (c) provisions including the word “agree”, “agreed” or “agreement” require the agreement to be recorded in writing, and
- (d) “Written” or “in writing” means hand-written, type-written, printed or electronically made, and resulting in a permanent record.

The marginal words and other headings shall not be taken into consideration in the interpretation of these Conditions.

1.3

Communications

Wherever these Conditions provide for the giving or issuing of approvals, certificates, consents, determinations, notices and requests, these communications shall be:

- (a) in writing and delivered by hand (against receipt), sent by mail or courier, or transmitted using any of the agreed systems of electronic transmission as stated in the Particular Conditions; and
- (b) Delivered, sent or transmitted to the address for the recipient’s communications as stated in the Contract. However:
 - i. if the recipient gives notice of another address, communications shall thereafter be delivered accordingly; and
 - ii. If the recipient has not stated otherwise when requesting an approval or consent, it may be sent to the address from which the request was issued.

Approvals, certificates, consents and determinations shall not be unreasonably withheld or delayed.

1.4

Law and Language

The Contract shall be governed by the law of India only.

The language in the contract shall be English only. The language for communication for the purpose of this Contract shall be English only.

In addition to this, any document, which is in any language other than English, shall be translated to English and certified.

If there are versions of any part of the Contract which are written in more than one language, the version which is in English shall prevail.

The Contractor shall familiarize himself with the local laws and administration of West Bengal and comply by them.

1.5

Priority of Documents

The documents forming the Contract are to be taken as mutually explanatory of one another. For the purposes of interpretation, the priority of the documents shall be in accordance with the following sequence:

- (a) The Agreement, [including the Financial Bid/ Bill of Quantities (BOQ)],
- (b) The Particular Conditions,
- (c) These General Conditions,
- (d) The Employer's Requirements,
- (e) The Tender and any other documents forming part of the Contract.

1.6

Agreement

The Contract shall come into full force and effect on the date stated in the Agreement.

The costs of stamp duties and similar charges (if any) imposed by law in connection with entry into the Agreement shall be borne by the Employer.

1.7 **Intentionally kept blank**

1.8

Care and Supply of Documents

Each of the Contractor's Documents shall be in the custody and care of the Contractor, unless and until taken over by the Employer. Unless otherwise stated in the Contract, the Contractor shall supply to the Employer six copies of each of the Contractor's Documents.

The Contractor shall keep, on the Site, a copy of the Contract, publications named in the Employer's Requirements, the Contractor's Documents, and Variations and other communications given under the Contract. The Employer's Personnel shall have the right of access to all these documents at all reasonable times.

If a Party becomes aware of an error or defect of a technical nature in a document which was prepared for use in executing the Works, the Party shall promptly give notice to the other Party of such error or defect.

1.9

Confidentiality

The Contractor shall not publish, permit to be published, or disclose any particulars of the Works in any trade or technical paper or elsewhere without the previous agreement of the Employer.

1.10

Employer's Use of Contractor's Documents

As between the Parties, the Contractor shall retain the copyright and other intellectual property rights in the Contractor's Documents made by (or on behalf of) the Contractor. The Contractor shall be deemed (by signing the Contract) to give to the Employer a non-terminable transferable non-exclusive royalty-free licence to copy, use and communicate the Contractor's Documents, including making and using modifications of them. This licence shall:

- (a) Apply throughout the actual or intended working life (whichever is longer) of the relevant parts of the Works,
- (b) Entitle any person in proper possession of the relevant part of the Works to copy, use and communicate the Contractor's Documents for the purposes of completing, operating, maintaining, altering, adjusting, repairing and demolishing the Works, and

- (c) In the case of Contractor's Documents which are in the form of computer programs and other software, permit their use on any computer on the Site and other places as envisaged by the Contract, including replacements of any computers supplied by the Contractor.

The Contractor's Documents made by (or on behalf of) the Contractor shall not, without the Contractor's consent, be used, copied or communicated to a third party by (or on behalf of) the Employer for purposes other than those permitted under this Sub-Clause.

1.11

Contractor's
use of
Employer's
Documents

As between the Parties, the Employer shall retain the copyright and other Employer's intellectual property rights in the Employer's Requirements and other documents made by (or on behalf of) the Employer. The Contractor may, at its cost, copy, use, and obtain communication of these documents for the purposes of the Contract. They shall not, without the Employer's consent, be copied, used or communicated to a third party by the Contractor, except as necessary for the purposes of the Contract.

1.12

Confidential
Details

The Contractor shall not be required to disclose, to the Employer, any information which the Contractor described in the Tender as being confidential. The Contractor shall disclose any other information which the Employer may reasonably require in order to verify the Contractor's compliance with the Contract.

1.13

Compliance
with Laws

The Contractor shall, in performing the Contract, comply with applicable Laws. Unless otherwise stated in the Particular Conditions:

(a) The Contractor shall have obtained (or shall obtain) the planning, zoning or similar permission for the Permanent Works, and any other permissions described in the Employer's Requirements as having been (or being) obtained by the Employer; and the Contractor shall indemnify and hold the Employer harmless against and from the consequences of any failure to do so; however, the Employer shall assist and/or facilitate (without any recourse or liability) obtaining of all permits, licences, approval, clearances, No Objection Certificates and the like, as required by

Compliance with Laws	<p>the Laws and shall sign such documents as may be required by statutory authority. The cost for obtaining the sanctions and/or permission in respect of such permit, licence, approval, No Objection Certificate, clearance and the like, shall be paid by the Contractor, which shall be reimbursed by the Employer within 60 days from the date of submission of necessary documents claiming reimbursement including supporting documents; and</p> <p>(b) The Contractor shall give all notices, pay all taxes, duties and fees, and obtain all permits, licences and approvals, as required by the Laws in relation to the planning, execution and completion of the Works and the remedying of any defects; and the Contractor shall indemnify and hold the Employer harmless against and from the consequences of any failure to do so. However, the Employer shall assist and/or facilitate (without any recourse or liability) obtaining of all permits, licences and approval, as required by the Laws and shall sign such documents as may be required by statutory authorities.</p>
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2 The Employer

2.1

Right of Access to the Site	<p>The Employer shall give the Contractor right of access to, and possession of, all parts of the Site within 7 working days of the issuance of Letter of Acceptance / Notification of Award. The right and possession may not be exclusive to the Contractor. If, under the Contract, the Employer is required to give (to the Contractor) possession of any foundation, structure or means of access, the Employer shall do so in the time and manner stated in the Employer's Requirements. However, the Employer may withhold any such right or possession until the Performance Security has been received.</p> <p>If the Contractor suffers delay and/or incurs Cost as a result of a failure by the Employer to give any such right or possession within such time, the Contractor shall give notice to the Employer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.5 [Extension of Time for Completion].</p> <p>After receiving this notice, the Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.</p>
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Right of Access to the Site	However, if and to the extent that the Employer's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time.
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2.2

Permits,
Licences or
Approvals

It will be the duty of the Contractor to apply for and obtain any permits, licences, approvals, clearances or No Objection Certificates required by the Laws of India including local laws, which the Contractor is required to obtain under Sub-Clause 1.13 [Compliance with Laws] for the delivery of Goods, including clearance through customs, and for the export of Contractor's Equipment when it is removed from the Site.

2.3

Employer's
Personnel

The Employer shall be responsible for ensuring that the Employer's Personnel and the Employer's other contractors on the Site, take actions similar to those which the Contractor is required to take under Sub-Clause 4.8 [Safety Procedures] and under Sub-Clause 4.24 [Protection of the Environment].

2.4 Intentionally kept blank

2.5

Employer's
Claims

If the Employer considers itself to be entitled to any payment under any Clause of these Conditions or otherwise in connection with the Contract, and/or to any extension of the Defects Notification Period, it shall give notice and particulars to the Contractor. However, notice is not required for payments due under Sub-Clause 4.25 [Electricity, Water and Gas] or for other services requested by the Contractor. The notice shall be given as soon as practicable after the Employer became aware of the event or circumstances giving rise to the claim. A notice relating to any extension of the Defects Notification Period shall be given before the expiry of such period. The particulars shall specify the Clause or other basis of the claim, and shall include substantiation of the amount and/or extension to which the Employer considers himself to be entitled in connection with the Contract. The Employer shall then proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i)

Employer's
Claims

the amount (if any) which the Employer is entitled to be paid by the Contractor, and/or (ii) the extension (if any) of the Defects Notification Period in accordance with Sub-Clause 11.3 [Extension of Defects Notification Period].

The Employer may deduct this amount from any moneys due, or to become due, to the Contractor. The Employer shall only be entitled to set off against or make any deduction from an amount due to the Contractor, or to otherwise claim against the Contractor, in accordance with this Sub-Clause or with sub-paragraph (a) and/or (b) of Sub-Clause 14.6 [Interim Payments].

Whenever any claim or claims for payment of a sum of money arises out of or under the Contract or against the Contractor, the Employer's Representative or the Employer shall be entitled to withhold and also have a lien to retain such sum or sums in whole or in part from the Earnest Money Deposit and Performance Guarantee, if any deposited by the Contractor, pending finalization or adjudication of any such claim. In the event of the Earnest Money Deposit and Performance Guarantee, being insufficient to cover the claimed amount or amounts or if no Earnest Money Deposit and Performance Guarantee has been taken from the Contractor, the Employer's Representative or the Employer shall be entitled to withhold and have a lien to retain to the extent of such claimed amount or amounts referred to above, from any sum or sums found payable or which may at any time thereafter become payable to the Contractor under the same Contract or any other contract with the Employer's Representative of the Employer or any contracting person through the Employer's Representative pending finalisation of/adjudication of any such claim.

It is an agreed term of the Contract that the sum of money or moneys so withheld or retained under the lien referred by the Employer's Representative or the Employer will be kept withheld or retained as such by the Employer's Representative or the Employer till the claim arising out of or under the Contract is determined by the competent court and that the Contractor will have no claim for interest or damages whatsoever on any account in respect of such withholding or retention under the lien referred to above and duly notified as such to the Contractor.

3 The Employer's Administration

3.1

The Employer's Representative

The Employer shall appoint an Employer's Representative to act on its behalf under the Contract. In this event, the Employer shall give notice to the Contractor of the name, address, duties and authority of the Employer's Representative.

The Employer's Representative shall carry out the duties assigned to him, and shall exercise the authority delegated to him, by the Employer. Unless and until the Employer notifies the Contractor otherwise, the Employer's Representative shall be deemed to have the full authority of the Employer under the Contract, except in respect of Clause 15 [Termination by Employer].

If the Employer wishes to replace any person appointed as Employer's Representative, the Employer shall give the Contractor not less than 14 days' notice of the replacement's name, address, duties and authority, and of the date of appointment.

3.2

Other Employer's Personnel

The Employer or the Employer's Representative may from time to time assign duties and delegate authority to assistants, and may also revoke such assignment or delegation. These assistants may include a resident engineer, and/or independent inspectors appointed to inspect and/or test items of Plant and/or Materials. The assignment, delegation or revocation shall not take effect until instructions to such effect has been received by the Contractor in writing, from the Employer or the Employer's Representative.

Assistants shall be suitably qualified persons, who are competent to carry out these duties and exercise this authority, and who are fluent in the language for communications defined in Sub-Clause 1.4 [Law and Language].

3.3

Delegated Persons

All these persons, including the Employer's Representative and assistants, to whom duties have been assigned or authority has been delegated, shall only be authorised to issue instructions to the Contractor to the extent defined by the delegation. Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by a delegated person, in accordance with the

delegation, shall have the same effect as though the act had been an act of the Employer. However:

- (a) Unless otherwise stated in the delegated person's communication relating to such act, it shall not relieve the Contractor from any responsibility it has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances;
- (b) Any failure to disapprove any work, Plant or Materials shall not constitute approval, and shall therefore not prejudice the right of the Employer to reject the work, Plant or Materials; and
- (c) If the Contractor questions any determination or instruction of a delegated person, the Contractor may refer the matter to the Employer, who shall promptly confirm, reverse or vary the determination or instruction.

3.4

Instructions

The Employer may issue to the Contractor instructions which may be necessary for the Contractor to perform its obligations under the Contract. Each instruction shall be given in writing and shall state the obligations to which it relates and the Sub-Clause (or other term of the Contract) in which the obligations are specified. If any such instruction constitutes a Variation, Clause 13 [Variations and Adjustments] shall apply.

The Contractor shall take instructions from the Employer, or from the Employer's Representative or an assistant to whom the appropriate authority has been delegated under this Clause.

3.5

Determinations

Whenever these Conditions provide that the Employer shall proceed in accordance with this Sub-Clause to agree or determine any matter, the Employer shall consult with the Contractor in an endeavour to reach agreement. If agreement is not achieved, the Employer shall make a fair determination in accordance with the Contract, taking due regard of all relevant circumstances and after giving an opportunity to the Contractor of being heard.

The Employer shall give notice to the Contractor of each agreement or determination, with supporting particulars. Each Party shall give effect to each agreement or determination, unless the Contractor gives notice, to the Employer, of its dissatisfaction

with a determination within 14 days of receiving it. Either Party may then refer the dispute to courts of Kolkata according to Sub-Clause 20.2 [Dispute Resolution].

4 The Contractor

4.1

Contractor's General Obligations

In terms of the contract entered between the Employer and the Design & PMC Consultant, it shall be binding upon the Contractor to carry out the instructions received in writing from Design & PMC Consultant.

The Contractor shall plan, execute and complete the Works and commissioning of Plant and Materials in accordance with the Contract, and shall remedy any defects in the Works. When completed, the Works shall be fit for the purposes for which the Works are intended as defined in the Contract.

The Contractor, after obtaining any necessary consent from any relevant authority, shall submit to the Employer, proposals showing the layout of pedestrian routes, lighting, signs, and guarding any road opening or traffic diversion which may be required in connection with the execution of the Works and which the Contractor intends to construct. Any consent given by the Employer to such proposals shall not relieve the Contractor of any obligation under the Contract or absolve the Contractor from any liability for or arising from such proposals or the implementation thereof. The Contractor's proposals for erection of all ancillary and Temporary Works shall be in conformity with the proposals submitted along with the tender and modifications thereto as approved by the Employer.

The Contractor shall submit shop-drawings, supporting calculations where called for by the Employer and other relevant details of all such works to the Employer for approval at least 14 working days before it desires to commence such Works. Approval by the Employer of any such proposal shall not relieve the Contractor of its responsibility for the adequacy of such Works.

No extra payment will be made for complying with the provisions of this clause and the cost of the work under this element shall be deemed to be included in the Financial Bid.

The Contractor shall provide the Plant and Contractor's Documents specified in the Contract, and all Contractor's Personnel, Goods, and other things and services,

Contractor's	whether of a temporary or permanent nature, required in and for this execution, completion and remedying of defects.
General Obligations	<p>The Works shall include any work which is necessary to satisfy the Employer's Requirements, or is implied by the Contract, and all works which (although not mentioned in the Contract) are necessary for stability or for the completion, or safe and proper operation, of the Works.</p> <p>The Contractor shall be responsible for the adequacy, stability and safety of all Site operations, of all methods of construction and of all the Works.</p> <p>The Contractor shall, whenever required by the Employer, submit details of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works. No significant alteration to these arrangements and methods shall be made without this having previously been notified to the Employer.</p> <p>The Contractor shall survey and fix the alignment, set out the buildings maintaining vertical and horizontal clearances and keeping in view important site references and obligatory locations in consultation with the Employer. GTS bench mark, temporary bench marks and three control points on all straights and other details shall be obtained by the Contractor. However, the Employer shall assist and/or facilitate (without any recourse or liability) in such obtaining of GTS bench mark, temporary bench marks etc.</p> <p>The Contractor shall establish at its cost, at suitable points, additional reference lines and bench marks as may be necessary. The Contractor shall remain responsible for the sufficiency and accuracy of all its benchmarks and reference lines. It shall take precautions to see that lines, points and bench marks fixed by the Employer are not disturbed by its work and shall make good any damage thereto.</p>

4.2

Performance Security	<p>The Contractor shall submit with the Employer (at its cost) a Performance Security for proper performance, equivalent to 3% of Contract Price deducted by an amount paid as EMD, prior to signing of the Agreement. Out of which, 2% of Contract Price shall be considered to be given towards Earnest Money Deposit and the balance 1%, towards Performance Security.</p> <p>The Performance Security should be submitted in the form of the Bank Guarantee prescribed for Performance Security from a scheduled commercial bank/ financial institution approved by Reserve Bank of India. No Performance Security will be accepted from</p>
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the Contractor, if the location of the branch of the bank/ financial institution is not situated within the municipal limits of any of the cities of Kolkata, Bidhannagar and New Town Kolkata. The Performance Security shall have a validity of 84 months. The Contractor shall continue to keep its Performance Security duly validated and enforceable for such extended period beyond 84 months as may be directed by the Employer, until the Contractor has executed and completed the Works and remedied any defects.

The Contractor shall ensure that the Performance Security is valid and enforceable until the Contractor has executed and completed the Works and remedied any defects. If the terms of the Performance Security specify its expiry date, and the Contractor has not become entitled to receive the Performance Certificate by 28 days prior to the expiry date, the Contractor shall extend the validity of the Performance Security until the Works have been completed and all defects have been remedied.

The Employer shall not make a claim under the Performance Security, except for amounts to which the Employer is entitled under the Contract in the event of:

- (a) Failure by the Contractor to extend the validity of the Performance Security as described in the preceding paragraph, in which event the Employer may claim the full amount of the Performance Security.
- (b) Failure by the Contractor to pay the Employer an amount due, as either agreed by the Contractor or determined under Sub-Clause 2.5 [Employer's Claims] or Clause 20 [Claims and Dispute Resolution], within 42 days after this agreement or termination,
- (c) Failure by the Contractor to remedy a default within 42 days after receiving the Employer's notice requiring the default to be remedied, or
- (d) Circumstances which entitle the Employer to termination under Sub-Clause 15.2 [Termination by Employer], irrespective of whether notice of termination has been given.

The Employer shall return the Performance Security to the Contractor within 21 days after the Contractor has become entitled to receive the Performance Certificate.

4.3

Contractor's Representative

The Contractor shall appoint the Contractor's Representative by a duly notarised Power of Attorney in favour of the Contractor's Representative, a copy of which shall be forwarded and shall give him all authority necessary to act on the Contractor's behalf under the Contract. The Contractor's Representative shall be a resident of West Bengal.

Unless the Contractor's Representative is named in the Contract, the Contractor shall, prior to the Commencement Date, submit to the Employer for consent the name and particulars of the person the Contractor proposes to appoint as Contractor's Representative. If consent is withheld or subsequently revoked, or if the appointed person fails to act as Contractor's Representative, the Contractor shall similarly submit the name and particulars of another suitable person for such appointment.

The Contractor shall not, without the prior consent of the Employer, revoke the appointment of the Contractor's Representative or appoint a replacement.

The Contractor's Representative shall, on behalf of the Contractor, receive instructions under Sub-Clause 3.4 [Instructions]. The Contractor's Representative may delegate any powers, functions and authority to any competent person, and may at any time revoke the delegation. Any delegation or revocation shall not take effect until the Employer has received prior notice signed by the Contractor's Representative, naming the person and specifying the powers, functions and authority being delegated or revoked. The Contractor's Representative and all these persons shall be fluent in the language for communications defined in Sub-Clause 1.4 [Law and Language].

