

# **BRIDGE AND ROOF CO. (INDIA) LIMITED**

KANKARIA CENTRE (4<sup>TH</sup> & 5<sup>TH</sup> FLOOR)  
2/1, RUSSEL STREET,  
KOLKATA - 700071

**NOTICE INVITING e-TENDER (e-NIT) NO. BANDR/HO/SMPK/61038/SOLAR-  
WORK/NIT/CW/01**

## **BIDDING DOCUMENT**

**FOR**

**DESIGN, ENGINEERING, MANUFACTURING, PROCUREMENT & SUPPLY,  
INSTALLATION, TESTING & COMMISSIONING OF CUMULATIVE 2.30MWP  
ROOF MOUNTED GRID CONNECTED SOLAR PHOTO VOLTAIC POWER  
PLANT INCLUDING 10 YEARS COMPREHENSIVE MAINTENANCE  
CONTRACT (CMC) POST 1 YEAR WARRANTY AT KHIDIRPORE DOCK -II,  
KOLKATA, WEST BENGAL.**



**BRIDGE AND ROOF CO. (INDIA) LIMITED  
KANKARIA CENTRE (5<sup>TH</sup> FLOOR)  
2/1, RUSSEL STREET,  
KOLKATA - 700071**

**Document Fee: Rs. 20,000.00 + GST @18% (Non-Refundable)**

# MASTER INDEX

**Name of work:** Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock –II , Kolkata, West Bengal.

**e-NIT Document No:** B AND R/HO/SMPK/61038/SOLAR-WORK/NIT/CW/01 DTD. 11.03.2024

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**NAME OF WORK.:** Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.

**Notice Inviting e-Tender (e-NIT) No.:** B AND R/HO/SMPK/61038/SOLAR-WORK/NIT/CW/01 DTD. 11.03.2024

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**BRIDGE AND ROOF CO. (INDIA) LTD.**  
“KANKARIA CENTRE” (4<sup>TH</sup> & 5<sup>TH</sup> FLOOR),  
2/1, RUSSEL STREET,  
KOLKATA-700071

**INVITATION FOR NOTICE INVITING e-TENDER (e-NIT)**

**ANNEXURE - A**

**Notice Inviting e-Tender (e-NIT) No. B AND R/HO/SMPK/61038/SOLAR-WORK/NIT/CW/01 DTD. 11.03.2024**

Online **Single Percentage Rate Bid(s)** in Two Part Bid System are invited from Reputed, Resourceful and Experienced Parties meeting prescribed Qualifying Criteria for “**Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.**”

Interested Bidder(s) have to enroll & register with the Government e-Procurement System and download the tender document through logging on to <https://eprocure.gov.in/eprocure/app>.

**Last Date of submission of Bid: 01.04.2024 up to 17:30 Hours.**

All Corrigendum / Addendum, if any, shall be hosted in Company's website: <https://www.bridgeroof.co.in> as well as CPP Portal: <https://eprocure.gov.in/eprocure/app>.

**BRIDGE AND ROOF CO.(INDIA) LIMITED**  
**Kankaria Centre (4<sup>th</sup>&5<sup>th</sup> Floor),2/1, Russel Street, Kolkata – 700 071**  
**CIN No. : U27310WB1920GOI003601**

**Notice Inviting e-Tender (e-NIT) No.: B AND R/HO/SMPK/61038/SOLAR-WORK/NIT/CW/01 DTD. 11.03.2024**

Online **Single Percentage Rate bid(s)** are invited by B AND R from Reputed, Resourceful and Experienced Parties meeting prescribed Qualifying Criteria for “**Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.**”