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Safety Procedures

The Contractor shall ensure and arrange at its cost fire and the safety provisions, as provided under National Building Code of India latest edition, Bureau of Indian Standards, safety manuals of the Employer, if any, and such provisions as are locally in force from time to time for all labour, directly or indirectly employed in the works for performance of this Contract. The Contractor will indemnify the Employer from any consequence arising due to Contractor's failure in respect of safety provisions.

4.8.1 Compliances

Following Codes may be referred to in this connection: -

- 4.8.1.1 IS 5916 Safety code for construction involving use of hot bituminous materials.
- 4.8.1.2 IS 7293 Safety code for working with construction machinery.
- 4.8.1.3 IS 7969 Safety code for handling and storage of building materials.
- 4.8.1.4 IS 8989 Safety code for erection of concrete framed structures.
- 4.8.1.5 IS 13415 Protective barriers in and around buildings - Code of Safety
- 4.8.1.6 IS 13416 Preventive measures against hazards at work places - Recommendations (Parts - 1 to 5)
- 4.8.1.7 IS 3696 (PART I):1987 Safety Code for Scaffolds and Ladders
- 4.8.1.8 IS 3696(PART II):1991 Scaffolds and Ladders-Code of Safety
- 4.8.1.9 IS 13416 (PART I):1991 Falling material hazards protection
- 4.8.1.10 IS 13416(PART II):1992 Fall protection
- 4.8.1.11 IS 5216 (PART-1)-1982: Recommendations on Safety Procedures and Practices in Electrical Work, Part I: General
- 4.8.1.12 IS 5216(PART-2)-1982: Recommendation on Safety Procedures and Practices in Electrical Work, Part II: Life Saving Techniques

4.8.2 First Aid & Industrial Injuries

- 4.8.2.1 First aid facilities at easily accessible place shall be provided by the Contractor as per the applicable labour laws or Rules of the Authority controlling the area where work is carried out.
- 4.8.2.2 The Contractor shall make arrangements with hospitals for ambulance service and for treatment of industrial injuries to meet eventualities leading to the need for such facilities. The Employer's Representative shall be informed of their telephone numbers and addresses of the Hospitals.
- 4.8.2.3 Details of all critical industrial injuries shall be reported promptly to the Employer's Representative.
- 4.8.2.4 Report shall cover type, nature, cause, physician's report and action for prevention of those types again.

4.8.3 General Safety Rules

4.8.3.1 Smoking within Site, restricted areas, closed areas, near storage place of lubricant oil and fuel etc. is strictly prohibited.

4.8.3.2 The Contractor shall erect and maintain barricades required in connection with its operation to guard or protect:

4.8.3.2.1 Excavation Hoisting/lifting

4.8.3.2.2 Slab openings

4.8.3.2.3 Hazardous areas

4.8.3.2.4 Employer's existing property likely to be subjected to damage by the Contractor's operations

4.8.3.2.5 Unloading spots

4.8.4 Accidents - Precautions at Worksite

No materials on the Site shall be so stacked or placed as to cause danger or inconveniences to any person or to the public. The Contractor shall provide all necessary fencing and lights to protect the public from accidents and shall be bound to bear expenses of defence of every suit, action 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 costs which may be awarded in any such suit, action or proceeding, to any such person or which may, with the consent of the Contractor be paid to compromise any claim by any such person. In case any damage or destruction of public utilities is caused at the Site by any act or omission of the Contractor, the Contractor shall also be liable to bear the costs and expenses for replacement or repair of such public utilities and all costs and expenses arising in connection thereto, upon such costs and expenses being determined by the Employer or the appropriate Government body. The Employer shall have the right to deduct all costs and expenses arising out of application of this clause, from the Statements raised by the Contractor on the Employer, for payment, in terms of Sub-Clause 14.3.

4.8.5 Electrical Equipment – Precautions

(i) All temporary and permanent Electrical installations and Lift Installation, power distribution and supply required for execution of work shall be cleared out conforming to IE Rules -1956 amended up to-date, National Building Code-2016-Vol-2, IS:5216-1982, BIS Code-SP-70-2001 (Handbook of Construc-

tion Safety Practices and other existing industrial and domestic safety rules and regulations). Important specific points to be noted are as under: Meter room and main switches should be freely accessible at all times and fully protected against all weather conditions.

- (ii) Power distribution system shall be identifiable with display marking on switches.
- (iii) All power distribution shall be carried out with coated, adequately insulated and of appropriate current/load rating cables. It shall be securely routed for this purpose. No loose, naked, hanging wires shall be permitted.
- (iv) Over load protection devices shall be installed whenever and wherever heavy current/load consuming construction plant or machinery susceptible to hazard is in use and as directed by the Employer's Representative.
- (v) Metallic plugs and sockets shall be used in field work. Switch board shall be in close proximity so as to have quick control over the supply.
- (vi) Proper and adequate earthing connection should be provided for all installations, Plant and machinery and distribution system.
- (vii) Hand lamps and inspection lamps shall be adequately insulated and guarded with wire mesh and should have proper plugs for use.
- (viii) Security and illuminator light shall be secured firmly and protected to withstand all weather conditions.
- (ix) Motors, gearing, transmission, electrical wiring and other dangerous parts of hoisting appliances shall be provided with efficient safeguards, hoisting appliances shall be provided with such means as will reduce to the minimum the risk of accidental descent of the load. Adequate precautions shall be taken to reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced. When the staff and labour of the Contractor are employed on electrical installations which are already energised, insulating mats, wearing apparel, such as gloves, sleeves, and boots as may be necessary shall be provided. The staff and labour of the Contractor shall not wear any rings, watches and carry keys or other Materials which are good conductors of electricity.
- (x) Before any demolition work is commenced and also during the progress of work, it shall be ensured that no electrical cable or apparatus which is liable to be a source of danger or a cable or apparatus used by the operator shall remain electrically charged.

- (xi) Protective and safety equipment such as rubber gauntlets or gloves, earthing rods, linemen's belt, portable artificial respiration apparatus etc. shall be provided in each sub-station, service centre, enquiry office and important installations. Where electric welding or such other nature of work is undertaken, goggles shall also be provided.
- (xii) No work shall be undertaken on live installations, or on installations, which could be energized unless another person is present to immediately isolate the electric supply in case of any accident and to render first aid if necessary.
- (xiii) Electrical wiring and control switches shall be periodically inspected and any defective wiring, broken parts of switches which will expose live parts, shall be replaced immediately to make the installation safer for user.
- (xiv) When working on or near live installations, suitably insulated tools shall be used, and special care shall be taken to see that those tools accidentally do not drop on live terminals causing shock or dead short.
- (xv) The electrical switchgears and distribution boards shall be clearly marked to indicate the areas being controlled by them.
- (xvi) Rubber or insulating mats shall be provided in front of the main switchboards or any other control equipment of medium voltage and above.
- (xvii) No inflammable Materials shall be stored in places other than the rooms specially constructed for this purpose in accordance with the provisions of Indian Explosives Act.
- (xviii) Periodical examination of the first aid facilities and protective and safety equipment provided at the various installations shall be undertaken for adequacy and effectiveness and a proper record shall be maintained.

4.8.6 Maintenance of Safety Devices

All scaffoldings, ladders and other safety devices mentioned or described herein shall be maintained in a safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate maintenance facilities shall be provided at or near places at work.

4.8.7 Personal Safety

- 4.8.7.1 All necessary personal safety equipment as considered adequate by the Employer's Representative shall be available for use of persons

employed on the Site and maintained in a condition suitable for immediate use and the Contractor shall take adequate steps to ensure proper use of equipment by those concerned.

4.8.7.2 The staff and labour of the Contractor employed on mixing asphaltic materials, cement, and lime mortars/concrete shall be provided with protective footwear and protective gloves.

4.8.7.3 Those engaged in handling any materials which are injurious to eyes shall be provided with protective goggles.

4.8.7.4 The staff and labour of the Contractor employed on erection works, etc. shall be provided with helmets, safety belts etc.

4.8.7.5 The staff and labour of the Contractor employed on concrete finishing, welding, painting and other works above 2 metres height shall be provided with a suitable safety belt, as per the applicable Factory Rules.

4.8.8 Storing Fuel, Oil and Lubricant

The Contractor shall take approval from the Employer's Representative for storing the lubricants, oil and fuel at Site for running the machinery required for the construction.

4.8.9 Fire Extinguishing

Suitable, sufficient number of fire extinguishers for all types of fire, shall be provided at Site. In addition, sufficient number of fire buckets filled with water and sand shall also be provided. The firefighting equipment as outlined above shall be dispersed in a suitable and purposeful manner.

4.8.10 Fire Precautions

The Contractor shall comply with regulations of the controlling authority in force at the Site of the Works relating to the precautions to be taken against fire hazards.

4.8.11 Protection arrangements at Site

Adequate protection against any form of damage or deterioration shall be provided for in all sections of the Works. This shall include protective tapes, casings, guard

rails and the likes, which shall be provided as necessary. Particular care shall be taken to protect finished surfaces during the execution of adjacent in-situ work. The Contractor shall carryout all steps necessary and comply with the directions and instructions of the Employer's Representative to its satisfaction.

4.8.12 Safety Arrangements for labour

The Contractor shall, at its own expense, arrange for the safety provisions as given above and as required by the Employer's Representative, in respect of all the staff and labour of the Contractor directly or indirectly employed for performance of the Works and shall provide all facilities in connection therewith. In case the Contractor fails to make arrangements to provide necessary facilities as aforesaid, the Employer's Representative shall be entitled to do so and recover the cost thereof, from the Contractor.

4.8.13 Safety Manual

The Contractor shall leverage all applicable procedures noted in CPWD Health and Environment Handbook 2019 for preparation of Site safety plan. The Contractor shall submit a Safety Manual indicating the safety measures proposed to be adopted in light of above provisions, for approval of the Employer's Representative. The Contractor should have tie-up with any multi-specialty hospital in New Town, Kolkata with ambulance facility (for providing medical services to the staff and labour of the Contractor during the construction period)

4.8.14 Accidents – Reporting

The Contractor shall, within twenty-four (24) hours of the occurrence of any accident on, or about the Site, or in connection with the execution of the Works, report such accident to the Employer's Representative and to the appropriate authority wherever such report is required by law. The Contractor will indemnify the Employer from all accident cases.

4.8.15 Security Measures

The Contractor shall be responsible at its cost for security of Works for the duration of the Contract and shall provide and maintain continuously adequate security personnel to fulfil these obligations. The requirements of security measures shall include, but not limited to, maintenance of law and order at Site, provision of all lighting, guard, flagmen, and other measures necessary for protection of Works within the camps and elsewhere at Site, for all Materials delivered to the Site and all persons employed in connection with the Works continuously throughout working and non-working periods including nights, Sundays, holidays, for the duration of the Contract. At Site in close proximity of traffic corridors where public are likely to come close to the work area, suitable fencing as directed by the Employer's Representative should be provided.

4.9

Quality Assurance

The Contractor shall institute a quality assurance system / manual to demonstrate compliance with the requirements of the Contract. The system shall be in accordance with the details stated in the Contract. The Employer shall be entitled to audit any aspect of the system. The Employer, at its sole discretion, may direct the Contractor to send the sample for quality check to any national or regional institution in respect of each of the Site. The system / manual should cover the following items as minimum:

- (i) Q.A. Plan for Basic Construction Materials indicating the details of tests to be undergone before use in works.
- (ii) Q.A. Plan for site activities indicating the details of tests to be conducted at the various stages of construction for various activities.
- (iii) In house/on site testing facilities to be developed for Materials, site activities and calibration of equipment.
- (iv) Site documents to be maintained including records of results of tests for Materials and workmanship, inventory record on availability of vital Materials and their consumption requirements, site inspection records, quality audit record, safety audit record, site progress record, etc.
- (v) Check lists for source approval of Materials etc., check lists for site activities and proforma for recording results of tests.
- (vi) Method statements for important construction activities.

Details of all procedures and compliance documents shall be submitted to the Employer for information before execution stage is commenced. When any document of a technical nature is issued to the Employer, evidence of the prior approval by the Contractor itself shall be apparent on the document itself.

Compliance with the quality assurance system shall not relieve the Contractor of any of its duties, obligations or responsibilities under the Contract.

4.10

Site Data

The Employer shall have made available to the Contractor for its information, prior to signing of the Contract, all relevant data in the Employer's possession in respect of the Site. Such relevant data shall be indicative only and not exhaustive.

The Contractor shall be responsible for verifying and interpreting all such data. The Employer shall have no responsibility for the accuracy, sufficiency or completeness of such data.

The responsibility of Contractor under this sub-clause is full and final and no claim by the Contractor for additional payment or extension of time shall be allowed on the ground of any misunderstanding or misapprehension by the Contractor or that incorrect or insufficient information was given to the Contractor or that it failed to obtain correct and sufficient information.

4.11

Sufficiency of the Contract Price

The Contractor shall be deemed to have satisfied himself as to the correctness and Sufficiency of the Contract Price. Unless otherwise stated in the Contract, the Contract Price covers all the Contractor's obligations under the Contract and all things necessary for the proper execution and completion of the Works and the remedying of any defects.

4.12

Unforeseeable Difficulties	<p>Except as otherwise stated in the Contract</p> <p>(a) The Contractor shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances which may influence or affect the Works;</p> <p>(b) By signing the Contract, the Contractor accepts total responsibility for having foreseen all difficulties and costs of successfully completing the Works; and</p> <p>(c) The Contract Price shall not be adjusted to take account of any unforeseen difficulties or costs.</p>
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4.13

Rights of Way and Facilities	<p>The Contractor shall bear all costs and charges for special and/or temporary rights-of-way which it may require, including those for access to the Site. The Contractor shall also obtain, at its risk and cost, any additional facilities outside the Site which it may require for the purposes of the Works.</p>
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4.14

Avoidance of Interference	<p>The Contractor shall not interfere unnecessarily or improperly with:</p> <p>(a) The convenience of the public, or</p> <p>(b) The access to and use and occupation of all roads and footpaths, irrespective of whether they are public or in the possession of the Employer or of others.</p> <p>The Contractor shall indemnify and hold the Employer harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from any such unnecessary or improper interference.</p> <p>The Contractor shall maintain a safe environment for Project personnel and public around, if any.</p> <p>The Contractor shall ensure that its employees do not leave the Site at any time without the permission of the Employer's Representative.</p>
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The Contractor shall ensure that the vehicles, machines and equipment, which it uses, are safe and do not cause any harm to Project personnel or public around, if any.

All equipment shall operate under all conditions of load without any sound or vibration, which is objectionable and beyond the limits specified by the relevant laws. In case of rotating machinery, sound or vibration noticeable outside the room in which it is installed or annoyingly noticeable inside its own room, shall be considered objectionable. The Contractor at its own expense shall correct such conditions.

Existing roads and other public roads may be used by the Contractor at its risk and cost to carry out construction activities, with prior approval of the competent authority. The Contractor's heavy construction traffic or tracked equipment shall not travel on any public road or bridge, unless the Contractor has made arrangements with the authority concerned and has obtained the approval of the Employer's Representative to such arrangements. The Contractor shall include in its price the cost of strengthening any such public road or bridge if it considers it would be necessary. The Contractor shall repair any damage to the road or bear the cost thereof due to movement of Contractor's Plant and equipment, vehicles etc. to the specifications and satisfaction of road authorities as well as of Employer's Representative.

The Contractor shall plan transportation of construction Materials to the Site in accordance with traffic regulations enforced by local traffic authorities from time to time and in such a way that road accidents are avoided and minimum inconvenience is caused.

No claim of the Contractor whatsoever shall be entertained on this account by the Employer. The transportation of certain equipment and Materials and launching may not be possible during day and may have to be carried out within time schedule specified by traffic police.

The Contractor must note that the Works at the Site shall have to be executed within a fast-growing planned satellite city where basic infrastructure facilities are shared by many complexes; Hence no part of the Works shall interfere or damage or cause

harm to the existing activities of the neighbouring housing or commercial complexes. The Contractor shall ensure that the noise levels are within allowable limits and noise from construction site do not disturb the day to day activities.

Proper barricading shall be provided to ensure the safety of Works and public.

4.15

Access Route

The Contractor shall be deemed to have been satisfied as to the suitability and availability of access routes to the Site. The Contractor shall use reasonable efforts to prevent any road or bridge from being damaged by the Contractor's traffic or by the Contractor's Personnel. These efforts shall include the proper use of appropriate vehicles and routes.

Except as otherwise stated in these Conditions:

- (a) The Contractor shall (as between the Parties) be responsible for any maintenance which may be required for its use of access routes;
- (b) The Contractor shall provide all necessary signs or directions along access routes, and shall obtain any permission which may be required from the relevant authorities for its use of routes, signs and directions;
- (c) The Employer shall not be responsible for any claims which may arise from the use or otherwise of any access route,
- (d) The Employer does not guarantee the suitability or availability of particular access routes, and
- (e) Costs due to non-suitability or non-availability, for the use required by the Contractor, of access routes shall be borne by the Contractor.

4.16

Transport of Goods

Unless otherwise stated in the Particular Conditions:

- (a) The Contractor shall give the Employer not less than 21 days' notice of the date on which any Plant or a major item of other Goods will be delivered to the Site;

- (b) The Contractor shall be responsible for packing, loading, transporting, receiving, unloading, storing and protecting all Goods and other things required for the Works; and
- (c) The Contractor shall be responsible for making all transport arrangements and for payment of freight and insurance costs for the shipment and delivery of Goods and other things required for the Works and
- (d) The Contractor shall indemnify and hold the Employer harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from the transport of Goods, and shall negotiate and pay all claims arising from their transport.

4.17

Inspection of Goods

All Goods may be subjected to inspection and testing by the Employer or its designated representatives at all times and places including the period of manufacture and in any event prior to final acceptance by the Employer. Neither the carrying out of any inspection of the Goods nor any failure to undertake any such inspections shall relieve the Contractor of any of their warranties or the performance of any obligations under the Contract.

For Goods supplied from within India

- (a) For Goods supplied from within India, the Employer retains the right to perform pre-shipment inspection at the manufacturer's premises, if necessary or any place where the Goods have been commissioned and are currently in use and an independent quality control laboratory testing at its own cost.
- (b) The Employer will retain the right to perform further inspections and quality testing at any time till the satisfactory installation of Goods, as it deems fit, at its own cost.

Should any inspected or tested Goods fail to conform to the specifications, the Employer shall reject them and the Contractor shall replace the rejected Goods free of cost to the Employer, within a period of 45 (forty-five) working days or such other period as may be specified by the Employer, of intimating such rejection.

4.18

Acceptance and Rejection of Goods Under no circumstances shall the Employer be required to accept any Goods that do not conform to the specifications of or requirements of the Contract. The Employer may condition acceptance of the Goods upon the successful completion of acceptance tests, as may be specified in the Contract or otherwise agreed in writing by the Parties. In no case shall the Employer be obligated to accept any Goods unless and until the Employer has inspected the Goods following commissioning of the Goods in accordance with the requirements of the Contract. The Goods shall be deemed to be accepted only after the Employer provides acceptance in writing.

Provided that, upon supply and installation of the Goods comprising the Works, the right of such Goods shall vest on the Employer and the Contractor will be the custodian of all such Goods till installation, commissioning and handing over to the Employer. The Contractor shall submit along with the Goods, the following documents: (a) Manufacture Test Certificate (b) Original Invoice of purchase of such Goods (c) Material Receipt Note (signed in triplicate and containing the endorsement of the Employer's Representative, certifying delivery of such Goods at Site)

Notwithstanding any other rights of, or remedies available to, the Employer under the Contract, in case any of the Goods is defective or otherwise does not conform to the specifications or other requirements of the Contract, the Employer may, at its sole option, reject or refuse to accept the Goods, and the Contractor agrees promptly to replace such Goods with Goods of equal or better quality.