The Bidder(s) shall submit the documents for any or all the following work:-

**TABLE-1**

Name of Work and Location	Assessed Value put to Tender (Rs. in Crore) (Approx.)	Cost of Tender Document (Non Refundable)	Earnest Money Deposit (EMD)	Time of Completion	Tender Inviting Authority (TIA)
(1)	(2)	(3)	(4)	(5)	(6)
Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.	Rs. 16.85 Cr.	Rs. 20,000.00 + GST @18% = Rs. <u>23,600.00 (Rupees Twenty Three Thousand and Six Hundred only)</u> in the form of Demand Draft (DD) / Pay order / Banker's Cheque from any Scheduled Bank in favour of "Bridge And Roof Co.(India) Ltd." payable at Kolkata. <b><u>(No A/c Payee Cheque shall be considered)</u></b>	Rs. 26.85 Lakhs (Rupees Twenty Six Lakhs and Eighty Five Thousand only) and shall be submitted by Bidder(s) along with their offer in the form of Demand Draft (D.D.) / Pay Order / Banker's Cheque valid for minimum 90 (Ninety) days / Bank Guarantee (BG) in prescribed format valid for minimum 06 (Six) months / Term Deposit Receipt valid for minimum 45 days beyond the validity of bid from any Scheduled Bank pledged in favour of "Bridge and Roof Co. (India) Ltd" alongwith Offer. <b><u>[No A/c Payee Cheque shall be Considered]</u></b> .	<b>10 (Ten) Months</b>	<b>General Manager (Commercial)</b> Bridge And Roof Co.(India) Ltd., Kankaria Centre (5th Floor), 2/1, Russel Street, Kolkata – 700071

Cost of Tender Document & EMD prescribed above shall be submitted alongwith Techno-Commercial Part of offer **in Original.**

### 3. CRITICAL DATE SHEET:

Dates & Time For:-	Dates and Time
Bid Document Publishing Date	: 11.03.2024
Bid Document Download Start Date	: 11.03.2024
Bid Document Submission Start Date	: 22.03.2024
Date and Time of Pre-bid Meeting	: 21.03.2024 at 15:30 Hrs.
Place of Pre Bid Meeting	: Bridge and Roof Co(l) Ltd Kankaria Centre (5th Floor), 2/1, Russel Street, Kolkata – 700 071 Bidder should send their queries at least one day in advance.
Bid Document Submission End Date	: 02.04.2024 at 17:30 Hrs.
Last date of submitting Tender Fee, EMD and physical documents as specified in Tender Document.	: 03.04.2024 at 11:00 Hrs. <b>Positively</b>
Date of Opening of Technical Bid Document	: 03.04.2024 at 17:30 Hrs. through CPP Portal (ON-LINE) System
Site Visit	: 18.03.2024 at 15:30 Hrs.
Date Original Document Verification	: shall be intimated after opening of Tender to Initial Short-Listed Bidder(s), if required
Date of Opening of Financial Bid Document	: Shall be intimated to Techno-Commercially Recommended Bidder(s) only through CPP Portal System.

#### GENERAL GUIDANCE:-

1. Tender documents consisting of Pre-Qualification Criteria and the set of Techno-Commercial Terms & Conditions of Contract, Technical Specification, Drawings and other necessary Documents may be downloaded from the website <https://eprocure.gov.in/eprocure/app>.
2. Bids must be accompanied by cost of Tender Document (Non-Refundable) as mentioned in Table-1, in the form of Demand Draft (D.D.) / Pay Order / Banker's Cheque in favour of Bridge And Roof Co. (India) Limited issued by a Scheduled Bank payable at Kolkata.  
  
Bank Guarantee (BG) in lieu of Earnest Money Deposit (EMD), Security Cum Performance Bank Guarantee (SPBG), Additional Performance Security (if any), Mobilization Advance (if any), Secured Advance (if any) shall be issued by a Scheduled Bank in favour of Bridge And Roof Co. (India) Limited.
3. Checklist is to be duly filled in.
4. Price Bid shall be opened for the Techno-Commercially Recommended / Qualified bidder(s) only through CPP Portal. Bidder(s) shall submit Percentage Price (**to be quoted as "above/ below/ at par" in percentage**) in the allotted space of the Price Bid format. Quoted price shall be inclusive of all but excluding GST.
5. If any of the intending bidders wishes to withdraw from participation in the bid, he / she can freely withdraw from the participation before scheduled date and time of closure of Bid Submission.
6. B AND R reserves right to cancel the bid without assigning any reason thereof.
7. Instructions / Guidelines for tenders for electronic submission of the tenders have been annexed for assigning the agencies to participate in e-Tendering.
8. Any agencies willing to take part in the process of e-Tendering will have to be enrolled & registered with the Government e-Procurement System; through logging on to <https://eprocure.gov.in/eprocure/app>. The agency has to click on the link for e-Tendering site as given on the web portal.
9. **Each Tenderer is required to obtain DSC (Enlisted Class- III ) for submission of online e-tendering from any Certifying Authorities (CAs) certified by the Controller of Certifying Authorities (CCA) on payment of requisite amount , details are available at the Website [www.cca.gov.in](http://www.cca.gov.in).**
10. Bids shall be submitted online only at CPPP website: <https://eprocure.gov.in/eprocure/app>. Manual bids shall not be accepted. Tenderer / Contractors are advised to follow the instructions provided in the 'Instructions to Tenderer' for the e-submission of the bids online through the Central Public Procurement Portal for e-Procurement at <https://eprocure.gov.in/eprocure/app> before proceeding with the tender.