Provided that commissioning of the Goods within the meaning of these Conditions, will mean and shall be deemed to include obtaining necessary No Objection Certificates or clearances or approvals which may be required for operation of such Goods.

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Title Unless otherwise expressly provided in the Contract, title in and to the Plant and Materials shall pass from the Contractor to the Employer upon delivery of such Plant and Materials and their acceptance by the Employer in accordance with the requirements of the Contract.

4.21

Warranties Without limitation of any other warranties stated in or arising under the Contract, the Contractor warrants and represents that

- (a) The Plant and Materials, including all packaging and packing thereof, conform to the specifications of the Contract, are fit for the purposes for which such Plant and Materials are ordinarily used and for the purposes expressly made known in writing by the Employer to the Contractor, and shall be of even quality, free from faults and defects in material, manufacture and workmanship under normal use in the conditions prevailing in the country of final destination;
- (b) The Contractor shall provide the Employer with the benefit of all manufacturers warranties in addition to any other warranties required to be provided hereunder;
- (c) The Plant and Materials are of the quality, quantity and description required by the Contract;
- (d) The Goods are free from any right of claim by any third-party and unencumbered by any title or other rights, including any liens or security interests and claims of infringement of any intellectual property rights, including, but not limited to, patents, copyright and trade secrets.
- (e) Unless otherwise indicated in the Technical Specifications, this warranty shall remain valid for 3 (three) years after the Plant and Materials have been commissioned at the final destination indicated in the Contract subject to issue of certificate regarding date of commissioning issued by the Employer.
- (f) During the warranty, free comprehensive annual maintenance and repairs services including testing and calibration, labour and spares shall be provided by the Contractor during the period of warranty. If necessary, the Contractor shall engage qualified person to carry out maintenance, repair etc.
- (g) If the Contractor, having been notified, fails to remedy the defect(s) within the stipulated period, the Employer may proceed to take such remedial action as may be necessary, at the Contractor's risk and expense and without prejudice to any other rights which the Employer may have against the Contractor under the Contract.

- (h) The Contractor shall visit each installation site as recommended in the manufacturers technical/ service/ operational manual, but at least once in three months during the warranty period for preventive maintenance.

The Plant and Materials shall be new and unused. The Contractor shall remain responsive to the needs of the Employer for any services that may be required in connection with any of the Contractors warranties under the Contract. During any period in which the Contractors warranties are effective, upon notice by the Employer that the Plant and Materials do not conform to the requirements of the Contract, the Contractor shall replace the defective Plant and Materials with Plant and Materials of the same or better quality or fully reimburse the Employer for the purchase price paid for the defective Plant and Materials; and if having been notified by any means, the Contractor fails to replace the defective Plant and Materials within 30 days or such other period as may be specified by the Employer, the Employer may proceed to take such remedial action as may be necessary, at the Contractors risk and expense and without prejudice to any other rights which the Employer may have against the Contractor under the Contract.

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4.23

Contractor's Equipment

The Contractor shall be responsible for all Contractor's Equipment. When brought on to the Site, Contractor's Equipment shall be deemed to be exclusively intended for the execution of the Works. For any imported equipment or part thereof offered by the Contractor, it will have to make its own arrangements for import formalities and procurement of equipment without involving the Employer in any way for any clearance certificates /licenses /assistance. The Employer may, at its sole discretion, assist (but is not obligated to) the Contractor, where required, in obtaining clearance through the Customs for Constructional Plant, Materials and other things required for the Works. The Contractor shall obtain all permits / licenses and pay for any and all fees required for the inspection, approval and commissioning of their installation.

4.24

Protection of the Environment

The Contractor shall take all reasonable steps to protect the environment (both on and off the Site) and to limit damage and nuisance to people and property resulting from pollution, noise and other results of its operations.

The Contractor shall ensure that emissions, surface discharges and effluent from the Contractor's activities shall not exceed the values indicated in the Employer's Requirements, and shall not exceed the values prescribed by applicable Laws.

The Contractor shall maintain ecological balance by preventing deforestation, water pollution and defacing of natural landscape. The Contractor shall so conduct its construction operations as to prevent any avoidable destruction, scarring or defacing of natural surroundings in the vicinity of work. In respect of ecological balance, the Contractor shall observe the following instructions for which no extra payments will be made: -

- 4.24.1 Where destruction, scarring, damage or defacing may occur as a result of operations relating to Permanent or Temporary Works, the same shall be repaired, replanted or otherwise corrected at Contractor's expense. All areas of work shall be smoothened and graded in a manner to conform to natural appearance of the landscape as directed by the Employer's Representative.
- 4.24.2 All trees and shrubbery, which are not specifically required to be cleared or removed for construction purposes, shall be preserved and shall be protected from any damage that may be caused by Contractor's construction operations and equipment or by their men and agents. The removal of trees or shrubs will be permitted only after prior approval of the Employer's Representative. Special care shall be exercised where trees or shrubs are exposed to injuries by construction equipment, blasting, excavating, dumping, chemical damage or other operation and the Contractor shall adequately protect such trees by use of protective barriers or other methods approved by the Employer's Representative. Trees shall not be used for anchorage. The Contractor shall be responsible for injuries to trees and shrubs caused by the operations of the Contractor and its men and agents. The terms "injury" shall include, without limitation, bruising, scarring, tearing and breaking of roots, trunks or

Protection
of the
Environment

branches. All injured trees and shrubs shall be restored as nearly practicable, without delay, to their original condition at Contractor's expense.

- 4.24.3 Where trees have to be necessarily cut for progressing Temporary or Permanent Works, the Contractor shall arrange for compensatory afforestation as may be required by environmental rules and regulations.
- 4.24.4 In the conduct of construction activities and operation of equipment, the Contractor shall utilize such practicable methods and devices as are reasonably available to control, prevent and otherwise minimize air/ noise pollution.
- 4.24.5 Excessive emission of dust into the atmosphere will not be permitted during manufacture, handling and storage of concrete aggregates/fly ash/earth/building Materials and the Contractor shall use such methods and equipment as are necessary for collection and disposal or prevention of dust during these operations. The Contractor's method of storing and handling cement shall also include means of eliminating atmospheric discharge of dust. Equipment and vehicles that give objectionable emission of exhaust gases shall not be operated. Burning of materials resulting from cleaning of trees, branches, combustible construction materials and rubbish may be permitted only when atmospheric conditions for burning are considered favourable.
- 4.24.6 Special care must be exercised in ensuring that the labour housed in labour camp within the Site do not indulge in any activity like drinking alcohol, taking drugs etc. and other activities that may affect the ecological balance such as cutting of shrubs for fuel, creating open air nuisance etc.
- 4.24.7 The Contractor shall not cut or destroy any tree in the Site to the maximum extent possible. In case any tree is to be cut, the Contractor shall obtain prior permission from the competent authority under the relevant laws and shall adhere to the requirements of the prevailing environmental laws / terms of the permission. The Employer may assist the Contractor in obtaining such permission, including signing necessary documents. The Contractor shall use all means to minimize the effluents from its construction work and transportation activity or any other activity in the course of the execution of the Works.

4.25

Electricity,
Water and
Gas

The Contractor shall, except as stated below, be responsible for the provision of all power, water and other services it may require.

The Contractor shall be entitled to use for the purposes of the Works such supplies of electricity, water, gas and other services as may be available on the Site and of which details and prices are given in the Employer's Requirements. The Contractor shall, at its risk and cost, provide any apparatus necessary for its use of these services and for measuring the quantities consumed.

The quantities consumed and the amounts due (at these prices) for such services shall be agreed or determined in accordance with Sub-Clause 2.5 [Employer's Claims] and Sub-Clause 3.5 [Determinations]. The Contractor shall pay these amounts to the Employer.

Upon issue of Performance Certificate and upon handover to the Association/ society formed by the apartment owners of the Project, it shall be the responsibility of the Association/ society to provide electricity, gas, water and to enable the Contractor to rectify any defects, which the Contractor is liable to cure during the Defects Liability Period.

4.26

Employer's
Equipment

The Employer shall not supply any tools, Plant, Materials, machinery or equipment.

The Contractor has to arrange all tools, Plant, equipment as well as construction Materials required for the Works.

4.7

Progress Reports

Unless otherwise stated in the Particular Conditions, monthly progress reports shall be prepared by the Contractor and submitted to the Employer's representative in six copies. The first report shall cover the period up to the end of the first calendar month following the Commencement Date. Reports shall be submitted monthly thereafter, each within 7 working days after the last day of the period to which it relates. Reporting shall continue until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.

Each report shall include:

- (a) Charts and detailed descriptions of progress, including Contractor's Documents, procurement, manufacture, delivery to Site, construction, erection, testing, commissioning and trial operation;
- (b) Photographs showing the status of manufacture and of progress on the Site;
- (c) For the manufacture of each main item of Plant and Materials, the name of the manufacturer, manufacture location, percentage progress, and the actual or expected dates of:
 - i. Commencement of manufacture,
 - ii. Contractor's inspections,
 - iii. Tests, and
 - iv. Shipment and arrival at the Site;
 - v. Installation
- (d) The details described in Sub-Clause 6.10 [Records of Contractor's Personnel and Equipment];
- (e) Copies of quality assurance documents, test results and certificates of Materials;
- (f) List of Variations, notices given under Sub-Clause 2.5 [Employer's Claims] and notices given under Sub-Clause 20.1 (Contractor's Claims);
- (g) Safety statistics, including details of any hazardous' incidents and activities relating to environmental aspects and public relations; and
- (h) Comparisons of actual and planned progress, with details of any events or circumstances which may jeopardize the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome delays.

4.8

Security of the Site	<p>Unless otherwise stated in the Particular Conditions:</p> <p>(a) The Contractor shall be responsible for keeping unauthorised persons off the Site, and</p> <p>(b) Authorised persons shall be limited to the Contractor's Personnel and the Employer's Personnel; and to any other personnel notified to the Contractor, by (or on behalf of) the Employer, as authorised personnel of the Employer's other contractors on the Site.</p>
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4.29

Contractor's Operations on Site	<p>The Contractor shall confine its operations to the Site, and to any additional areas which may be obtained by the Contractor and agreed by the Employer as working areas. The Contractor shall take all necessary precautions to keep Contractor's Equipment and Contractor's Personnel within the Site and these additional areas, and to keep them off adjacent land.</p> <p>During the execution of the Works, the Contractor shall keep the Site free from all unnecessary obstruction, and shall store or dispose of any Contractor's Equipment or surplus Materials. The Contractor shall clear away and remove from the Site any wreckage, rubbish and Temporary Works which are no longer required. All surface and sub-soil drains at the Site shall be maintained in a clean, sound and satisfactory state of performance.</p> <p>Upon the issue of the Taking-Over Certificate for the Works, the Contractor shall clear away and remove all Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works. The Contractor shall leave the Site and the Works in a clean and safe condition. However, the Contractor may retain on Site, during the Defects Notification Period, such Goods as are required for the Contractor to fulfil obligations under the Contract.</p>
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4.30

Watching and Lighting	The Contractor shall in connection with the Works, provide and maintain at its own cost all lights, guards, fencing and watching when and where necessary or as required by the “Employer’s Representative “or by any duly constituted authority, for the protection of the Works, or for the safety and convenience of the public or others.
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4.31

Way leaves etc.	The Contractor shall bear all costs and charges for special or temporary way leaves required by the Contractor in connection with access to the Site. The Contractor shall also provide at its own cost any additional accommodation outside the Site required by it for the purposes of the Works.
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4.32

Site Office for the Employer	The Contractor will provide free of cost temporarily furnished office space with toilet facilities for the Employer’s Representative and his staff, at the site of work in terms of Section 5 (Employer’s Requirements). Lay out of such facilities by the Contractor shall be prepared in consultation with the Design & Project Management Consultant.
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4.33

Fossils, Dis- coveries, Items of Value	All fossils, coins, articles of value or antiquity, and structures and other remains or items of geological or archaeological interest found on the Site shall be placed under the care and authority of the Employer. The Contractor shall take reasonable precautions to prevent Contractor’s Personnel or other persons from removing or damaging any of these findings.
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The Contractor shall, upon discovery of any such finding, promptly give notice to the Employer, who shall issue instructions for dealing with it. If the Contractor suffers delay and/or incurs Cost from complying with the instructions, the Contractor shall give a further notice to the Employer and shall be entitled subject to Sub-Clause 20.1 [Contractor’s Claims] to:

- (a) An extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.5 [Extension of Time for Completion], and
- (b) Payment of any such Cost, which shall be added to the Contract Price.

After receiving this further notice, the Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

The Contractor must note that the Project may involve some items of demolition. If during such works, the Contractor finds any items of salvage value, which can be sold, it shall indicate the same in the fortnightly progress report submitted to the Employer and sell it off only after the approval from the Employer. The Contractor shall be solely entitled to the sale proceeds of such items of salvage value and/ or debris accumulated during demolition and/ or construction works in the Site and neither the Employer nor any Government instrumentality can lay its claim to such sale proceeds.

4.34

Production
of Vouchers
etc. by the
Contractor

The Contractor shall, whenever required produce or cause to be produced for examination by the Employer's Representative any quotation, invoice, cost or other account, book of accounts, voucher, receipt, letter, memorandum, paper of writing or any copy of or extract from any such document and also furnish information and returns verified in such manner as may be required in any way relating to the execution of this Contract or relevant for verifying or ascertaining cost of execution of this Contract and the decision of the Employer's Representative on the question of relevancy of any documents, information or return being final and binding on the Parties. The Contractor shall similarly produce vouchers etc. if required to prove to the Employer's Representative that the Materials supplied by him, are in accordance with the specifications laid down in the Contract.

The obligations imposed by the Employer as above are without prejudice to the obligations of the Contractor under any statute, rules or orders binding on the Contractor.

5 General Obligations, Undertakings, Standards and Manuals

5.1

General Obligations

The Contractor shall be deemed to have scrutinised, prior to the Base Date, the Employer's Requirements and the Contractor shall be responsible for the accuracy of such Employer's Requirements except as stated below.

The Employer shall not be responsible for any error, inaccuracy, or omission of any kind in the Employer's Requirements as originally included in the Contract and shall not be deemed to have given any representation of accuracy or completeness of any data or information, except as stated below. Any data or information received by the Contractor, from the Employer or otherwise, shall not relieve the Contractor from its responsibility for the execution of the Works.

If the Employer's Representative has reasonable cause for being dissatisfied with the Contractor's shop-drawings or documents the Employer shall, within a period of 5 working days from the date of submission, require the Contractor in writing to make such amendments thereto as the Employer may consider necessary. The Contractor shall make and be bound by such amendments at no additional expense to the Employer and shall resubmit the amended shop-drawings or documents for the Employer's approval for the execution of Works within the next 3 working days. The Employer shall then intimate the Contractor its in-principle approval to such amended shop-drawings or documents within the next 3 working days. The Employer, at its sole discretion may approve such shop-drawing or documents in a phased manner so as to expedite the Works.

No extension of time or extra payment shall be given to the Contractor to comply with the above. Should it be found at any time after notification of consent that the relevant drawings or documents do not comply with the Contract or do not agree with drawings or documents in relation to which the Employer has previously notified its consent, the Contractor shall, at its own expense, make such alterations or additions as, in the opinion of the Employer, are necessary to remedy such non-compliance or non-agreement and shall submit all such varied or amended drawings or documents for the consent of the Employer. In no circumstances, the Contractor shall commence the construction work beyond 75 days from the date of Notification of Award / Letter of Acceptance.

5.2

Contractor's Documents

The Contractor's Documents shall comprise the technical documents specified in the Employer's Requirements, documents required to satisfy all regulatory approvals, and the documents described in Sub-Clause 5.6 [As-Built Documents] and Sub-Clause 5.7 [Operation and Maintenance Manuals]. Unless otherwise stated in the Employer's Requirements, the Contractor's Documents shall be written in the language for communications defined in Sub-Clause 1.4 [Law and Language] and shall include the following: -

- (a) Detailed drawings including the structural Shop drawings, architectural Shop drawings, electrical Shop drawing including air-conditioning, firefighting, utility pipeline lay out plan, drainage, pavement shop-drawings, sanitary and water supply shop-drawings, waste disposal implementation plan etc.
- (b) Consolidated statement in a tabular form for the Standards and Specifications being followed for Materials to be used including that for flooring, internal and external finishes.
- (c) List of suppliers from whom the Materials are proposed to be procured.
- (d) Samples
- (e) Tests required to be carried out in the Contract.
- (f) Outline safety plan for the site and an outline quality plan.
- (g) Manpower/Labour histogram.
- (h) Month wise Cash flow forecast.

The Contractor shall prepare all Contractor's Documents and shall also prepare any other documents necessary to instruct the Contractor's Personnel.

If the Employer's Requirements describe the Contractor's Documents which are to be submitted to the Employer for review, they shall be submitted accordingly, together with a notice as described below. In the following provisions of this Sub-Clause, (i) "review period" means the period required by the Employer for review, and (ii) "Contractor's Documents" exclude any documents which are not specified as being required to be submitted for review.

Unless otherwise stated in the Employer's Requirements, each review period shall not exceed 21 working days, calculated from the date on which the Employer receives a Contractor's Document and the Contractor's notice. This notice shall state that the Contractor's Document is considered ready, both for review in accordance with this Sub-Clause and for use. The notice shall also state that the Contractor's Document complies with the Contract, or the extent to which it does not comply.

The Employer may, within the review period, give notice to the Contractor that a Contractor's Document fails (to the extent stated) to comply with the Contract. If a Contractor's Document so fails to comply, it shall be rectified, resubmitted and reviewed in accordance with this Sub-Clause, at the Contractor's cost. For each part of the Works, and except to the extent that the Parties otherwise agree:

- (a) Execution of such part of the Works shall not commence prior to the expiry of the review periods for all the Contractor's Documents which are relevant to its execution;
- (b) Execution of such part of the Works shall be in accordance with these Contractor's Documents, as submitted for review; and
- (c) If the Contractor wishes to modify any document which has previously been submitted for review, the Contractor shall immediately give notice to the Employer. Thereafter, the Contractor shall submit revised documents to the Employer in accordance with the above procedure.

Any such agreement (under the preceding paragraph) or any review (under this Sub Clause or otherwise) shall not relieve the Contractor from any obligation or responsibility.

5.3

Contractor's Undertakings

The Contractor undertakes that the Contractor's Documents, the execution and the completed Works will be in accordance with:

- (a) The Laws in the Country, and
- (b) Project Specification
- (c) The documents forming the Contract, as altered or modified by Variations.

5.4

Technical Standards and Regulations

The Contractor's Documents, the execution and the completed Works shall comply with the Country's technical standards i.e. Bureau of Indian Standards, National Building Code of India, and other standards such as American Society for Testing and Materials (ASTM), BSEN (the British and European standard), NFPA (National Fire Protection Association), ANSI/ASHRAE/IGBC etc., building, construction and environmental Laws, Laws applicable to the product being produced from the Works, and other standards specified in the Employer's Requirements, applicable to the Works, or defined by the applicable Laws.

All these Laws shall, in respect of the Works and each Section, be those prevailing when the Works or Section are taken over by the Employer under Clause 10 [Employer's Taking Over]. References in the Contract to published standards shall be understood to be references to the edition applicable on the Base Date, unless stated otherwise.