**NOTE:** All corrigendum, addenda, amendments and clarifications to this Tender will be hosted in Company's Website & CPP Portal and not in the newspaper. Bidder shall keep themselves updated with all such amendments.

**QUALIFYING CRITERIA**

**Notice Inviting e-Tender (e-NIT) No. B AND R/HO/SMPK/61038/SOLAR-WORK/NIT/CW/01 DTD. 11.03.2024**

Bridge And Roof Co. (India) Ltd., Kolkata as Executing Agency of **M/s. Syama Prasad Mookerjee Port Kolkata (SMPK)** for this Project, invites offers from Capable and Competent Agencies to carry out the works mentioned below:

**“Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.”**

Interested Reputed, Resourceful & Experienced Parties having adequate proven experience in similar type of work may download the Tender along with Qualifying Criteria from Company's website: <http://www.bridgeroof.co.in> & <https://eprocure.gov.in/eprocure/app>.

The Company (B AND R) reserves the right to reject any or all offer(s) or cancel the notice at their sole discretion without assigning any reason, whatsoever thereof, which shall be final & binding upon the Bidders.

**I. QUALIFICATION CRITERIA FOR PARTICIPATION IN TENDER :-**

Experience should be in the name of the bidding Company and not in Subsidiary / Associate Company / Group Company etc.

**A.** The bidder should have successfully completed **“Similar Works”** of the value during the last **07(Seven) years** ending on the last date of month previous to the one in which tender is invited, not less than the followings:

i. **01 (One) Similar** completed work costing not less than the amount equal to **Rs. 13.48 Cr.**

**OR,**

ii. **02 (Two) Similar** completed work each costing not less than the amount equal to **Rs. 10.11 Cr.**

**OR,**

iii. **03 (Three) Similar** completed work each costing not less than the amount equal to **Rs. 6.74 Cr.**

**Note: “Similar Work” shall mean a Project comprising “Supply, Installation & Commissioning of Solar Power Plant in any Central Govt. / State Govt. / UTs / PSUs / Autonomous bodies / Private Sector etc.” in all respect under one Agreement / Contract.**

**Manufacturers who have supplied Solar Power Plant of the values as mentioned above in any Central Govt. / State Govt. / UTs / PSUs / Autonomous bodies / Private Sector etc. may also participate, provided supplier have to make MOU/Letter of Undertaking with the installation agency who have adequate experience in installation & commissioning of Solar Power Plant subject to fulfillment of PQ Criteria mentioned above [A(i / ii / iii)] for supply only. Relevant Documents regarding installation & commissioning of Solar Power Plant of Installation agency to be submitted.**

Notarized copy of **Completion Certificate** mentioning executed value of work & date of completion along with corresponding LOI/WO duly certified by clients from an officer not below the rank of EE or equivalent, substantiating the above-mentioned criterion under Sl. No. A as well as value of work to be submitted.

In case the Bidder is executing a Project, then Client / Owner has issued Completion Certificate in respect of a part of work, **(more than 90% of the value of work has been completed)** which meets the eligibility criteria, the same shall be considered while evaluating the Technical Bid.

In case the work experience is of Private Sector, the completion certificate shall be supported with copies of letter of award and copies of corresponding TDS Certificates along with the copy of relevant certified invoice. Value of work will be considered equivalent to the amount of TDS Certificates duly Notarized.

The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum; calculated from the date of completion to last date of receipt of offers for Tenders.



- B. Average Annual Financial Turnover** during the last 03 (Three) years ending **31.03.2023** should not be less than **the amount equal to Rs. 5.06 Cr.**

The value of annual turnover shall be brought to current costing level by enhancing the actual turnover figures at simple rate of 7% per annum; calculated in the following manner.