If changed or new applicable standards come into force in India after the Base Date, the Contractor shall give notice to the Employer and (if appropriate) submit proposals for compliance. In the event that:

- (a) The Employer determines that compliance is required, and
- (b) The proposals for compliance constitute a variation, then the Employer shall initiate a Variation in accordance with Clause 13 [Variations and Adjustments].

In the case of any class of work for which there is no such specification as referred to in Sub-Clause 5.2 above, such work shall be carried out in accordance with the Bureau of Indian Standards Specifications. In case there is no such specification in Bureau of India Standards, the work shall be carried out as per manufacturer's specifications. In case there are no such specifications as required above, the work shall be carried out in all respects in accordance with the instructions and requirements of the Employer's Representative.

5.5 **Intentionally kept Blank**

5.6

As-Built Documents

The Contractor shall prepare, and keep up-to-date, a complete set of “as-built” records of the execution of the Works, showing the exact as-built locations, sizes and details of the work as executed. These records shall be kept on the Site and shall be used exclusively for the purposes of this Sub-Clause. Two copies shall be supplied to the Employer prior to the commencement of the Tests on Completion.

The Contractor shall obtain the consent of the Employer as to their size, the referencing system, and other relevant details. In addition, the Contractor shall supply complete set of “as-built” drawings showing all Works (i.e. under the ground and over the ground) as executed and other relevant records to the Employer’s representative for review before final submission to the Employer.

Prior to the issue of any Taking-Over Certificate, the Contractor shall supply to the Employer the specified numbers and types of copies of the relevant as-built drawings, in accordance with the Employer’s Requirements. The Works shall not be considered to be completed for the purposes of taking-over under Sub Clause 10.1 [Taking Over of the Works and Sections] until the Employer has received these documents.

5.7

Operation and Maintenance Manuals

Prior to commencement of the Tests on Completion, the Contractor shall supply to the Employer provisional operation and maintenance manuals in sufficient detail for the Employer to operate, maintain, dismantle, reassemble, adjust and repair the Plant.

The Works shall not be considered to be completed for the purposes of taking-over under Sub-Clause 10.1 [Taking Over of the Works and Sections] until the Employer has received final operation and maintenance manuals in such detail, and any other manuals specified in the Employer’s Requirements for these purposes.

5.8

Error in Contractor’s Documents

If errors, omissions, ambiguities, inconsistencies, inadequacies or other defects are found in the Contractor’s Documents, they and the Works shall be corrected at the Contractor’s cost, notwithstanding any consent or approval, under this Clause.

6 Staff and Labour

6.1

Engagement of Staff and Labour	The Contractor shall and make arrangements for the engagement of all staff and labour, local or otherwise, and for their payment, housing, feeding and transport.
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6.2

Rates of Wages and Conditions of Labour	The Contractor shall pay rates of wages, and observe conditions of labour as per current provisions stated in Indian labour laws applicable in the State of West Bengal. If no established rates or conditions are applicable, the Contractor shall pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by employers whose trade or industry is similar to that of the Contractor. The Contractor must familiarize himself and comply with relevant labour laws as per current provisions like Minimum Wages Act, 1948 and Contract Labour (Regulation and Abolition) Act, 1970, etc. No extra payment whatsoever shall be made to the Contractor to comply with the rules and laws.
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6.3

Persons in the Service	The Contractor shall not recruit, or attempt to recruit, staff and labour from amongst the Employer's Personnel.
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6.4

Labour Laws	The Contractor shall comply with all the relevant labour laws as amended from time to time which are applicable to the Contractor's Personnel in the State of West Bengal, including Laws relating to their employment, health, safety, welfare, immigration and emigration, and shall allow them all their legal rights. The Contractor shall undertake construction works in accordance with all applicable legislation and Indian statutory requirements listed below but are not limited to: -
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- (a) the Employee's Compensation Act, 1923.
- (b) the Minimum Wages Act, 1948.
- (c) the Contract Labour (Regulation and Abolition) Act, 1970
- (d) the Child and Adolescent Labour (Prohibition and Regulation) Act, 1986.

The Contractor shall require its employees to obey all applicable Laws, including those concerning safety at work.

6.5

Working Hours

No work shall be carried out on the Site on holidays, weekends, locally recognised days of rest, or outside normal working hours, except:

- (a) When the work is unavoidable, or necessary for the protection of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Employer. or
- (b) On Contractor's request, the Employer approves the Contractor to work.

If on the Contractor's request, the Contractor is permitted by the Employer to perform construction activities at the Site outside normal working hours, the Contractor shall provide and install all temporary lighting, equipment etc. as per approved layout to facilitate its work operations and shall maintain them for the duration of the Contract and all such arrangements shall be removed after completion of work by and at the expense of the Contractor.

No extra payment will be made to the Contractor for the provision of temporary lighting and fire prevention measures.

6.6

Facilities for Staff and Labour

The Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor's Personnel. The Contractor shall also provide on-site facilities for the Employer's Personnel as stated in the Employer's Requirements. The Contractor at its cost shall maintain all accommodation in a clean and sanitary condition. The Contractor shall not permit any of the Contractor's Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Permanent Works. The Contractor shall prepare and submit compliance reports of adherence to labour laws as and when desired by the Employer's Representative.

6.8

Health and Safety

The Contractor, within a safety conscious and safety regulated environment, shall be fully responsible for the Health and Safety of works, its personnel, associated Contractor's & Agencies' personnel, the public and all persons directly or indirectly associated with Works on the Site and follow and maintain a minimum standard in accordance with procedures stated in CPWD SHE handbook and management systems as amended from time to time.

In collaboration with a local health authority, the Contractor shall ensure that first aid facilities, sick bay are available at the Site and at any accommodation for Contractor's and Employer's Personnel including the staff and labour of the Contractor at all times, and when required, medical staff and prompt ambulance service are available at all locations. The Contractor shall also ensure that suitable arrangements as required from time to time are made for welfare and hygiene requirements and for the prevention of outbreak of a disease/epidemic etc., as may the case be.

The Contractor shall appoint an accident prevention officer at the Site, who will be responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the Works, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.

The Contractor shall send to the Employer, details of any accident, if so happens, as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Employer may reasonably require.

6.9

Contractor's
Superintend-
ence

Throughout the execution of the Works, and as long thereafter as is necessary to fulfil the Contractor's obligations, the Contractor shall provide all necessary superintendence to plan, arrange, direct, manage, inspect and test the work. Superintendence shall be given by a sufficient number of persons having adequate knowledge of the language for communications (defined in Sub-Clause 1.4 [Law and Language]) and of the operations to be carried out (including the methods and techniques required, the hazards likely to be encountered and methods of preventing accidents), for the satisfactory and safe execution of the Works.

6.9

Contractor's
Personnel

The Contractor's Personnel shall be appropriately qualified, skilled and experienced in their respective trades or occupations. The Employer may require the Contractor to remove (or cause to be removed) any person employed on the Site or Works, including the Contractor's Representative if applicable, who:

- (a) Persists in any misconduct or lack of care,
- (b) Carries out duties incompetently or negligently,
- (c) Fails to conform with any provisions of the Contract, or
- (d) Persists in any conduct which is prejudicial to safety, health, or the protection of the environment.

If appropriate, the Contractor shall then appoint (or cause to be appointed) a suitable replacement person.

6.10

Records of
Contractor's
Personnel and
Equipment

The Contractor shall submit, to the Employer, details showing the number of each class of Contractor's Personnel and of each type of Contractor's Equipment on the Site. Details shall be submitted each calendar month, in a form approved by the Employer, until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.

6.11

Disorderly Conduct

The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst the Contractor's Personnel, and to preserve peace and protection of persons and property on and near the Site.

6.12

Removal from Site of Undesirable Person

The Employer's Representative may require the Contractor to remove from the Site any person or persons employed by the Contractor who may be found incompetent. The Employer's Representative shall forward such recommendation through a notice and the Contractor shall forthwith comply with such requirements.

6.13

Unauthorised Occupation

It shall be the responsibility of the Contractor to see that the building under construction is not occupied by anybody unauthorised during construction, and is handed over to the Employer with vacant possession of complete building(s). If such building though completed is occupied illegally, then the Employer shall have the option to refuse to accept the said building/ buildings in that position. Any delay in acceptance on this account will be treated as the delay in completion and for such delay a levy up to 5% of Contract Price of the work may be imposed by the Employer /Employer's Representative whose decision shall be final both with regard to the justification and quantum and be binding on the Contractor. The Employer, through a notice, may require the Contractor to remove the illegal occupation any time on or before construction and delivery.

7 Plant, Materials and Workmanship

7.1

Manner of Execution	<p>The Contractor shall carry out the manufacture of Plant, the production and manufacture of Materials, and all other execution of the Works:</p> <ul style="list-style-type: none">(a) In the manner (if any) specified in the Contract,(b) In a proper workmanlike and careful manner, in accordance with recognised good practice, and(c) With properly equipped facilities and non-hazardous Materials, except as otherwise specified in the Contract.
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7.2

Samples	<p>The Contractor shall arrange for and submit samples to the Employer's Representative for review in accordance with the procedures for Contractor's Documents described in Sub-Clause 5.2 [Contractor's Documents], as specified in the Contract and at the Contractor's cost. Each sample shall be labelled as to origin and intended use in the Works. It will be Contractor's responsibility to return samples to their suppliers. Only selected samples shall be kept on display in a sample room at site up until the completion of works and thereafter the Contractor may return those approved samples to related suppliers.</p>
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7.3

Inspection	<p>The Contractor shall administer a Request for Inspection (RFI) system, and Employer's Personnel shall at all reasonable times:</p> <ul style="list-style-type: none">(a) Have full access to all parts of the Site and to all places from which natural Materials are being obtained, and(b) During production, manufacture and construction (at the Site and, to the extent specified in the Contract, elsewhere), be entitled to examine, inspect, measure and test the materials and workmanship, and to check the progress of manufacture of Plant and production and manufacture of Materials.
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The Contractor shall give the Employer's Personnel full opportunity to carry out these activities, including providing access, facilities, permissions and safety equipment. No such activity shall relieve the Contractor from any obligation or responsibility.

In respect of the work which Employer's Personnel are entitled to examine, inspect, measure and/or test, the Contractor shall give RFI to the Employer whenever any such work is ready (no inspection shall be scheduled beyond normal working hours) and before it is covered up, put out of sight, or packaged for storage or transport. The Employer shall then either carry out the examination, inspection, measurement or testing without unreasonable delay, or promptly give notice to the Contractor that the Employer does not require to do so. If the Contractor fails to give the notice, it shall, if and when required by the Employer, uncover the work and thereafter reinstate and make good, all at the Contractor's cost.

The Employer in its sole discretion, may appoint a Supervising Consultant for day to day supervision of the Works at the Site along with checking and certifying the Statements, interim and final, of executed work on behalf of the Employer for the purpose of ascertaining the compliance of the Employer's Requirement, progress of the Works, payment etc.

7.4

Testing

This Sub-Clause shall apply to all tests specified in the Contract, other than the Tests after Completion (if any).

The Contractor shall provide all apparatus, assistance, documents and other information, electricity, equipment, fuel, consumables, instruments, labour, Materials, and suitably qualified and experienced staff, as are necessary to carry out the relevant tests as per IS Code efficiently. The Contractor shall agree, with the Employer's Representative, the time and place for the specified testing of any Plant, Materials and other parts of the Works.

The Employer may, under Clause 13 [Variations and Adjustments], reasonably vary the details of specified tests, or instruct varied or additional tests to show that the tested Plant, Materials or workmanship is in accordance with the Contract, the cost of carrying

out this Variation shall be borne by the Contractor, notwithstanding other provisions of the Contract.

The Employer's Representative shall give the Contractor not less than 24 hours' notice of the Employer's intention to attend the tests. If the Employer does not attend at the time and place agreed, the Contractor may proceed with the tests, unless otherwise instructed by the Employer, and the tests shall then be deemed to have been made in the Employer's presence.

If the Contractor suffers delay and/or incurs Cost from complying with these instructions or as a result of a delay for which the Employer is responsible, the Contractor shall give notice to the Employer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.5 [Extension of Time for Completion].

After receiving this notice, the Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

The Contractor shall promptly forward to the Employer duly certified reports of the tests. When the specified tests have been passed, the Employer shall endorse the Contractor's test certificate, or issue a certificate to the Contractor, to that effect. If the Employer has not attended the tests, it shall be deemed to have accepted the readings as accurate.

7.5

Rejection If, as a result of an examination, inspection, measurement or testing, any Plant, Materials, or workmanship is found to be defective or otherwise not in accordance with the Contract, the Employer may reject the Plant, Materials, or workmanship by giving notice to the Contractor, with reasons. The Contractor shall then promptly make good the defect and ensure that the rejected item complies with the Contract.

If the Employer requires this Plant, Materials, or workmanship to be retested, the tests shall be repeated under the same terms and conditions. If the rejection and retesting cause the Employer to incur additional costs, the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay these costs to the Employer.

7.6

Remedial Work Notwithstanding any previous test or certification, the Employer may instruct the Contractor to:

- (a) Remove from the Site and replace any Plant or Materials which is not in accordance with the Contract,
- (b) Remove and re-execute any other work which is not in accordance with the Contract, and
- (c) Execute any work which is urgently required for the safety of the Works, whether because of an accident, unforeseeable event or otherwise.

If the Contractor fails to comply with any such instruction, which complies with Sub Clause 3.4 [Instructions], the Employer shall be entitled to employ and pay other persons to carry out the work. Except to the extent that the Contractor would have been entitled to payment for the work, the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay to the Employer all costs arising from this failure.

7.7

Ownership of Plant and Materials Each item of Plant and Materials shall, to the extent consistent with the Laws of the Country, become the property of the Employer, free from liens and other encumbrances, when it is delivered to the Site.

7.8

Royalties The Contractor shall pay all royalties, rents and other payments for: -

- (a) Natural Materials obtained from outside the Site.
- (b) The disposal of Materials from demolitions and excavations and of other surplus Materials (whether natural or man-made), except to the extent that disposal areas within the Site are specified in the Contract.

8 Commencement, Delays and Suspension

8.1

Commencement
of
Works

Unless otherwise stated in the Particular Conditions :

- (a) The Employer shall give the Contractor not less than 7 days' notice of the Commencement date; and
- (b) the actual date of commencement of the Works shall be the date of the handing over possession of the Site.

The Contractor shall commence the execution of the Works as soon as is reasonably practicable after date of getting the Letter of Acceptance / Notification of Award, and shall then proceed with the Works with due expeditiousness and without delay.

However, under no circumstances, Commencement of Works shall be delayed on the guise of any site clearance or relocation of services.

8.2

Time for
Completion

The Contractor shall complete the whole of the Works, end each Section (if any), within the Time for Completion (2 years) for the Works or Section (as the case may be), including:

- (a) Achieving the passing of the Tests on Completion, and
- (b) Completing all work which is stated in the Contract as being required for the Works or Section to be considered to be completed for the purposes of taking over under Sub-Clause 10.1 [Taking Over of the Works and Sections].

8.3

Programme

Activities in the initial works programme would be arranged as per the Works Break Down Structure (WBS) of the work developed by the Contractor in consultation with and approved by the Employer's Representative. As soon as possible after the Contract is concluded the Contractor shall submit a Net Work (PERT/CPM) Time and Progress Chart for each activity and milestone and get it approved by the Employer's Representative. The Chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the Works. It shall indicate sequence of

various activities of the phased requirement of Plant and equipment to be deployed by the Contractor, the forecast of the dates of commencement and completion of various trades of Sections of the Works and may be amended as necessary by agreement between the Employer's Representative and the Contractor within the limitations of time imposed in the Contract documents, and further to ensure good progress during the execution of the Works, the Contractor shall in all cases in which the time allowed for any work, exceeds one month (save for special jobs for which a separate programme has been agreed upon) complete the work as per milestones approved by the Employer. After the work has started, the Contractor shall deliver in every fortnight to the Employer an update of the construction programme showing changes, if any, in planning or progress scheduling and reflecting the progress of all the activities of the Net Work and the Project status as at the end of previous month. If the Contractor falls behind the approved construction programme by more than one month, it shall, within 14 (fourteen) working days from the date of such information, submit for approval, a revised construction programme showing the proposed measures, including augmentation of Plant, labour and Materials resources to complete the Works on time.

The Contractor shall submit a revised programme whenever the previous programme is inconsistent with actual progress or with the Contractor's obligations. Whenever the Contractor proposes to change the construction programme, it shall immediately advise the Employer's Representative in writing and, if the Employer's Representative considers the change a major one, the Contractor shall submit a revised programme for approval.

Detailed Net Work Plan shall be prepared by the Contractor for each and every activity within the same time frame and in the same sequence as indicated in the master Net Work plan. Such programme shall be according to such computer program as determined by the Employer from time to time and for the time being in the latest version of Microsoft Projects. A copy of the same shall also be installed at a designated computer of the Employer's Representative. The data shall be updated fortnightly in the designated computer at the office of the Employer by the Contractor. The Employer shall compare the projected progress and the actual progress and if upon comparison finds that the actual progress is not satisfactory, the Employer shall issue instruction to the Contractor to meet the projected progress within a particular time period.

The Employer's monitoring team will have access to all the data/information of the Contractor, required for the assessment of the progress and monitoring. If necessary, the monitoring team will visit the Site in order to assess the status of critical activities.

If the Employer through a notice to the Contractor states that a programme fails (to the extent stated) to comply with the Contract or to be consistent with actual progress and the Contractor's stated intentions, in this event, or if the Contractor foresees any specific probable future event or circumstances which may adversely affect or delay the execution of the Works, the Contractor shall promptly give notice to the Employer and the Contractor shall provide additional inputs whenever there is a possible slip-page in the completion schedule. Such additional inputs may require supplementing of equipment, personnel, work in excess of the normal work per day, and work in excess of the normal work per week or other resources.

The programme shall include:

- (a) The order in which the Contractor intends to carry out the Works, including the anticipated timing of each major stage of the Works.
- (b) The periods for reviews.
- (c) The sequence and timing of inspections and tests specified in the Contract, and
- (d) A supporting report which includes:
 - i. A general description of the methods which the Contractor intends to adopt for the execution of each major stage of the Works, and
 - ii. The approximate number of each class of Contractor's Personnel and of each type of Contractor's Equipment for each major stage.

The Employer will hold periodic Project Status Review Meetings. The Contractor shall depute its Engineers/Managers at appropriate level as decided by the Employer to attend the Review Meetings.

8.4 Execution

8.4.8

Mobilisation

Period of Mobilisation shall be 7 days counting from the stipulated date of start of work as mentioned in Letter of Acceptance/ Notification of Award by the Employer. The Contractor shall carry out following activities within this period stated. It shall submit to the Employer's Representative within the same 7 days period, the stipulated date of start, the proposed layout of locating offices, stores, godowns, yards, water, electric network etc. for approval of the Employer's Representative. Following activities shall be completed within the mobilisation period of 7 days or such extended period as approved by the Employer's Representative: -

- (a) Site office of the Contractor
- (b) Line out including establishing of grid line levels and its approval from the Employer's Representative.
- (c) Tapping electric and water connections
- (d) One cement store and steel yard
- (e) Obtaining insurance policies as per the Contract
- (f) Obtaining labour licences, as required
- (g) Obtaining approval of local authorities and complying with any statutory requirements prior to actual start of work.
- (h) Establishing water and electric network within site.
- (i) Submitting the programme in terms of Sub-Clause 8.3 and its approval by the Employer's Representative.

8.4.9

Setting out of Works

The Contractor shall be responsible for the true and proper setting-out of the Works in relating to original points, lines and levels of reference given by the Employer's Representative in writing and for the correctness, subject as above mentioned, of the position, levels, dimension and alignment of all parts of the Works and for the provision of all necessary instruments, appliances and labour in connection therewith. If, at any time during the progress of the Works, any error shall appear or arise in the position, levels, dimensions or alignment of any part of the Works, the Contractor, on being required so to do by the Employer's Representative shall, at its own cost, rectify such error to the satisfaction of the Employer's Representative. The checking of any setting-out or of any line or level by the Employer's Representative shall not in any way relieve the Contractor of its responsibility for the correctness thereof and the Contractor shall carefully protect and preserve all bench-marks, sight-rails, pegs and other things used in setting-out the works. The Contractor shall use latest equipment like Total Station/Theodolite and Auto level etc. for setting out the works.

8.4.3

Temporary Works

The Contractor is entirely responsible for the construction, maintenance and removal of all Temporary Works employed in executing the Project. Within a reasonable time (and in any case not less than 15 days) before it intends to commence construction of any Temporary Works, the Contractor shall submit full particulars including drawings of the same, for the approval of the Employer's Representative. The Employer's Representative's approval will in no way relieve the Contractor of its responsibility for the safety of the Works, operators, adjoining property, structures or services and compliance with appropriate regulations and codes of practice. Documents for Temporary Works supporting adjoining buildings, property and public utilities and roads shall also be submitted to the appropriate authority for their approval if requested /required.

- (a) The Temporary Works shall be constructed in such a manner as to enable the permanent structures to be built around them without detriment to their effectiveness and due allowance will be deemed to have been made for all necessary adjustments thereto to enable the Works to proceed.
- (b) Timber shoring, boards, struts or similar items shall not be left in position upon completion of the Works without the written consent of the Employer's Representative.

- (c) All services or utilities on or adjoining the Site which are required to be maintained operational shall be protected from movement, subsidence or damage from any cause whatsoever by adequate temporary props, struts, shores and protective screens to the approval of the Employer's Representative and the agent of the service or utility.
- (d) The Contractor shall make safe and reinstate all areas affected by the Temporary Works.
- (e) The Contractor shall use properly designed and manufactured steel staging platforms for carrying out work above 3.0 m height. All required staging for supporting, centering, shuttering of beams, slab, masonry work, etc. shall be carried out strictly as per approved arrangement. No work above 3.0 m shall be permitted without compliance of this condition.

8.4.4

Plant, Temporary Works & Materials
– Exclusive

Use of all Plant, Temporary Works and Materials provided by the Contractor, when brought on to the Site, shall be deemed for the execution of the Works exclusive to this Project and the Contractor shall not remove the same or any part thereof, except for the purpose of moving it from one part of the Site to another, without the consent, in writing, of the Employer's Representative, which shall not be unreasonably withheld by the Employer.

8.4.5

Use of Site only
for Works

The Contractor shall not use any portion of the Site for purpose not connected with the Works without the prior written approval of the Employer's Representative. It shall maintain permanent and Site access roads free of spillage and shall not interfere with the flow of traffic. The same shall apply to terraces and other developed areas.

8.4.6

Name Board at Site	<p>The Contractor shall prepare and display name board at Site as per design approved by the Employer's Representative. It shall have: -</p> <ul style="list-style-type: none">(a) Name of Works, statutory approval details, an image.(b) Name of the Employer.(c) Name of the Consulting Architect & Project Management Consultant.(d) Name of the structural Consultant.(e) Name of the Contractor.
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8.4.7

Site Drainage/ Cleaning/ Nuisance	<p>All water which may accumulate on the Site during the progress of the Works or in trenches and excavation, shall be removed from the Site to the satisfaction of the Employer's Representative at the Contractor's cost.</p> <p>The Site shall be maintained free from rubbish. Proper stacking of scaffolding Materials, shuttering material, bricks/brick bats, steel pieces, etc. needed for work on day to day basis shall be organized. Heaps in unplanned manner and disorderly fashion shall not be permitted. The Employer's Representative 's decision in this matter shall be final.</p> <p>The Contractor shall not, at any time, cause or permit any nuisance on the Site or do anything which shall cause unnecessary disturbance or inconvenience to the Employer, tenants or occupants of other properties near the Site and to the public in general.</p>
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8.4.8

Disposal of Rubbish	<p>The Contractor shall cart away from Site and deposit where directed by the Employer's Representative, all refuse, etc. arising from the Works both as it accumulates and at completion of the Works at the direction of the Employer's Representative.</p> <p>It is the responsibility of the Contractor to obtain a certificate from the local authorities concerned to the effect that all rubbish arising out of Contractor's activities at the construction site or any other offsite activities borrow pits and/or disposal area (s) has been properly disposed of.</p>
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8.4.9

Urgent
Repairs

If, by reason of any accident or failure, or other event occurring to, in, or in connection with the Works or any part thereof, either during the execution of the Works or during the Defects Liability Period, any remedial or other work or repair shall, in the opinion of the Employer's Representative, be urgently necessary for the safety of the Works and the Contractor is unable or unwilling at once to do such work or repair, the Employer may employ and pay other persons to carry out such work or repair as the Employer's Representative may consider necessary. If the work or repair so done by the Employer is work which, in the opinion of the Employer's Representative, the Contractor was liable to do at its own expense under the Contract, all expenses properly incurred by the Employer in so doing shall be recoverable from the Contractor by the Employer or may be deducted by the Employer from any moneys due or which may become due to the Contractor. Provided always that the Employer's Representative, shall, as soon after the occurrence of any such emergency as may be reasonably practicable, notify the Contractor thereof in writing.

8.4.10

Contractor to
search

The Contractor shall, if required by the Employer's Representative in writing, search under the directions of the Employer's Representative for the cause of any defect, imperfection or fault appearing during the progress of the Works or within the Defects Liability Period. If such defect, imperfection or fault shall be one for which the Contractor is liable, the cost of the work carried out in searching as aforesaid shall be borne by the Contractor and it shall in such case repair, rectify and make good such defect, imperfection or fault at its own expense in accordance with the provisions of Clause 17 [Risk and Responsibility] hereof.

8.5

Extension of
Time for
Completion

The Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to an extension of the Time for Completion if and to the extent that completion for the purposes of Sub-Clause 10.1 [Taking Over of the Works and Sections] is or will be delayed by any of the following causes: -

- | | |
|--|--|
| Extension of
Time for
Completion | <p>(a) A Variation (unless an adjustment to the Time for Completion has been agreed under Sub-Clause 13.1.1 [Variation Procedure]).</p> <p>(b) Any delay, impediment or prevention caused by or attributable to the Employer, the Employer's Personnel, or the Employer's other contractors on the Site.</p> |
|--|--|

If the Contractor considers himself to be entitled to an extension of the Time for Completion, the Contractor shall give notice to the Employer in accordance with Sub-Clause 20.1 [Contractor's Claims]. When determining each extension of time under Sub-Clause 20.1, the Employer shall review previous determinations and may increase, but shall not decrease, the total extension of time.

8.6

- | | |
|---------------------|--|
| Rate of
Progress | <p>If, at any time: -</p> <p>(a) actual progress is too slow to complete within the Time for Completion, and/or</p> <p>(b) progress has fallen (or will fall) behind the current programme</p> |
|---------------------|--|

Other than as a result of a cause listed in Sub-Clause 8.5 [Extension of Time for Completion], then the Employer may instruct the Contractor to submit, a revised programme and supporting report describing the revised methods which the Contractor proposes to adopt in order to expedite progress and complete within the Time for Completion.

Unless the Employer notifies otherwise, the Contractor shall adopt these revised methods, which may require increases in the working hours and/or in the numbers of Contractor's Personnel and/or Goods, at the risk and cost of the Contractor. If these revised methods cause the Employer to incur additional costs, the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay these costs to the Employer, in addition to delay damages (if any) under Sub-Clause 8.7 below.

8.7

If the Contractor fails to maintain the required progress in terms hereof, or to complete the work and clear the Site on or before the Date for Completion or the extended date of completion, it shall, without prejudice to any other right or remedy available

Delay
Damages

under the law to the Employer on account of such breach, pay as agreed compensation the amount calculated at the rates stipulated below.

This will also apply to items or group of items for which a separate period of completion has been specified.

Compensation for delay of work @0.5% of the Contract Price per month of delay to be computed on per day basis.

Provided always that the total amount of compensation for delay to be paid under this condition shall not exceed 10% of the Contract Price.

The penalty shall not relieve the Contractor from its obligation to complete the Works or from any other of its obligations and liabilities under the Contract.

The Contractor shall co-ordinate its programme to the extent feasible with the programme of other Contractors to be engaged at the Site or in the vicinity of the Site as furnished by the Employer's Representative so that the Project can be completed in time as per the overall programme.

The amount of compensation may be adjusted or set-off against any sum payable to the Contractor under this or any other Contract with the Employer. In case, the Contractor does not achieve a particular milestone as approved by the Employer or the rescheduled milestone(s), the amount shown against that milestone shall be withheld, to be adjusted against the compensation levied at the final grant of Extension of Time. Withholding of this amount on failure to achieve a milestone, shall be automatic without any notice to the Contractor. However, if the Contractor catches up with the progress of Work on the subsequent milestone(s), the withheld amount shall be released. In case the Contractor fails to make up for the delay in subsequent milestone(s), amount mentioned against each milestone missed subsequently also shall be withheld. However, no interest, whatsoever, shall be payable on such withheld amount.

8.8

Suspension of Work The Employer may at any time instruct the Contractor to suspend progress of part or all of the Works. During such suspension, the Contractor shall protect, store and secure such part or the Works against any deterioration, loss or damage. The Employer may also notify the cause for the suspension. If and to the extent that the cause is notified and is the responsibility of the Contractor, the following Sub-Clauses 8.9 and 8.11 shall not apply.

8.9

Consequences of Suspension If the Contractor suffers delay for complying with the Employer's instructions under Sub Clause 8.8 [Suspension of Work], and/or from resuming the work, the Contractor shall give notice to the Employer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.5 [Extension of Time for Completion], and after receiving this notice/the Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters. The Contractor shall not be entitled to an extension of time for, or to payment of the Cost incurred in, making good the consequences of the Contractor's faulty workmanship or Materials, or of the Contractor's failure to protect, store or secure in accordance with Sub-Clause 8.8 [Suspension of Work].

8.10 Intentionally kept blank

8.11

Prolonged Suspension If the suspension under Sub-Clause 8.8 [Suspension of Work] has continued for more than 84 days, the Contractor may request the Employer's permission to proceed. If the Employer does not give permission within 28 days after being requested to do so, the Contractor may, by giving notice to the Employer, treat the suspension as an omission under Clause 13 [Variations and Adjustments] of the affected part of the Works.

8.12

Resumption of Work After the permission or instruction to proceed is given, the Parties shall jointly examine the Works and the Plant and Materials affected by the suspension. The Contractor shall make good any deterioration or defect in or loss of the Works or Plant or Materials, which has occurred during the suspension.

9 Tests on Completion

9.1

Contractor's Obligations

The Contractor shall carry out the Tests on Completion in accordance with this Clause and Sub-Clause 7.4, [Testing] after providing the documents in accordance with Sub Clause 5.6 [As-Built Documents] and Sub-Clause 5.7 [Operation and Maintenance Manuals] including tests prescribed in NBC 2016 & BIS and / or instructed by Employer's Representative.

The Contractor shall give to the Employer not less than 21 days' notice of the date after which the Contractor will be ready to carry out each of the Tests on Completion. Unless otherwise agreed, Tests on Completion shall be carried out within 14 days after this date, on such day or days as the Employer shall instruct.

The Tests on Completion shall be carried out in the following sequence:

- (a) pre-commissioning tests, which shall include the appropriate inspections and ("dry" or "cold") functional tests to demonstrate that each item of Plant or Materials can safely under-take the next stage;
- (b) commissioning tests, which shall include the specified operational tests to demonstrate that the Works or Section can be operated safely and as specified, under all available operating conditions; and
- (c) trial operation, which shall demonstrate that the Works or Section perform reliably and in accordance with the Contract.

During trial operation, when the Works are operating under stable conditions, the Contractor shall give notice to the Employer that the Works are ready for any other Tests on Completion, including performance tests to demonstrate whether the Works conform with criteria specified in the Employer's Requirements and with the Performance Guarantees.

Trial operation shall not constitute a taking-over under Clause 10 [Employer's Taking Over]. Unless otherwise stated in the Particular Conditions, any product produced by the Works during trial operation shall be the property of the Employer.

In considering the results of the Tests on Completion, appropriate allowances shall be made for the effect of any use of the Works by the Employer on the performance or other characteristics of the Works. As soon as the Works, or a Section, have passed each of the Tests on Completion described in sub-paragraph (a), (b) or (c), the Contractor shall submit a certified report of the results of these Tests to the Employer.

9.2

Delayed Tests

If the Tests on Completion are being unduly delayed by the Contractor, the Employer may by notice require the Contractor to carry out the Tests within 21 days after receiving the notice. The Contractor shall carry out the Tests on such day or days within that period as the Contractor may fix and of which it shall give notice to the Employer. If the Contractor fails to carry out the Tests on Completion within the period of 21 days, the Employer's Personnel may proceed with the Tests at the risk and cost of the Contractor. These Tests on Completion shall then be deemed to have been carried but in the presence of the Contractor and the results of the Tests shall be accepted as accurate.

9.3

Retesting

If the Works, or a Section, fail to pass the Tests on Completion, Sub-Clause 7.5 [Rejection] shall apply, and the Employer or the Contractor may require the failed Tests, and Tests on Completion on any related work, to be repeated under the same terms and conditions.

9.4

Failure to Pass Tests on Completion

If the Works, or a Section, fail to pass the Tests on Completion repeated under Sub-Failure to Pass Tests on Clause 9.3 [Retesting], the Employer shall be entitled to: (a) order further repetition of Tests on Completion under Sub-Clause 9.3; (b) if the failure deprives the Employer of substantially the whole benefit of the Works or Section, reject the Works or Section (as the case may be), in which event the Employer shall have the same remedies as are provided in sub-paragraph (c) of Sub-Clause 11.4 [Failure to Remedy Defects]; or (c) issue a Taking-Over Certificate. In the event of sub-paragraph (c), the Contractor shall proceed in accordance with all other obligations under the Contract, and the Contract Price shall be reduced by such amount as shall be appropriate to cover the reduced value to the Employer as a result of this failure. Unless the relevant reduction for this failure is stated (or its method of calculation is defined) in the Contract, the Employer may require the reduction to be (i) agreed by both Parties (in full satisfaction of this failure only) and paid before this Taking-Over Certificate is issued, or (ii) determined and paid under Sub-Clause 2.5 [Employer's Claims] and Sub-Clause 3.5 [Determinations].

10 Employer's Taking Over

10.1

Taking Over of the Works and Sections

Except as stated in Sub-Clause 9.4 [Failure to Pass Tests on Completion], the Works shall be taken over by the Employer when (i) the Works have been completed in accordance with the Contract, including the matters described in Sub-Clause 8.2 [Time for Completion] and except as allowed in sub-paragraph (a) below, and (ii) a Taking Over Certificate for the Works has been issued, or is deemed to have been issued in accordance with this Sub-Clause. The Contractor may apply by notice to the Employer for a Taking-Over Certificate not earlier than 14 days before the Works will, in the Contractor's opinion, be completed and ready for taking over. If the Works are divided into Sections, the Contractor may similarly apply for a Taking Over Certificate for each Section.

The Employer shall, within 28 days after receiving the Contractor's application:

- (a) issue the Taking-Over Certificate to the Contractor, stating the date on which the Works or Section were completed in accordance with the Contract, except for any minor outstanding work and defects which will not substantially affect the use of the Works or

Taking Over of the Works and Sections

Section for their intended purpose (either until or whilst this work is completed and these defects are remedied); or

(b) reject the application, giving reasons and specifying the work required to be done by the Contractor to enable the Taking-Over Certificate to be issued. The Contractor shall then complete this work before issuing a further notice under this Sub-Clause.

If the Employer fails either to issue the Taking-Over Certificate or to reject the Contractor's application within the period of 28 days, and if the Works or Section (as the case may be) are substantially completed in accordance with the Contract, the Taking-Over Certificate shall be deemed to have been issued on the last day of that period.

10.2

Taking Over of Parts of the Works due to Default of the Contractor and Recovery of Additional Cost

Parts of the Works (other than Sections) shall not be taken over or used by the Employer, except as may be stated in the Contract or as may be agreed by both Parties.

If the Contractor:

- (a) At any time makes default during currency of work or does not execute any part of the work with due diligence and continues to do so even after a notice in writing of 7 days in this respect from the Employer's Representative; or
- (b) Commits default in complying with any of the terms and conditions of the contract and does not remedy it or takes effective steps to remedy it within 7 days even after a notice in writing is given in that behalf by the Employer's Representative; or
- (c) Fails to complete the work(s) or items of work with individual dates of completion, on or before the date(s) so determined, and does not complete them within the period specified in the notice given in writing in that behalf by the Employer's Representative. The Employer, without prejudice to any other right or remedy against the Contractor which have either accrued or accrue thereafter to the Employer, by a notice in writing to take the part work / part incomplete work of any item (s) out of its hands and shall have powers to:

- i. Take possession of the Site and any Materials, constructional Plant, implements, stores etc., thereon; and / or

- ii. Carry out the part work / part incomplete work of any item (s) by any other Agency. In such an event, the Contractor shall be liable for loss / damage suffered by the Employer because of action under this clause and to compensate for this loss or damage, the Employer shall be entitled to recover a sum equivalent to 20% of the value of the part work / part incomplete work so taken away subject to a maximum limit of 10% of the Contract Price of the work.

The value of the work taken away shall be calculated for the items and Quantities taken away, at the Contract rates including price variation as applicable on the date when notice in writing for taking away part work, was issued to the Contractor. The Contractor from whom part work is being taken out, shall not be allowed to participate in the tendering process for carrying out such work.

The amount to be recovered from the Contractor as determined above, shall, without prejudice to any other right or remedy available to the Employer as per law or as per agreement, will be recovered from any money due to the Contractor on any account, and if such money is insufficient, the Contractor shall be called upon in writing and the Contractor shall be liable to pay the same within 30 days.

If the Contractor fails to pay the required sum within the aforesaid period of 30 days, the Employer shall have the right to sell any or all of the Contractor's unused Materials, constructional Plant, implements, temporary building at Site etc., and adjust the proceeds of sale thereof towards the dues recoverable from the Contractor under the Contract and if thereafter there remains any balance outstanding, it shall be recovered in accordance with the provisions of the Contract. In the event of the above course being adopted by the Employer, the Contractor shall have no claim to compensation for any loss sustained by it, by reasons of having purchased or procured any Materials or entered into any engagements or made any advance on any account or with a view to the execution of the work or the performance of the Contract.

10.3

Interference with Tests on Completion

If the Contractor is prevented, for more than 14 days, from carrying out the Tests on Completion by a cause for which the Employer is responsible, the Contractor shall carry out the Tests on Completion as soon as practicable.

If the Contractor suffers delay and/or incurs Cost as a result of this delay in carrying out the Tests on Completion, the Contractor shall give notice to the Employer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.5 [Extension of Time for Completion].