Financial Year*	2022-23	2021-22	2020-21	2019-20	2018-19
VEF*	1.00	1.07	1.14	1.21	1.28

- Copy of Audited Balance Sheet(s) along with Turnover Certificate duly signed by Chartered Accountant with his / her Seal, Signature & Registration Number for last 03 (Three) financial years ending **31.03.2023** to be submitted. The year in which no Turnover is shown, would also be considered for working out the average. **Turnover should be of the Bidding Company and not for Subsidiary / Associate Company / Group Company etc.**
- C.** The Bidder should not have incurred any loss (**Profit after Tax should be Positive**) **in more than two years during the last five years ending 31st March, 2023. Net Worth of the Company / Firm as on 31st March 2023 should be positive.** Net Worth Certificate for F.Y.: 2022-23 should be submitted duly certified by Chartered Accountant with his / her Seal, Signature & Registration Number.
- D.** Bidder has to submit **Bank Solvency Certificate** not less than **the amount equal to Rs. 6.74 Cr. The Solvency certificate being not more than 3 months old from the last date of bid submission.**  
**OR,**  
Net-worth certificate of **Rs. 1.70 Cr.** issued by certified Chartered Accountant with UDIN
- E.** The bidder should have adequate Engineers in his Company's roll and the bidder should also have own / lease / hiring arrangement for plant and machineries for execution of the work.
- F.** The bidder should have PAN, GST Registration and Current Income Tax Deposition Document.
- G.** The bidder should be able to abide by and handle statutory requirements related to Labour License, PF & ESI Registration Certificate during tenure of construction activities.
- H.** Bidder(s) should not have been black-listed by any Central / State Govt. / Autonomous Body / PSU in last five years from the original last date of bid submission. Bidder shall submit duly Notarized Affidavit to this effect as per Format **(Form – F)**.
- I.** Constitutional Status i.e. to specify whether Proprietary or Partnership Firm etc. with Documentary Evidence.
- J.** Bidder(s) have to submit copy of valid Electrical License or Bidder must associate himself with Agencies for Electrical Work having valid Electrical License. Therefore Bidder has to submit Willingness Certificate as per specified format from Associating Electrical Agency alongwith valid Electrical License.
- K.** **Bidder(s) should have submitted copy of Latest Filed Monthly / Quarterly GSTR-3B Return as GST Clearance Certificate.**
- L.** **Direct or Indirect Joint Venture(s) / Consortium / Special Purpose Vehicle (SPV) / Special Purpose Entity (SPE) are not permitted to participate.**
- M. BID CAPACITY :**  
Bidders who meet the minimum Qualification Criteria will be qualified only if their available bid capacity of work is **equal to more than the total bid value put to tender.**

The Bidder who fulfills the following requirements and having bidding capacity as per the following formula, shall be eligible to apply. **Consortium / Joint ventures are not accepted.**

$$\text{Bidding Capacity} = [ \{ A \times N \times 1.5 \} - B ]$$

Where,

**A** = Maximum turnover in construction works executed in any one year during **the last 05 (Five) years** taking into account the completed as well as works in progress. The value of completed works shall be brought to current costing level by enhancing at a simple rate of 7% per annum. Provisional / Un-Audited Balance Sheet shall not be considered.

**N** = Number of years prescribed for completion of work for which bids has been invited. **[N=1]**

**B** = Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited.

**N. Bidder(s) (Private Limited / Limited Company) should submit the Copy of Screenshot of MCA Portal showing 'Active' Status. Bidder(s) (other than Private Limited / Limited Company) should not submit the Copy of Screenshot of MCA Portal showing 'Active' Status.**

• **Note for clause I.A. above :**

- i. If the qualifying work is completed in the seven (7) year period specified above, even if it has been started earlier, the same will also be considered as meeting the qualifying requirements.
- ii. The one (1) year period means any continuous 12 months period. However, for concurrent works the same 12 months period shall be considered.
- iii. The word "executed" means the bidder should have achieved the criteria specified in the above QR even if the total contract is not closed i.e. under execution and provided the works is not terminated by the client.