After receiving this notice, the Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

11 Defects Liability

11.1

Completion of Outstanding Work and Remedying Defects

In order that the Works and Contractor's Documents, and each Section, shall be in the condition required by the Contract (fair wear and tear excepted) by the expiry date of the relevant Defects Notification Period or as soon as practicable thereafter, the Contractor shall:

(a) complete any work which is outstanding on the date stated in a Taking-Over Certificate, within such reasonable time as is instructed by the Employer/Employer's Representative, and

(b) execute all work required to remedy defects or damage, as may be notified by the Employer on or before the expiry date of the Defects Notification Period for the Works or Section (as the case may be).

Defects Liability Period for the purpose of the Contract shall be 5 (five) years from the date of Taking Over Certificate. Two certified/licenced personnel shall be engaged full time on-site by the Contractor for managing complaints or defects that may appear or

Completion of Outstanding Work and Remedying Defects	damages that may occur in plumbing and electrical works, or any other Works (as the case may be); Contractor's personnel shall be engaged for the entire duration of Defects Liability Period. If a defect appears or damage occurs, the Employer shall notify the Contractor accordingly.
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During the Defects Liability Period, the Earnest Money Deposit will be refunded to the Contractor, in the following phases:

- a) 30% of the Earnest Money Deposit shall be refunded to the Contractor, after successful completion of the 4th year of the Defects Liability Period; and
- b) the balance 70% of the Earnest Money Deposit shall be refunded to the Contractor, upon successful completion of the entire Defects Liability Period, i.e. upon completion of 5(five) years from the date of handing over.

11.2

Cost of Remedying Defects	All work referred to in sub-paragraph (b) of Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects] shall be executed at the risk and cost of the Contractor, if and to the extent that the work is attributable to:
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- (a) Plant, Materials, Goods, or workmanship not being in accordance with the Contract.
- (b) The quality of the construction works for which the Contractor is responsible.
- (c) Improper operation or maintenance which was attributable to matters for which the Contractor is responsible (under Sub-Clauses 5.6 and 5.7 or otherwise), or
- (d) Failure by the Contractor to comply with any other obligation.

If and to the extent that such work is attributable to any other cause, the Employer may give notice to the Contractor accordingly, and Variation Procedure shall apply.

11.3

Extension of Defects Notification Period	The Employer shall be entitled subject to Sub-Clause 2.5 [Employer's Claims] to an extension of the Defects Notification Period (not exceeding by a period of 2 years) for the Works or a Section if and to the extent that the Works, Section or a major item of
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Plant (as the case may be, and after taking over) cannot be used for the purposes for which they are intended by reason of a defect or damage.

Extension of
Defects Notifi-
cation Period

If delivery and/or erection of Plant and/or Materials was suspended under Sub-Clause 8.8 [Suspension of Work], the Contractor's obligations under this Clause shall not apply to any defects or damage occurring more than 2 years after the Defects Notification Period for the Plant and/or Materials would otherwise have expired.

11.4

Failure to
Remedy
Defects

If the Contractor fails to remedy any defect or damage within a reasonable time, a date may be fixed by the Employer, on or by which the defect or damage is to be remedied. The Contractor shall be given reasonable notice of this date.

If the Contractor fails to remedy the defect or damage by this notified date and this remedial work was to be executed at the cost of the Contractor under Sub-Clause 11.2 [Cost of Remedying Defects], the Employer may (at its option):

- (a) Carry out the work itself or by others, in a reasonable manner and at the Contractor's cost, but the Contractor shall have no responsibility for this work; and the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay to the Employer the costs reasonably incurred by the Employer in remedying the defect or damage.
- (b) Agree or determine a reasonable reduction in the Contract Price in accordance with Sub-Clause 3.5 [Determinations]; or
- (c) If the defect or damage deprives the Employer of substantially the whole benefit of the Works or any major part of the Works, terminate the Contract as a whole, or in respect of such major part which cannot be put to the intended use. Without prejudice to any other rights, under the Contract or otherwise, the Employer shall then be entitled to recover all sums paid for the Works or for such part (as the case may be), plus financing costs and the cost of dismantling the same, clearing the Site and returning Plant and Materials to the Contractor.

11.5

Removal of Defective Work

If the defect or damage cannot be remedied expeditiously on the Site and the Employer gives consent, the Contractor may remove from the Site for the purposes of repair such items of Plant as are defective or damaged. This consent shall require the Contractor to increase the amount of the Performance Security by the full replacement cost of these items, or to provide other appropriate security.

11.6

Further Tests

If the work of remedying of any defect or damage may affect the performance of the Works, the Employer may require the repetition of any of the tests described in the Contract, including Tests on Completion and/or Tests after Completion. The requirement shall be made by notice within 28 days after the defect or damage is remedied. These tests shall be carried out in accordance with the terms applicable to the previous tests, except that they shall be carried out at the risk and cost of the Party liable, under Sub-Clause 11.2 [Cost of Remedying Defects], for the cost of the remedial work.

11.7

Right of Access

Until the Performance Certificate has been issued, the Contractor shall have the right of access to all parts of the Works and to records of the operation and performance of the Works, except as may be inconsistent with the Employer's reasonable security restrictions.

11.8

Contractor to Search

The Contractor shall, if required by the Employer, search for the cause of any defect, under the direction of the Employer. Unless the defect is to be remedied at the cost of the Contractor under Sub-Clause 11.2 [Cost of Remedying Defects], the Cost of the search shall be agreed or determined in accordance with Sub Clause 3.5 [Determinations] and shall be added to the Contract Price.

11.9

Performance Certificate

Performance of the Contractor's obligations shall not be considered to have been completed until the Employer has issued the Performance Certificate to the Contractor, stating the date on which the Contractor completed its obligations under the Contract.

Performance Certificate	The Employer shall issue the Performance Certificate within 28 days after the expiry of the Defects Liability Period. If the Employer fails to issue the Performance Certificate accordingly, the Performance Certificate shall be deemed to have been issued on the date 28 days after the date on which it should have been issued, as required by this Sub-Clause.
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Only the Performance Certificate shall be deemed to constitute acceptance of the Works.

11.10

Unfulfilled Obligations	After the Performance Certificate has been issued, each Party shall remain liable for the fulfilment of any obligation which remains unperformed at that time. For the purposes of determining the nature and extent of unperformed obligations, the Contract shall be deemed to remain in force.
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11.11

Clearance of Site	Upon the expiry of the Defects Liability Period, the Contractor shall remove any remaining Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works from the Site. If all these items have not been removed within 28 days after the Employer issues the Performance Certificate, the Employer may sell or otherwise dispose of any remaining items. The Employer shall be entitled to be paid the costs incurred in connection with, or attributable to, such sale or disposal and restoring the Site. Any balance of the moneys from the sale shall be paid to the Contractor. If these moneys are less than the Employer's costs, the Contractor shall pay the outstanding balance to the Employer.
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12 Tests after Completion

12.1

Procedure for Tests after Completion

If Tests after Completion are specified in the Contract, this Clause shall apply unless otherwise stated in the Particular Conditions: -

(a) the Contractor shall provide any other Plant, equipment and suitably qualified and experienced staff, as are necessary to carry, out the Tests after Completion efficiently; and

(b) the Contractor shall carry out the Tests after Completion in the presence of such Employer's and/or Contractor's Personnel as either Party may reasonably request.

(c) The Tests after Completion shall be carried out as soon as is reasonably practicable after the Works or Section have been taken over by the Employer, the Employer shall give to the Contractor 21 days' notice of the date after which the Tests after Completion will be carried out. Unless otherwise agreed, these Tests shall be carried out within 14 days after this date, on the day or days determined by the Employer.

(d) The results of the Tests after Completion shall be compiled and evaluated by the Contractor, who shall prepare a detailed report. Appropriate account shall be taken of the effect of the Employer's prior use of the Works.

12.2

Delayed Tests

If the Contractor incurs Cost as a result of any unreasonable delay by the Employer to the Tests after Completion, the Contractor shall (i) give notice to the Employer and (ii) be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to payment of any such Cost plus reasonable profit, which shall be added to the Contract Price.

After receiving this notice, the Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine this Cost and profit.

If, for reasons not attributable to the Contractor, a Test after Completion on the Works or any Section cannot be completed during the Defects Notification Period (or any other period agreed upon by both Parties), then the Works or Section shall be deemed to have passed this Test after Completion.

12.3

Retesting

If the Works, or a Section, fail to pass the Tests after Completion

(a) Sub-Clause 11.1 [Completion of Outstanding Work and Remedying of Defects] shall apply, and

(b) either Party may then require the failed Tests, and the Tests after Completion on any related work, to be repeated under the same terms and conditions.

If and to the extent that this failure and retesting are attributable to any of the matters listed Sub-Clause 11.2 [Cost of Remedying Defects] and cause the Employer to incur additional costs, the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay these costs to the Employer.

12.4

Failure to Pass Tests after Completion

If the Works, or a Section, fail to pass a Test after Completion and the Contractor proposes to make adjustments or modifications to the Works or such Section, the Contractor may be instructed by (or on behalf of) the Employer that right of access to the Works or Section cannot be given until a time that is convenient to the Employer. The Contractor shall then remain liable to carry out the adjustments or modifications and to satisfy this Test, within a reasonable period of receiving, notice by (or on behalf of) the Employer of the time that is convenient to the Employer. Even if the Contractor does not receive this notice during the relevant Defects Notification Period, the Contractor shall not be relieved of this obligation.

13 Variations and Adjustments

13.1

Right to Vary

No Variation shall be accepted unless specifically stated in this contract.

Variations may be initiated by the Employer at any time prior to issuing the Taking-Over Certificate for the Works, either by an instruction or by a request for the Contractor to submit a proposal. A Variation shall not comprise the omission of any work which is to be carried out by others.

13.1.1

Variation Procedure

If the Employer requests a proposal, prior to instructing a Variation, the Contractor shall respond in writing as soon as practicable, either by giving reasons why it cannot comply (if this is the case) or by submitting:

- (a) A description of the proposed design and/or work to be performed and a programme for its execution
- (b) the Contractor's proposal for any necessary modifications to the programme according to Sub-Clause 8.3 [Programme] and to the Time for Completion and
- (c) the Contractor's proposal for adjustment to the Contract Price.

The Employer shall, as soon as practicable after receiving such proposal, respond with approval, disapproval or comments. The Contractor shall not delay any work whilst awaiting a response.

13.1.2

Daywork

For work of a minor or incidental nature, the Employer may instruct that a Variation shall be executed on a daywork basis. The work shall then be valued in accordance with the daywork schedule included in the Contract. Before ordering Goods for the work, the Contractor shall submit quotations to the Employer. When applying for payment, the Contractor shall submit invoices, vouchers and accounts or receipts for any Goods.

Except for any items for which the daywork schedule specifies that payment is not due, the Contractor shall deliver each day to the Employer accurate statements in duplicate which shall include the following details of the resources used in executing the previous day's work:

- (a) the names, occupations and time of Contractor's Personnel,
- (b) the identification type and time of Contractor's Equipment and Temporary Works, and
- (c) the quantities and types of Plant and Materials used.

One copy of each statement will, if correct, or when agreed, be signed by the Employer and returned to the Contractor. The Contractor shall then submit priced statements of these resources to the Employer, prior to their inclusion in the next Statement under Sub-Clause 14.3 [Application for Interim Payments].

If a daywork schedule is not included in the Contract, this Sub-Clause shall not apply.

13.1.3

Adjustments
for Changes in
Legislation

The Contract Price shall be adjusted to take account of any increase or decrease in Cost resulting from a change in the Laws of the Country (including the introduction of new Laws and the repeal or modification of existing Laws) or in the judicial or official governmental interpretation of such Laws, made after the Base Date, which affect the Contractor in the performance of obligations under the Contract.

13.2

Foreclosure of
Contract due
to Abandon-
ment or Re-
duction in
Scope of
Works

If at any time after acceptance of the tender the Employer shall decide to abandon or reduce the scope of the Works for any reason whatsoever and hence not require the whole or any part of the Works to be carried out, the Employer's Representative shall give notice in writing to that effect to the Contractor, and the Contractor shall act accordingly in the matter. The Contractor shall have no claim to any payment of compensation or otherwise whatsoever, on account of any profit or advantage which it might have derived from the execution of the Works in full but which it did not derive in consequence of the foreclosure of the whole or part of the Works. The Contractor shall be paid for Works executed at site to be decided by the Employer.

14 Contract Price and Payment

14.1

Lump sum	Unless otherwise stated in the Particular Conditions:
Contract Price	<ul style="list-style-type: none">i. Payment for the Works shall be made on the basis of the lump sum Contract Price subject to adjustments (if any) in accordance with the Contract; and Payment under this Contract shall be made only in Indian Rupees.ii. The Contractor shall pay all taxes, duties and fees required to be paid by it under the Contract.

The Contract Price shall not be adjusted for any of these costs, except as stated in Sub-Clause 13.1.3 [Adjustments for Changes in Legislation].

14.2

Mobilisation Advance Payment	<p>Mobilisation Advance not exceeding 2% of the Contract Price may be given, if requested by the Contractor in writing within 30 days of the handing over of the site.</p> <p>In such a case, the Contractor shall provide Bank Guarantee securing the Mobilisation Advance from a scheduled commercial bank /financial institution as approved by RBI as per form given in Section 8 (Contract Forms) aggregating to the full amount of Mobilisation Advance before such advance is released. Such Advance shall be paid in one single-tranche. The Mobilisation Advance above shall not bear any interest. Repayment of the Mobilisation Advance shall commence as a deduction from First Interim Payment Statement @ 10% of the value of Interim Payment Statement, until the total amount of Advance has been repaid by the Contractor, provided that the complete recovery of Advance shall be made before 90% completion of Works or three-fourth of completion period as originally specified in the Contract, whichever occurs first. Recovery of Advance at any intermediate stage shall be effected, if necessary, by encashment of part Bank Guarantees if the appropriate pro-rata amount of Advance is not available from the Works done by the Contractor. If the circumstances are considered reasonable by the Employer's Representative, the period mentioned for request by the Contractor in writing for grant of Mobilization Advance may be extended in the discretion of the Employer's Representative. The</p>
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Mobilisation Advance Payment	said Bank Guarantees for advances shall initially be made for the full amount and valid for the Contract period, and be kept renewed from time to time to cover the balance amount and likely period of complete recovery.
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14.3

Application for Interim Payments	The Contractor shall submit a Statement duly certified by the Employer's Representative in six copies to the Employer after completion of each milestone referred to in Payment Schedule in Section 5 (Employer's Requirements) in a form approved by the Employer, showing in detail the amounts to which the Contractor considers himself to be entitled, together with supporting documents which shall include the relevant report on progress in accordance with Sub-Clause 4.27 [Progress Reports]. The Statement shall include the following items, as applicable, which shall be expressed in INR, in the sequence listed: (a) the estimated contract value in accordance with Payment Schedule ; (b) any other additions, or deductions which may have become due under the Contract or otherwise, including those under Clause 20 [Claims and Dispute Resolution]; and (c) the deduction of amounts included in previous Statements.
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14.4

Schedule of Payments	Milestone-based Schedule of Payments is specified in Section 5 (Employer's Requirements) in which the Contract Price will be paid in respect of the progress of the construction of the Project. All measurement shall be checked and verified by the concerned Executive Engineer (Engineer – In – Charge) and necessary certificates in this respect shall be issued as per PWD Code, before payment.
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14.5

Supporting Documents	Copies of all such reports at various stages recording the progress of the Project and completion of the consequential Project milestone, shall be compulsorily appended with each Statement as referred to in Sub-Clause 14.3 as well as the final Statement, failing which no payment shall be released by the Employer to the Contractor.
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14.6

Interim Payments

No amount will be paid until the Employer has received and approved the Performance Security. Thereafter, the Employer shall within 7 working days after receiving a Statement and supporting documents, give to the Contractor notice of any items in the Statement with which the Employer disagrees, with supporting particulars. Payments due shall not be withheld, except that:

(a) if anything supplied or work done by the Contractor is not in accordance with the Contract, the cost of rectification or replacement may be withheld until rectification or replacement has been completed; and/or

(b) if the Contractor was or is failing to perform any work or obligation in accordance with the Contract, and had been so notified by the Employer/Employer's Representative, the value of this work or obligation may be withheld until the work or obligation has been performed.

The Employer may, by any payment, make any correction or modification that should properly be made to any amount previously considered due. Payment shall not be deemed to indicate the Employer's acceptance, approval, consent or satisfaction.

14.7

Timing of Payments

Except as otherwise stated in Sub-Clause 2.5 [Employer's Claims], the Employer shall pay to the Contractor:

(a) The first instalment of the Mobilisation Advance within 30 working days after the date of delivery of possession of the Site subject to commencement of work at the site including setting up of site office etc.;

(b) The amount which is due in respect of each Statement, other than the Final Statement, within 15 working days after receiving the Statement and supporting documents; and

Timing of Payments (c) The final amount due, within 60 working days after receiving the Final Statement and written discharge in accordance with Sub-Clause 14.11 [Application for Final Payment] and Sub-Clause 14.13 [Discharge]. Payment of the amount due in INR shall be made into the bank account, nominated by the Contractor.

14.8 Intentionally kept blank

14.9 Intentionally kept blank

14.10

Statement at Completion Within 60 days after receiving the Taking-Over Certificate for the Works, the Contractor shall submit to the Employer six copies of supporting documents, in accordance with Sub-Clause 14.3 [Application for Interim Payments], showing:

- (a) the value of all work done in accordance with the Contract up to the date stated in the Taking-Over Certificate for the Works,
- (b) any further sums which the Contractor considers to be due, and
- (c) an estimate of any other amounts which the Contractor considers will become due to him under the Contract.
- (d) Estimated amounts shall be shown separately in this Statement at Completion.

The Employer shall then give notice to the Contractor in accordance with Sub-Clause 14.6 [Interim Payments] and make payment in accordance with Sub-Clause 14.7 [Timing of Payments].

14.11

Application for Final Payment Within 30 days after receiving the Taking Over Certificate for the Works, the Contractor shall submit, to the Employer, six copies of a draft final statement with supporting documents showing in detail in a form approved by the Employer:

- (a) the value of all work done in accordance with the Contract, and
- (b) any further sums which the Contractor considers to be due to him under the Contract or otherwise.

Application
for Final
Payment

If the Employer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Employer may reasonably require and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Employer the final statement as agreed. This agreed statement is referred to in these Conditions as the "Final Statement",

14.12

Audit

The Employer shall have the right to cause an audit and technical examination of the Works and the Final Statement of the Contractor including all supporting vouchers, abstract, etc. to be made after payment of the Final Statement and if as a result of such audit and technical examination, any sum is found to have been overpaid in respect of any work done by the Contractor under the Contract or any work claimed to have been done by it under the Contract and found not to have been executed, the Contractor shall be liable to refund the amount of over-payment and it shall be lawful for the Employer to recover the same from the Contractor in the manner prescribed in these Conditions or in any other manner legally permissible.

However, if following discussions between the Parties and any changes to the Final Statement which are agreed, it becomes evident that a dispute exists, the Employer shall pay the agreed parts of the Final Statement in accordance with Sub-Clause 14.6 [Interim Payments] and Sub-Clause 14.7 [Timing of Payments]. Thereafter, if the dispute is finally resolved under Sub-Clause 20.2 [Dispute Resolution], the Contractor shall then prepare and submit to the Employer a revised Final Statement.