❖ **The bidder is liable to be disqualified, even though they meet the Qualifying Criteria, if they.**

- a. **Made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or**
- b. **Record of poor performance such as abandoning the works, not properly completing the Contract, inordinate delays in completion attributable to the Contractor, litigation history with B AND R / Client, or financial failures etc.; and/or**
- c. **Participated in the previous bidding for the same work and had quoted unreasonable prices and could not furnish rational justification to the Engineer-in-Charge.**
- d. **Indulged in unlawful & corrupt means in obtaining bids.**
- e. **Been black listed / cancelled their registrations by the Competent Authority (i.e. Any Govt. Dept. / PSU / Semi Govt. / Local Govt. bodies etc.).**
- f. **If Bidder or any of Constituent Partner had been debarred to participate in Tender by Client i.e. SMPK / B AND R during the last 05 (Five) years prior to the date of this NIT, such debarment will be considered as disqualification towards eligibility. A Declaration in this respect has to be furnished by the Bidder as per prescribed format (Form – F) without which the Technical bid shall be treated as Non-Responsive. Technical Bid shall be treated as Non-Responsive if anything adverse has come to the Notice of the Tender Inviting Authority against Firm / Agency / Bidder so far as his performance within the jurisdiction of this company.**
- g. **If the tenderer deliberately gives wrong information / submit fake, false, fabricated, forged documents in his tender, B AND R reserves the right to reject such tender at any stage or to cancel the Contract if awarded and forfeit the Earnest Money / Retention Money / any other money due and to keep under black list / holiday list for 02 years.**

This being a composite tender, the Bidder must associate with himself agencies otherwise eligible to tender for other components individually including specialized services for which an Affidavit/Undertaking as per format enclosed should be submitted along with the Technical Bid.

The Contractor/Firm will indemnify B AND R and SMPK, as the case may be, against all penal action that may be levied/effectuated by any concerned authority for default in any Labour Regulation/PF/ESI and other statutory requirements of the relevant Acts/Laws related to the work of the contractor and will bear the legal charges, if any, and will pay the legal charges/dues directly to the Concerned Authority. An undertaking in this regard is required to be submitted by applicants along with prequalification.

CMC is important and shall be integral part of the Solar Power plant Tender, The Comprehensive Maintenance Contract (CMC) shall be part of the tender and it will be specifically mentioned that after defect liability period the solar contractor shall carry out the CMC job as per the rates quoted by them after acceptance of M/s SMPK and subsequently order given to them. However the payment shall be made by M/s SMPK directly to the solar contractor. There shall be tripartite agreement between the Solar contractor, M/s SMPK and B and R. In this regard by mentioning that after defect liability period, the solar contractor shall be directly liable to execute the CMC work under M/s SMPK's Guidance/ Instruction and the payment of CMC shall be made by M/S SMPK directly to the Solar Contractor as per the rates given in the Agreement. Band R shall not be responsible in any manner for CMC work post one year defect liability period after completion of total solar work. The CMC period shall be for 10 Years. Order shall be given by M/s B And R for execution part only and the CMC part shall be governed by tripartite agreement.

## **II. DETAILS TO BE FURNISHED WITH TENDER APPLICATION / OFFER :**

The bidders are requested to furnish the following details seriatim as under.

1. Details of Information to be furnished by the Bidder : Annexure – E
2. Letter of submission : Annexure : F
3. Power of Attorney in favour of the person signing the TENDER
4. Letter of Transmittal : Annexure : H
5. Process Compliance Form : Annexure – J
6. Financial Information (Form-A)
7. Solvency Certificate from a Scheduled Bank (Form-B)
8. Details of Similar nature of works (Form-C1) and Project under Execution or Awarded (Form-C2)
9. Performance Report of Works (Form-D)
10. Structure & Organization (Form-E)
11. Affidavit by the Bidder (Form-F) on non-judicial stamp paper of appropriate value duly notarized
12. Affidavit by the Bidder (Form-G) on Bidder's Letter Head
13. Willingness Certificate of Electrical Agency (Form-H)
14. List of Technical Manpower in Company's roll (Form-I)
15. List of Tools & Plants owned by the Company. (Form-J)
16. Information on Litigation History, Liquidated Damages, Disqualification etc (Form-K)
17. Declaration confirming Knowledge about Site Conditions (Form-L)
18. Laboratory Equipments (Form-M)
19. Compliance to Bid Requirement (Form-N)
20. Integrity Pact (Annexure -K)
21. Exhibits – EA to EK
22. Documentary evidence of Permanent Account No. (PAN) with Income Tax Department.

23. Documentary evidence of GST Registration with the concerned department and copy of Latest Filed Monthly / Quarterly GSTR-3B Return.
24. Documentary Evidence of P.F., ESI and Labour License with the Concerned Department.(if not registered with **Concerned Department** Documentary Evidence (s), **Successful Bidder must take Registration within one month from the date of Award and in this regard bidder has to submit an undertaking in their Letter Head alongwith their offer or the same**).
25. Documentary Evidence of **Screenshot of MCA Portal showing 'Active' Status of Bidder (for Private Limited / Limited Company)**.
26. Format for Input Tax Credit as per **Annexure - N**
27. Bidder(s) have to submit copy of valid Electrical License or, Bidder must associate himself with Agencies for Electrical Work having valid Electrical License. Therefore Bidder has to submit Willingness Certificate as per specified format from Associating Electrical Agency alongwith valid Electrical License.
28. Constitution and legal status along with attested copies of Deeds / Articles and Memorandum of Association etc. as applicable.
29. Documents pertaining to Qualifying Criteria furnished in **Annexure-B** of the Tender and Detail of information to be furnished by the bidder as per prescribed format.

By submitting the offer, the bidder authorizes B AND R to seek verification on the information supplied and related matters.

1. Bidders shall, on request, provide any necessary authority and assistance to enable relevant enquiries to be carried out.
2. After submission of their offer, bidder must notify B AND R promptly, if there is any:
  - Substantial change in their financial or technical capacity.
  - Change in their business (such as Company name, address)
  - Change of ownership or holding, including any transfer of key personnel.
  - Any other significant change in information provided in the application.
3. **The bidder must provide any further details required for the review upon request from B AND R. Failure to comply with any request by B AND R for such information will result in rejection of their offer.**
4. B AND R may, in its absolute discretion suspend or disqualify an agency/agencies who, at any time, is considered to have breached any of the qualification conditions or has performed in an unsatisfactory manner without assigning any reason whatsoever.
5. B AND R will not be liable for any loss or damages incurred by the agency/agencies in the above exercise.
6. B AND R reserves the right to disqualify such bidders who had a record of not meeting the contractual obligations against earlier contracts entered into with the B AND R.

**SRI D. MUKHOPADHYAY**  
**GM(COMMERCIAL)**  
**COMMERCIAL DEPARTMENT**  
**BRIDGE AND ROOF CO (I) LTD.**



**INSTRUCTIONS TO BIDDERS (ITB)****WORK DESCRIPTION:**

**“Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.”**

1. Online Single Percentage Bid(s) are invited by B AND R in **Two Part Four Cover System** from Resourceful & Capable Tenderer(s) fulfilling the Qualifying Criteria furnished in Annexure – A of the e-NIT by Bridge And Roof Co. (I) Ltd. (B AND R) on behalf of the National Education Society for Tribal Student (SMPK), Ministry of Tribal Affairs, Government of India, for the **“Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.”**

**[Technical (Cover- I, II & III) and Financial (Cover-IV)] before the Prescribed Date & Time in e-NIT using the valid Digital Signature Certificate (DSC) obtained from the Authorized Agencies of NIC.**

- 1.2 e-Tendering mode of Bid submission will be followed wholly for this Bid. Wherever manual mode of Bid submission is stipulated in this Bid Document, the e-tendering mode shall supersede all such stipulations.
2. Contract / Agreement shall be drawn with the Successful Tenderer on Prescribed Form. Tenderer shall quote his rates (in % or item rate whichever is applicable) as per various terms and conditions of the tender document, which will form part of the agreement / contract.
3. The time allowed for carrying out the work will be **10 (Ten) months** to be reckoned from the date of issue of letter of intent by B AND R or from the date of handing over of site by B AND R to the contractor, whichever is later, in accordance with the phasing, if any, indicated in the Tender Document.

Tender documents consisting of Pre-Qualification Criteria and the set of Techno-Commercial Terms & Conditions of Contract, Technical Specification, Drawings and other necessary Documents may be downloaded from the website <https://eprocure.gov.in/eprocure/app>. The Bidder(s) must have submitted cost of Tender documents as mentioned in Sl. No. 3.1 below alongwith their Offer. If the cost of Tender document is not submitted, their offer is liable to be rejected.