14.13

Discharge

When submitting the Final Statement, the Contractor shall submit a written discharge which confirms that the total of the Final Statement represents full and final settlement of all moneys due to the Contractor under or in connection with the Contract. This discharge may state that it becomes effective when the Contractor has received the Performance Security and the outstanding balance of this total, in which event the discharge shall be effective on such date.

14.14

Final Payment In accordance with sub-paragraph (c) of Sub-Clause 14.7 [Timing of Payments], the Employer shall pay to the Contractor the amount which is finally due, less all amounts previously paid by the Employer and any deductions in accordance with Sub-Clause 2.5 [Employer's Claims].

14.15

Cessation of Employer's Liability The Employer shall not be liable to the Contractor for any matter or thing under or in connection with the Contract or execution of the Works, except to the extent that the Contractor shall have included an amount expressly for it:

(a) In the Final Statement and also

(b) (Except for matters or things arising after the issue of the Taking-Over Certificate for the Works) in the Statement at completion described in Statement at Completion.

However, this Sub-Clause shall not limit the Employer's liability under its indemnification obligations, or the Employer's liability in any case of fraud, deliberate default or reckless misconduct by the Employer.

15 Termination by Employer

15.1

Notice to Correct If the Contractor fails to carry out any obligation under the Contract, the Employer may by notice require the Contractor to make good the failure and to remedy it within a specified reasonable time.

15.2

Termination by Employer The Employer shall be entitled to terminate the Contract and expel the Contractor upon giving notice to the Contractor, if the Contractor fails to comply with any of the clauses listed hereunder but are not limited to:

(a) Fails to comply with a notice under Sub-Clause 15.1 [Notice to Correct],

Termination
by Employer

- (b) Abandons the Works or otherwise plainly demonstrates the intention not to continue performance of its obligations under the Contract,
- (c) without reasonable excuse fails to proceed with the Works in accordance with Clause 8 [Commencement, Delays and Suspension],
- (d) fails to comply with the milestone as approved by the Employer or such modified milestone as subsequently approved by the Employer,
- (e) If the Contractor being a company shall pass a resolution or the Court shall make an order that the Contractor shall be wound up or if a receiver or a manager on behalf of a creditor shall be appointed or if circumstances shall arise which entitle the Court or the creditor to appoint a Receiver or a manager or which entitles the court to make a winding up order,
- (f) If the Contractor shall suffer an execution being levied on its goods and allows it to be continued for a period of 30 days ,
- (g) becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against it, compounds with its creditors, or carries on business under a receiver, trustee or manager for the benefit of its creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events, or
- (h) gives or offers to give (directly or indirectly) to any person any bribe, gift commission or other thing of value, as an inducement or reward:
 - i. for doing or forbearing to do any action in relation to the Contract, or
 - ii. for showing or forbearing to show favour or disfavour to any person in relation to the Contract,
 - iii. if any of the Contractor's Personnel or agents gives or offers to give (directly or indirectly) to any person any such inducement or reward as is described in this sub-paragraph. However, lawful inducements and rewards to Contractor's Personnel shall not entitle termination.

In any of these events or circumstances, the Employer may, upon giving 14 days' notice to the Contractor, terminate the Contract and expel the Contractor from the Site. However, in the case of sub-paragraph (h) or (i), the Employer may by notice terminate the Contract immediately. The Employer's election to terminate the Contract shall not prejudice any other rights of the Employer, under the Contract or otherwise. The Contractor shall then leave the Site and deliver any required Goods and all Contractor's Documents made by or for the Employer, to the Employer. However,

the Contractor shall use its best efforts to comply immediately with any reasonable instructions included in the notice for the protection of life or property or for the safety of the Works. After termination, the Employer may complete the Works and/or arrange for any other entities to do so. The Employer and these entities may then use any Goods and Contractor's Documents made by or on behalf of the Contractor. The Employer shall then give notice that the Contractor's Equipment and Temporary Works will be released to the Contractor at or near the Site. The Contractor shall promptly arrange their removal, at the risk and cost of the Contractor. However, if by this time, the Contractor has failed to make a payment due to the Employer, these items may be sold by the Employer in order to recover this payment. Any balance of the proceeds shall then be paid to the Contractor. In any case in which any of the powers conferred upon the Employer's Representative in terms hereof, shall have become exercisable and the same are not exercised, the non-exercise thereof shall not constitute a waiver of any of the conditions hereof and such powers shall notwithstanding be exercisable in the event of any future case of default by the Contractor and the liability of the Contractor for compensation shall remain unaffected. In the event of the Employer's Representative putting in force all or any of the powers vested in him under the preceding clause it may, if it so desires after giving a notice in writing to the Contractor, take possession of (or at the sole discretion of the Employer's Representative which shall be final and binding on the Contractor) use as on hire (the amount of the hire money being also in the final determination of the Employer's Representative) all or any tools, Plant, Materials and stores, in or upon the works, or the Site thereof belonging to the Contractor, or procured by the Contractor and intended to be used for the execution of the work/ or any part thereof, paying or allowing for the same in account at the Contract rates, or, in the case of these not being applicable, at current market rates to be certified by the Employer's Representative, whose certificate thereof shall be final and binding on the Contractor. The Employer's Representative may also direct where required, the clerk of the works, foreman or other authorized agent of the Contractor to remove such tools, Plant, Materials or stores from the Site (within a time to be specified in such notice). In the event of the Contractor failing to comply with any such requisition, the Employer's Representative may remove them at the Contractor's expense or sell them by auction or private sale on account of the Contractor and its risk in all respects and the certificate of the Employer's Representative as to

the expenses of any such removal and the amount of the proceeds and expenses of any such sale shall be final and conclusive against the Contractor.

15.3

Valuation at Date of Termination	As soon as practicable after a notice of termination under Sub-Clause 15.2 [Termination by Employer] has taken effect, the Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the value of the Works, Goods and Contractor's Documents, and any other sums due to the Contractor for work executed in accordance with the Contract.
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15.4

Payment after Termination	After a notice of termination under Sub-Clause 15.2 [Termination by Employer] has taken effect, the Employer may: (a) proceed in accordance with Sub-Clause 2.5 [Employer's Claims], (b) withhold further payments to the Contractor until the costs of execution, completion and remedying of any defects, damages for delay in completion (if any), and all other costs incurred by the Employer, have been established, and/or (c) recover from the Contractor any losses and damages incurred by the Employer and any extra costs of completing the Works, after allowing for any sum due to the Contractor under Sub-Clause 15.3 [Valuation at Date of Termination]. After recovering any such losses, damages and extra costs, the Employer shall pay any balance to the Contractor.
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15.5

Employer's Entitlement to Termination	The Employer shall be entitled to terminate the Contract, at any time to the Employer's convenience by giving notice of such termination to the Contractor, the termination shall take effect 28 days after the later of the dates on which the Contractor receives this notice.
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After this termination, the Contractor shall proceed in accordance with Clause 16 [Cessation of Work and Removal of Contractor's Equipment] and shall be paid in accordance with Sub-Clause 19.5 [Optional Termination, Payment and Release].

Cessation of Work and Removal of Contractor's Equipment	<p>After a notice of termination under Sub-Clause 15.5 [Employer's Entitlement to Termination], or Sub-Clause 19.5 [Optional Termination, Payment and Release] has taken effect, the Contractor shall promptly:</p> <p>(a) cease all further work, except for such work as may have been instructed by the Employer for the protection of life or property or for the safety of the Works,</p> <p>(b) hand over Contractor's Documents, Plant, Materials and other work, for which the Contractor has received payment, and</p> <p>(c) remove all other Goods from the Site, except as necessary for safety, and leave the Site.</p>
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17 Risk and Responsibility

17.1

Indemnities	<p>The Contractor shall indemnify and hold harmless the Employer, the Employer's Representative, the Employer's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of:</p> <p>(a) bodily injury, sickness, disease or death, of any person whatsoever arising out of or in the course of or by reason of the execution and completion of the Works and the remedying of any defects, unless attributable to any negligence, wilful act or breach of the Contract by the Employer, the Employer's Representative, Employer's Personnel, or any of their respective agents, and</p> <p>(b) Damage to or loss of any property, real or personal (other than the Works), to the extent that such damage or loss:</p> <ol style="list-style-type: none"> i. Arises out of or in the course of or by reason of the execution and completion of the Works and the remedying of any defects, and ii. is not attributable to any negligence, wilful act or breach of the Contract, the Employer, the Employer's Representative, the Employer's Personnel, or any of their respective agents or anyone directly or indirectly employed by any of them.
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The Employer shall indemnify and hold harmless the Contractor, the Contractor's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of:

- i. bodily injury, sickness, disease or death, which is attributable to any negligence, wilful act or breach of the Contract by the Employer, the Employer's Personnel, or any of their respective agents, and
- ii. the matters for which liability may be excluded from insurance cover, as described in Insurance Against Injury to Persons and Damage to Property.

17.2

Intellectual and Industrial Property Rights

In this Sub-Clause, "infringement" means an infringement (or alleged infringement) of any patent, registered design, copyright, trade mark, trade name, trade secret or other intellectual or industrial property right relating to the Works; and "claim" means a claim (or proceedings pursuing a claim) alleging an infringement. Whenever a Party does not give notice to the other Party of any claim within 28 days of receiving the claim, the first Party shall be deemed to have waived any right to indemnity under this Sub-Clause. The Employer shall indemnify and hold the Contractor harmless against and from any claim alleging an infringement which is or was:

- (a) an unavoidable result of the Contractor's compliance with the Employer's Requirements, or
- (b) a result of any Works being used by the Employer;
 - i. for a purpose other than that indicated by, or reasonably to be inferred from, the Contract, or
 - ii. in conjunction with anything not supplied by the Contractor, unless such use was disclosed to the Contractor is stated in the Contract.

The Contractor shall indemnify and hold the Employer harmless against and from any other claim which arises out of or in relation to:

- i. the Contractor's manufacture, construction or execution of the Works,
- ii. the use of Contractor's Equipment, or
- iii. the proper use of the Works.

If a Party is entitled to be indemnified under this Sub-Clause, the indemnifying Party may (at its cost) conduct negotiations for the settlement of the claim, and any litigation or arbitration which may arise from it, the other Party shall, at the request and cost of the indemnifying Party, assist in contesting the claim. This other Party (and its Personnel) shall not make any admission which might be prejudicial to the indemnifying Party, unless the indemnifying Party failed to take over the conduct of any negotiations, litigation or arbitration upon being requested to do so by such other Party.

17.3

Contractor's Care of the Works

The Contractor shall take full responsibility for the care of the Works and Goods from the Commencement Date until the Taking Over Certificate is issued (or is deemed to be issued under Sub-Clause 10.1 [Taking Over of the Works and Sections] for the Works, when responsibility for the care of the Works shall pass to the Employer. If a Taking Over Certificate is issued (or is so deemed to be issued) for any Section of the Works, responsibility for the care of the Section shall then pass to the Employer.

After responsibility has accordingly passed to the Employer, the Contractor shall take responsibility for the care of any work which is outstanding on the date stated in a Taking-Over Certificate, until this outstanding work has been completed.

If any loss or damage happens to the Works, Goods or Contractor's Documents during the period when the Contractor is responsible for their care, from any cause not listed in Sub-Clause 17.4 [Employer's Risks], the Contractor shall rectify the loss or damage at the Contractor's risk and cost, so that the Works, Goods and Contractor's Documents conform with the Contract.

The Contractor shall be liable for any loss or damage caused by any actions performed by the Contractor after a Taking Over Certificate has been issued. The Contractor shall also be liable for any loss or damage which occurs after a Taking Over Certificate has been issued and which arose from a previous event for which the Contractor was liable.

17.4

Employer's	The risks referred to in Sub-Clause 17.5 below are:
Risks	<p>(a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,</p> <p>(b) rebellion, terrorism, revolution, insurrection, military or usurped power, or civil war, within the Country,</p> <p>(c) riot, commotion or disorder within the Country by persons other than the Contractor's Personnel and other employees of the Contractor,</p> <p>(d) munitions of war, explosive Materials, ionising radiation or contamination by radioactivity, within the Country, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity, and</p> <p>(e) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds.</p>

17.5

Consequences of Employer's Risks	<p>If and to the extent that any of the risks listed in Sub-Clause 17.4 above results in loss or damage to the Works, Goods or Contractor's Documents, the Contractor shall promptly give notice to the Employer and shall rectify this loss or damage to the extent required by the Employer. If the Contractor suffers delay and/or incurs Cost from rectifying this loss or damage, the Contractor shall give a further notice to the Employer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:</p> <p>(a) an extension of time for any such delay, if completion is or will, be delayed, under Sub-Clause 8.5 [Extension of Time for Completion],</p> <p>(b) payment of any such Cost, (if any) which shall be added to the Contract Price.</p> <p>After receiving this further notice, the Employer shall proceed in accordance with Sub Clause 3.5 [Determinations] to agree or determine these matters.</p>
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17.6

Limitation of Liability	<p>Neither Party shall be liable to the other Party for loss of use of any Works, loss of profit, loss of any contract or for any indirect or consequential loss or damage which may be suffered by the other Party in connection with the Contract, other than under Sub-Clause 15.4 [Payment after Termination] and Sub-Clause 17.1 [Indemnities]. The</p>
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Limitation of Liability	total liability of the Contractor to the Employer, under or in connection with the Contract other than under Sub-Clause 4.25 [Electricity, Water and Gas], Sub-Clause 4.26 [Employer's Equipment], Sub-Clause 17.1 [Indemnities] and Sub-Clause 17.2 [Intellectual and Industrial Property Rights], shall not exceed the sum stated in the Particular Conditions or (if a sum is not so stated) the Contract Price stated in the Agreement. This Sub-Clause shall not limit liability in any case of fraud, deliberate default or reckless misconduct by the defaulting Party.
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18 Insurance

18.1

General Requirements for Insurances	<p>In this Clause, "insuring Party" means, for each type of insurance, the Party responsible for effecting and maintaining the insurance specified in the relevant Sub-Clause. Wherever the Contractor is the insuring Party, each insurance shall be effected with insurers. These terms shall be consistent with any terms agreed by both Parties before they signed the Agreement. This agreement of terms shall take precedence over the provisions of this Clause.</p>
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If a policy is required to indemnify joint insured, the cover shall apply separately to each insured as though a separate policy had been issued for each of the joint insured. If a policy indemnifies additional joint insured, namely in addition to the insured specified in this Clause,

- i. the Contractor shall act under the policy on behalf of these additional joint insured except that the Employer shall act for Employer's Personnel
- ii. additional joint insured shall not be entitled to receive payments directly from the insurer or to have any other direct dealings with the insurer, and
- iii. the insuring Party shall require all additional joint insured to comply with the conditions stipulated in the policy.

Each policy insuring against loss or damage shall provide for payments to be made in the currencies required to rectify the loss or damage. Payments received from insurers shall be used for the rectification of the loss or damage, the relevant insuring Party shall,

General
Requirements
for Insurances

within the respective periods stated in the Particular Conditions (calculated from the Commencement Date), submit to the other Party:

- i. evidence that the insurances described in this Clause have been effected, and
- ii. copies of the policies for the insurances described in Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment] and Sub-Clause 18.3 [Insurance against Injury to Persons and Damage to Property] When each premium is paid, the insuring Party shall submit evidence of payment to the other Party.

Each Party shall comply with the conditions stipulated in each of the insurance policies. The insuring Party shall keep the insurers informed of any relevant changes to the execution of the Works and ensure that insurance is maintained in accordance with this Clause.

Neither Party shall make any material alteration to the terms of any insurance without the prior approval of the other Party. If an insurer makes (or attempts to make) any alteration, the Party first notified by the insurer shall promptly give notice to the other Party.

If the insuring Party fails to effect and keep in force any of the insurances it is required to effect and maintain under the Contract, or fails to provide satisfactory evidence and copies of policies in accordance with this Sub-Clause, the other Party may (at its option and without prejudice to any other right or remedy) effect insurance for the relevant coverage and pay the premia due. The insuring Party shall pay the amount of these premia to the other Party, and the Contract Price shall be adjusted accordingly.

Nothing in this Clause limits the obligations, liabilities or responsibilities of the Contractor or the Employer, under the other terms of the Contract or otherwise. Any amounts not insured or not recovered from the insurers shall be borne by the Contractor and/or the Employer in accordance with these obligations, liabilities or responsibilities.

However, if the insuring Party fails to effect and keep in force an insurance which is available and which it is required to effect and maintain under the Contract, and the other Party neither approves the omission nor effects insurance for the coverage

relevant to this default, any moneys which should have been recoverable under this insurance shall be paid by the insuring Party. Payments by one Party to the other Party shall be subject to Sub-Clause 2.5 [Employer's Claims] or Sub-Clause 20.1 [Contractor's Claims], as applicable.

18.2

Insurance for Works and contractor's Equipment	The insuring Party shall insure the works, Plant, Materials and Contractor's Documents for not less than the full reinstatement cost including the costs of demolition, removal of debris and professional fees and profit. This insurance shall be effective from the date by which the evidence is to be submitted under Sub-Clause 18.1 [General Requirements for Insurances], until the date of issue of the Taking-Over Certificate for the Works. The insuring Party shall maintain this insurance to provide cover until the date of issue of the Performance Certificate, for loss or damage for which the Contractor is liable arising from a cause occurring prior to the issue of the Taking-Over Certificate, and for loss or damage caused by the Contractor in the course of any other operations (including those under Clause 11 [Defects Liability] and Clause 12 [Tests after Completion]. The insuring Party shall insure the Contractor's Equipment for not less than the full replacement value, including delivery to Site. For each item of Contractor's Equipment, the insurance shall be effective while it is being transported to the Site and until it is no longer required as Contractor's Equipment.
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Unless otherwise stated in the Particular Conditions, insurances under this Sub-Clause:

- (a) shall be effected and maintained by the Contractor as insuring Party,
- (b) shall be in the joint names of the Parties, who shall be jointly entitled to receive payments from the insurers, payments being held or allocated between the Parties for the sole purpose of rectifying the loss or damage,
- (c) shall cover all loss and damage from any cause not listed in Sub-Clause 17.4 [Employer's Risks],
- (d) shall also cover loss or damage from the risks listed in sub-paragraph (c) of Sub Clause 17.4 [Employer's Risks], with deductibles per occurrence of not more than the amount stated in the Particular Conditions (if any amount is not so stated, this sub-paragraph (d) shall not apply), and
- (e) may however exclude loss of, damage to, and reinstatement of:

- i. a part of the Works which is in a defective condition due to a defect in its Materials or workmanship (but cover shall include any other parts which are lost or damaged as a direct result of this defective condition and not as described in sub-paragraph (ii) below),
- ii. a part of the Works which is lost or damaged in order to reinstate any other part of the Works if this other part is in a defective condition due to a defect in its Materials or workmanship,
- iii. a part of the Works which has been taken over by the Employer, except to the extent that the Contractor is liable for the loss or damage, and
- iv. Goods while they are not in the Country.

18.3

Insurance
against Injury
to Persons
and Damage
to Property

The insuring Party shall insure against each Party's liability for any loss, damage, death or bodily injury which may occur to any physical property (except things insured under Sub-Clause 18.2 (Insurance for Works and Contractor's Equipment) or to any person (except persons insured under Sub-Clause 18.4 [Insurance for Contractor's Personnel], which may arise out of the Contractor's performance of the Contract and -occurring before the issue of the Performance Certificate. This insurance shall be for a limit per occurrence of not less than the amount stated in the Particular Conditions, with no limit on the number of occurrences. If an amount is not stated in the Contract, this Sub-Clause shall not apply.