- 3.1 The Bidder(s) must submit cost of Tender Document (Non-Refundable) of **Rs. 20,000.00 + GST @18% = Rs. 23,600.00 (Rupees Twenty Three Thousand and Six Hundred only)** in the form of Demand Draft (D.D.) / Pay Order / Banker's Cheque in favour of Bridge And Roof Co. (India) Limited issued by a Scheduled Bank payable at Kolkata. **[No A/c Payee Cheque shall be Considered]**.

**Earnest Money Deposit (EMD) :**

**Rs. 26.85 Lakhs (Rupees Twenty Six Lakhs and Eighty Five Thousand only)** shall be submitted by Bidder(s) along with their offer in the form of Demand Draft (D.D.) / Pay Order / Banker's Cheque valid for minimum 90 (Ninety) days / Bank Guarantee (BG) in prescribed format valid for minimum 06 (Six) months / Term Deposit Receipt valid for minimum 45 days beyond the validity of bid issued by a Scheduled Bank pledged in favour of “Bridge and Roof Co. (India) Ltd” along with Offer. **[No A/c Payee Cheque shall be Considered]**.

EMD amount in the form of BG / Term Deposit submitted by Successful Bidder(s) shall be retained till submission of valid BG / Term Deposit towards Performance Guarantee and the same shall be released thereafter. EMD amount in the form of Demand Draft (D.D.) / Pay Order / Banker's Cheque submitted by Successful Bidder(s) will be treated as a part of Security Deposit / Retention Money and the deduction towards the Security Deposit / Retention Money will be started after adjustment of EMD amount against value of work done in R/A bills. EMD amount of **Un-Successful Bidder(s)** shall be returned to them at the earliest after expiry of the final bid validity and latest on or before the 30<sup>th</sup> day after the award of the Contract. However, EMD amount of **Un-Successful Bidder(s) during First Stage i.e. Technical Evaluation etc.** should be returned within 30 days of declaration of result of First Stage i.e. Technical Evaluation. No interest will be payable on Earnest Money Deposit.

Since, the tender is a Works Contract, benefits (i.e. Exemption of Tender Fee & EMD) to Indian Micro & Small Enterprises (MSEs) Units registered with DIC / NSIC / KVIC / KVIB / Directorate of Handicraft and Handloom etc., under Provisions of Public Procurement Policy for MSEs Order 2012 with upto date amendments shall not be applicable.

No exemption for submission of Tender Fee & EMD shall be entertained for MSME parties **Therefore, MSME registered parties have to submit Tender Fee & EMD as specified in Tender alongwith their offer.**

3.2 Bids shall be submitted online at CPPP website: <https://eprocure.gov.in/eprocure/appin> Two Part Four Cover System in the following manner:-

**Part-I:** Containing one Copy each of following documents:

Cover - I Bidder should submit the **Tender Fee, EMD, Letter of Submission (in Company's letter head); Detail of information to be furnished by the bidder and Power of Attorney in favour of the person who has signed the bid on stamp paper of Appropriate value, as prescribed)** in Technical Cover as specified in the tender. In case, the offer is signed by Managing Director / Partner / Proprietor himself, Power of Attorney is not required. It is mandatory to mention on Letter Head that the offer is duly signed & stamped by CMD / Partner / Proprietor The original should be posted / couriered / given in person to the Tender Inviting Authority, within specified date and time for the tender. Scanned copy of the document should be uploaded as part of the offer. The details of the DD / any other accepted instrument, physically sent, should tally with the details available in the scanned copy and the data entered during bid submission time. Otherwise submitted bid will not be acceptable.

Cover - II **All Exhibits – EA to EK, ALL other Documents mentioned in Part – II.**

Documents pertaining to Qualifying Criteria furnished in Annexure – B of the e-NIT.

Cover - III Signed & Stamped e-NIT, ITB, GCC, SCC, Technical Sec, i.e. complete NIT documents as a token of acceptance along with all other submittals as prescribed in the Bidding document.