Unless otherwise stated in the Particular Conditions, the insurances specified in this Sub-Clause:

- (a) shall be effected and maintained by the Contractor as insuring Party,
- (b) shall be in the joint names of the Parties,
- (c) shall be extended to cover liability for all loss and damage to the Employer's property (except things insured under Sub-Clause 18.2) arising out of the Contractor's performance of the Contract, and
- (d) may however exclude liability to the extent that it arises from:
 - i. the Employer's right to have the Permanent Works executed on, over, under, in or through any land, and to occupy this land for the Permanent Works,
 - ii. damage which is an unavoidable result of the Contractor's obligation to execute the Works and remedy any defects, and

- iii. a cause listed in Sub-Clause 17.4 [Employer's Risks], except to the extent that cover is available at commercially reasonable terms.

18.4

Insurance for
Contractor's
Personnel

The Contractor shall effect and maintain insurance against liability for claims, Personnel damages, losses and expenses (including legal fees and expenses) arising from injury sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel. The Employer shall also be indemnified under the policy of insurance, except that this insurance may exclude losses and claims to the extent that they arise from any act or neglect of the Employer or of the Employer's Personnel. The insurance shall be maintained in full force and effect during the whole time that these personnel are assisting in the execution of the Works.

19 Force Majeure

19.1

Definition of
Force Majeure

Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind listed below:

- i. war, hostilities (whether war be declared or not), invasion, act of foreign enemies.
- ii. internal emergency, rebellion, terrorism, revolution, insurrection, military or usurped power, or civil war.
- iii. riot, commotion, disorder, strike or lockout by persons other than the Contractor's Personnel and other employees of the Contractor.
- iv. munitions of war, explosive materials, ionising radiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity, and
- v. abnormally bad weather, flood, natural calamity natural catastrophes such as earthquake, cyclone, hurricane, typhoon or volcanic activity.
- vi. loss or damage by fire

19.2

Notice of
Force Majeure

If a Party is or will be prevented from performing any of its obligations, if the work(s) be delayed, due to any event or circumstance constituting Force Majeure, then one party shall immediately give notice thereof in writing to the other Party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented. The notice shall be given within 14 days after the Party became aware, or should have become aware, of the relevant event or circumstance constituting Force Majeure. The Party shall, having given notice, be excused performance of such obligations for so long as such Force Majeure prevents it from performing them. Notwithstanding any other provision of this Clause, Force Majeure shall not apply to obligations of either Party to make payments to the other Party under the Contract.

19.3

Duty to
Minimise
Delay

Each Party shall at all times use all reasonable endeavours to minimise any delay in the performance of the Contract as a result of Force Majeure. A Party shall give notice to the other Party when it ceases to be affected by the Force Majeure.

19.4

Consequences
of Force
Majeure

If the Contractor is prevented from performing any of its obligations under the Contract by Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], and suffers delay and/or incurs Cost by reason of such Force Majeure, the Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.5 [Extension of Time for Completion], and
- (b) if the event or circumstance is of the kind described in sub-paragraphs (i) to (iv) of Sub-Clause 19.1 [Definition of Force Majeure] and, in the case of sub-paragraphs (ii) to (iv), occurs in the Country, payment of any such Cost.

After receiving this notice, the Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

19.5

Optional
Termination,
Payment and
Release

If the execution of substantially all the Works in progress is prevented for a continuous period of 84 days by reason of Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], or for multiple periods which total more than 140 days due to the same notified Force Majeure, then either Party may give to the other Party a notice of termination of the Contract. In this event, the termination shall take effect 7 days after the notice is given, and the Contractor shall proceed in accordance with Clause 16 [Cessation of Work and Removal of Contractor's Equipment]. Upon such termination, the Employer shall pay to the Contractor the amounts payable for any work carried out till that date to be determined in terms of Sub-Clause 3.5.

19.6

Release from
Performance
Under the
Laws

Notwithstanding any other provision of this Clause, if any event or circumstance outside the control of the Parties (including, but not limited to, Force Majeure) arises which makes it impossible or unlawful for either or both Parties to fulfil its or their contractual obligations or which, under the law governing the Contract, entitles the Parties to be released from further performance of the Contract, then upon notice by either Party to the other Party of such event or circumstance.

(a) The Parties shall be discharged from further performance, without prejudice to the rights of either Party in respect of any previous breach of the Contract, and

(b) the sum payable by the Employer to the Contractor shall be the same as would have been payable under Sub-Clause 19.5 [Optional Termination, Payment and Release] if the Contract had been terminated under Sub-Clause 19.5.

20 Claims and Dispute Resolution

20.1

Contractor's Claims If the Contractor considers itself to be entitled to any extension of the Time for Completion and/or any additional payment, under any Clause of these Conditions or otherwise in connection with the Contract the Contractor shall give notice to the Employer & Employer's Representative, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than 28 days after the Contractor became aware, or should have become aware, of the event or circumstance.

If the Contractor fails to give notice of a claim within such period of 28 days, the Time for Completion shall not be extended, the Contractor shall not be entitled to additional payment, and the Employer shall be discharged from all liability in connection with the claim. Otherwise, the following provisions of this Sub-Clause shall apply.

The Contractor shall also submit any other notices which are required by the Contract, and supporting particulars for the claim, all as relevant to such event or circumstance.

The Contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or at another location acceptable to the Employer. Without admitting liability, the Employer may, after receiving any notice under this Sub-Clause, monitor the record-keeping and/or instruct the Contractor to keep further contemporary records. The Contractor shall permit the Employer to inspect all these records, and shall (if instructed) submit copies to the Employer.

Within 42 days after the Contractor became aware (or should have become aware) of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Employer, the Contractor shall send to the Employer a fully detailed claim which includes full supporting particulars 'of the basis of the claim and of the extension of time and/or additional payment claimed. If the event or circumstance giving rise to the claim has a continuing effect:

- (a) this fully detailed claim shall be considered as interim;
- (b) the Contractor shall send further interim claims at monthly intervals, giving the accumulated delay and/or amount claimed, and such further particulars as the Employer may reasonably require; and

(c) the Contractor shall send a final claim within 30 days after the issuance of Taking Over Certificate of the Works, or within such other period as may be proposed by the Contractor and approved by the Employer.

Within 60 days after receiving a claim or any further particulars supporting a previous claim, or within such other period as may be proposed by the Employer and approved by the Contractor, the Employer shall respond with approval, or with disapproval and detailed comments. It may also request any necessary further particulars, but shall nevertheless give its response on the principles of the claim within such time,

Each interim payment shall include such amounts for any claim as have been reasonably substantiated as due under the relevant provision of the Contract. Unless and until the particulars supplied are sufficient to substantiate the whole of the claim, the Contractor shall only be entitled to payment for such part of the claim as it has been able to substantiate.

The Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) the extension (if any) of the Time for Completion (before or after its expiry) in accordance with Sub-Clause 8.5 [Extension of Time for Completion], and/or (ii) the additional payment (if any) to which the Contractor is entitled under the Contract.

The requirements of this Sub-Clause are in addition to those of any other Sub-Clause which may apply to a claim. If the Contractor fails to comply with this or another Sub Clause in relation to any claim, any extension of time and/or additional payment shall take account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim, unless the claim is excluded under the second paragraph of this Sub-Clause.

20.2

Dispute Resolution

Where a notice of dissatisfaction has been given by the Parties, then they shall attempt to settle any dispute or difference between them amicably. Unless settled amicably, any dispute, controversy or claim arising out of or in respect of this Contract (or its validity, interpretation, or enforcement) or the subject matter hereof shall be governed by, and interpreted and construed in accordance with the laws of India and the courts in Kolkata shall have exclusive jurisdiction over all matters, disputes (including claims for set-off and counterclaims) which may arise in connection with this Contract.



GOVERNMENT OF WEST BENGAL
OFFICE OF THE SUPERINTENDING ENGINEER, SOUTH CIRCLE
HOUSING DIRECTORATE, P- 7 & 8, C.I.T. ROAD, 1ST FLOOR,
KOLKATA – 700014.

BID DOCUMENTS FOR
CONSTRUCTION OF OITIKA-OWNERSHIP HOUSING
FOR WBCS(EXE) OFFICERS
AT PRE. NO.-44-0676, PLOT NO.-II-D/37 IN AA-IID,
ACTION AREA -IID, NEW TOWN, KOLKATA.
ON TURNKEY BASIS

SECTION 8
CONTRACT FORMS

FORM OF AGREEMENT

(ON NON JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

Agreement No. _____ dated _____

THIS AGREEMENT is made on _____ day of _____ between the Governor of West Bengal, being represented by the Superintending Engineer, South Circle, Housing Dte, Office of The Superintending Engineer, South Circle, Housing Directorate, P- 7 & 8, C.I.T. Road, 1st Floor, Kolkata – 700014 hereinafter called “the Employer” (which expression shall, wherever the context so demands or requires, include their assigns) of the One Part and _____ hereinafter called the Contractor (which expression shall wherever the context so demands or requires, include his/their successors and assigns) of the Other Part.

WHEREAS the Employer is desirous that OITIKA-Ownership Housing Project for WBCS(Exe) Officers should be executed and has by Notification of Award dated _____ accepted a tender submitted by the Contractor for the project at a total Contract Price of ₹ _____/- (Rupees _____ only).

Now THIS AGREEMENT WITNESSETH as follows: -

1. In this agreement words and expressions shall have the same meaning as are respectively assigned to them in the General Conditions of Contract hereinafter referred to.

2. Documents

The following documents in conjunction with Addenda/Corrigenda to Tender Documents shall be deemed to form and be read and construed as part of this agreement viz.

a. Notice Inviting e-Tender

- b. Instructions to Bidders
- c. Evaluation and Qualifying Criteria
- d. Bidding Forms
- e. Employer's Requirements
- f. General Conditions of Contract.
- g. Contract Forms.
- h. Amendment to Tender Documents

3. Previous Communications

This document constitutes the entire Contract between the parties and supersedes all previous communications, whether oral or written, in relation to the Services to be undertaken in accordance with the Contract.

4. Execution of the Work

In consideration of the payment to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute, complete, remedy defects therein and maintain the Work in conformity in all respects with the provisions of the Contract.

5. Payment

The Employer hereby covenants to pay to the Contractor in consideration of the execution, completion, remedying of any defects therein and maintenance of the works, the contract price or such other sum as may become payable under the provisions of the contract at the time and in the manner prescribed by the Contract.

6. Commencement of the Project

This Contract will remain in effect from_____and expire on_____unless terminated earlier in accordance with the provisions of the Contract.

7. Acknowledgement

The Contractor shall confirm acceptance of the terms of this Contract by signing and returning to Housing Directorate the duplicate copy enclosed herewith within a period of 7 days from date of receipt of Notification of Award.

IN WITNESS whereof the parties hereto have caused their respective hands to be hereinto affixed the day and year first above written.

In the capacity of _____

On behalf of
M/s. _____

In the presence of Witnesses
(Signature, Name & Designation)

1. _____

2. _____

Superintending Engineer,
South Circle, Housing Directorate,
For and on behalf of
the Governor of West Bengal

In the presence of Witnesses
(Signature, Name & Designation)

1. _____

2. _____

PROFORMA FOR BANK GUARANTEE FOR MOBILIZATION ADVANCE

(On Non-Judicial Stamp Paper of Appropriate Value)

To,
Superintending Engineer,
South Circle, Housing Dte,
Office of The Superintending Engineer,
South Circle, Housing Directorate,
P- 7 & 8, C.I.T. Road, 1st Floor,
Kolkata – 700 014

1. In consideration of, the Superintending Engineer, South Circle, Housing Dte, Office of The Superintending Engineer, South Circle, Housing Directorate, P- 7 & 8, C.I.T. Road, 1st Floor, Kolkata – 700014, hereinafter called “The Employer”) (which expression shall unless repugnant to the subject or context include its assigns) having agreed under the terms and conditions of the Contract Agreement No _____ dated _____ with _____ a company under the Companies Act, 1956 and having its registered office at _____ in the State of _____ (hereinafter called “the said bidder” which expression shall unless the context requires otherwise include its assigns) in connection with the work of _____ (hereinafter called "the said Contract") to make at the request of the bidder a lump sum advance of ₹ _____ /-(Rupees _____ only) for utilizing it for the purpose of the Contract on his furnishing a Guarantee acceptable to the Employer, we, Bank incorporated under _____ and having one of our branches at _____ (hereinafter referred to as "the said Bank") do hereby guarantee the due recovery by the Employer of this said advance with interest thereon as provided according to the terms and conditions of the Contract. If the said bidder fails to utilize the said advance for the purpose of the Contract and/or the said advance together with Interest thereon as aforesaid is not fully recovered by the Employer, we, Bank hereby

unconditionally and irrevocably undertake to pay to Housing Directorate on demand and without demur to the extent of the said sum of ₹ _____/- (Rupees _____ only), any claim made by the Employer on us for the loss or damage caused to or suffered by the Employer by reason of the Employer not being able to recover in full the said sum of ₹ _____/- (Rupees _____ only) with interest as aforesaid.

2. We, _____ (*indicate the name of the Bank*) further agree that the Employer shall be the sole judge of and as to whether the said bidder has not utilized the said advance or any part thereof for the purpose of the Contract and the extent of loss or damage caused to or suffered by the Employer on account of the said advance together with interest not being recovered in full and the decision of the Employer that the said bidder has not utilized the said advance or any part thereof for the purpose of the Contract and as to the amount or amounts of loss or damage caused to or suffered by the Employer shall be final and binding on us.
3. We, the said Bank, further agree that the Guarantee herein contained shall remain in force and effect during the period that would be taken for the performance of the said Contract and till the said advance with interest has been fully recovered and its claims satisfied or discharged and till the Employer certifies that the said advance with interest has been fully recovered from the said bidder, and accordingly shall have no claim under this Guarantee after 30 (thirty) days from the date of satisfactory completion of the said Contract (as per the mutually agreed Work Schedule) i.e. up to and inclusive of _____ (date) unless a notice of the claim under this Guarantee has been served on the Bank before the expiry of the said period i.e. _____ (date) in which case the same shall be enforceable against the Bank notwithstanding the fact, that the same is enforced after the expiry of the said period.
4. The Employer shall have the fullest liberty without affecting in any way the liability of the Bank under this Guarantee or Indemnity, from time to time, to vary any of the terms and conditions of the said Contractor the advance or to extend time of performance by the said bidder or to postpone for any time and from time to time any of the powers exercisable by it against the said bidder and either to enforce or forbear from enforcing any of the terms and conditions governing the said Contract or the advance available to the Employer and the said Bank shall not be released from its liability under these presents by any exercise by the Employer of the liberty with reference to the matters aforesaid or by reasons of time being

given to the said bidder or any other forbearance, actor omission on the part of the Employer or any indulgence by the Employer to the said bidder on any other matter or thing whatsoever which under the law relating to sureties would, but for this provision, have the effect of so releasing the Bank from its such liability.

5. It shall not be necessary for the Employer to proceed against the bidder before proceeding against the Bank and the Guarantee herein contained shall be enforceable against the Bank notwithstanding any security, which the Employer may have obtained or obtain from the bidder shall at the time when proceedings are taken against the Bank hereunder, be outstanding or unrealized.
6. We, the said Bank, lastly undertaken not to revoke this Guarantee during its currency except with the previous consent of the Employer in writing and agree that any change in the constitution of the said bidder or the said Bank shall not discharge our liability hereunder.
7. If any further extension of this Guarantee is required, the same shall be extended to such required periods on receiving instructions from the bidder_____on whose behalf this Guarantee is issued. Notwithstanding anything contained hereinbefore our liability under this Guarantee is restricted to ₹ _____(Rupees _____ only) together with interest @_____. Our undertaking shall commence from the date of execution and shall remain in force up to_____.

Dated this_____day of_____In presence of

Witness

1. _____
2. _____

For and on behalf of (the Bank)

Signature_____

Name_____

Designation_____

Authorization No.

Seal of the Bank

The above Guarantee is accepted by the Employer

For Housing Directorate

FORM OF PERFORMANCE SECURITY BANK GUARANTEE

In consideration of the Employer having agreed under the terms and conditions of contract made vide his Notification of Award No. _____ dated _____ between the Superintending Engineer, South Circle, Housing Dte, Office of The Superintending Engineer, South Circle, Housing Directorate, P- 7 & 8, C.I.T. Road, 1st Floor, Kolkata - 700014 (the "Employer") and _____ (hereinafter called the said "Contractor") for construction of Oitika - Ownership Housing for WBCS(Exe) officers at pre. no.- 44-0676, plot no.-II-D/37 in AA-IID, action area -IID, New Town, Kolkata (herein after called the said "Agreement") the Contractor having agreed to production of an irrevocable Bank Guarantee for ₹ _____ (Rupees _____ Only) as a Security/Guarantee for compliance of his obligations in accordance with the terms and conditions in the said Agreement:

1. We _____ (*indicate the name of the Bank*) (hereinafter referred to as "the Bank" hereby undertake to pay to the Superintending Engineer, South Circle, Housing Dte, Office of The Superintending Engineer, South Circle, Housing Directorate, P- 7 & 8, C.I.T. Road, 1st Floor, Kolkata - 700014, an amount not exceeding ₹ _____ (Rupees _____ only) on demand by Housing Directorate.
2. We _____ (*indicate the name of the Bank*) do hereby undertake to pay the amounts due and payable under this Guarantee without any demur, merely on a demand from Housing Director for and on behalf of the Employer as an Agent/Power of Attorney Holder stating that the amount claimed is required to meet the recoveries due or likely to be due from the said Contractor. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this Guarantee. However, our liability under this Guarantee shall be restricted to an amount not exceeding ₹ _____ (Rupees _____ only).
3. We, the said Bank further under take to pay to the Employer represented by Housing Directorate for and on behalf of the Employer as an Agent/Power of Attorney Holder any money so demanded notwithstanding any dispute or disputes raised by the Contractor in any suit or proceeding pending before any court or Tribunal relating thereto, our liabilities under this present being absolute and unequivocal. The payment so made by us under this

Guarantee shall be a valid discharge of our liability for payment thereunder and the Contractor shall have no claim against us for making such payment.

4. We _____ (*Indicate the name of the Bank*) further agree that the Guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Agreement and that it shall continue to be enforceable till all dues of the Employer under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharged or till the Employer's Representative on behalf of the Employer certifies that the terms and conditions of the said Agreement have been fully and properly carried out by the said Contractor and accordingly discharges this Guarantee.
5. We _____ (*indicate the name of the Bank*) further agree with the Employer, that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Agreement or to extend time of performance by the said Contractor from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said Contractor(s) and to forbear from or enforce any of the terms and conditions relating to the said Agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor or for any forbearance, act of omission on the part of the Employer or any indulgence by the Employer to the said Contractor or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.
6. This Guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor.
7. This Guarantee will neither be cancelled nor revoked by the Bank without the written authorization of Housing Directorate. For this purpose, the beneficiary Housing Directorate would inform the Bank of their authorized signatories together with the specimen signatures.
8. This Guarantee shall be valid up to _____ unless extended on demand by the Employer. Notwithstanding anything mentioned above, our liability against this guarantee is restricted to ₹ _____ (*Rupees* _____ only) and unless a claim in writing is lodged with us within six months of the date of expiry or the extended date of expiry of this Guarantee, all our liabilities under this Guarantee shall stand discharged.

Dated the _____ day of _____ for _____ (*indicate the name of the Bank*).

Note: To be put in sealed cover by Bank and addressed to the concerned officer of Housing Directorate.