**Part- II:**

Financial (Cover- IV) The Financial Bid format is provided in a **spread sheet file like BoQ\_xxxx.xls**, the rates offered should be entered in the allotted space only and uploaded after filling the relevant columns. The Financial Bid / BOQ template must not be modified / replaced by the bidder; else the bid submitted is liable to be rejected for this tender. The bidder should complete entry of the price bid then click on the 'validate' button to perform preliminary check of entry. The excel sheet should be saved after completing the entry.

**Tenderers should quote as "Above / Below / At Par (0%) in Single Percentage on Total Amount basis as per the Price Bid Format in the allotted space only.**

While submitting the bids online, the bidder reads the terms & conditions and accepts the same to proceed further to submit the bid packets.

The bidder has to digitally sign and upload the required bid documents one by one as indicated. Bidders to note that the very act of using DSC for downloading the bids and uploading their offers shall be deemed to be a confirmation that they have read all sections and pages of the bid document including General conditions of contract without any exception and have understood the entire document and are clear about the requirements of the tender requirements.

The bidder has to upload the relevant files required as indicated in the cover content. In case of any irrelevant files, the bid will be rejected.

The bidders are requested to submit the bids through online e-tendering system to the Tender Inviting Authority (TIA) well before the bid submission end date & time (as per Server System Clock). The TIA will not be held responsible for any sort of delay or the difficulties faced during the submission of bids online by the bidders at the eleventh hour.

The time settings fixed in the server side & displayed at the top of the tender site, will be valid for all actions of requesting, bid submission, bid opening etc., in the e-tender system. The bidders should follow this time during bid submission.

Unless otherwise specified, techno-commercial bids will be opened the next working day at **15-00 hrs** after latest due date of submission of offer.

Price Bids of those Bidders who will be Techno- commercially qualified for the subject job on the basis of evaluation of techno commercial bids, will be opened on specified date. The date & time to open the Financial bid (Cover-IV) shall be intimated through system to the qualified bidders only.

Telegraphic or Fax or Email offers shall not be accepted under any circumstances.

**Bidder should submit the following documents alongwith Technical Part duly filled, stamped & signed in Hard Copy on or before 03.04.2024 up to 11:00 Hrs. Positively at our Kolkata Office addressed to General Manager(Commercial), Bridge And Roof Co.(India) Ltd., Kankaria Centre (4<sup>th</sup>& 5<sup>th</sup>Floor), 2/1, Russel Street, Kolkata – 700071.**

- i. **Tender Fee: Rs. 20,000.00 + GST @18% = Rs. 23,600.00 (Rupees Twenty Three Thousand and Six Hundred only)** in the form of Demand Draft (D.D.) / Pay Order / Banker's Cheque in favour of Bridge and Roof Co. (India) Limited issued by a Scheduled Bank payable at Kolkata. **[No A/c Payee Cheque shall be Considered]**.
- ii. **EMD: Rs. 26.85 Lakhs (Rupees Twenty Six Lakhs and Eighty Five Thousand only)** in the form of Demand Draft (D.D.) / Pay Order / Banker's Cheque valid for minimum 90 (Ninety) days / Bank Guarantee (BG) in prescribed format valid for minimum 06 (Six) months / Term Deposit Receipt valid for minimum 45 days beyond the validity of bid issued by a Scheduled Bank pledged in favour of "Bridge and Roof Co. (India) Ltd" along with Offer. **[No A/c Payee Cheque shall be Considered]**.
- iii. Details of Information to be furnished by the Bidder in Bidder's Letter Head : Annexure – E
- iv. Letter of submission in Bidder's Letter Head : Annexure : F
- v. Power of Attorney in favour of the person signing the e-NIT
- vi. Letter of Transmittal : Annexure : H
- vii. Process Compliance Form : Annexure – J
- viii. Financial Information (Form-A)
- ix. Banker's Certificate from a scheduled Bank (Form-B)
- x. Details of Eligible Similar nature of works (Form-C1) and Project under Execution or Awarded (Form-C2)
- xi. Performance Report of Works (Form-D)
- xii. Structure & Organization (Form-E)
- xiii. Affidavit by the Bidder (Form-F) on non-judicial stamp paper of appropriate value duly notarized
- xiv. Affidavit by the Bidder (Form-G) on Bidder's Letter Head
- xv. Willingness Certificate of Electrical Agency (Form – H)
- xvi. List of Technical Manpower in Company's roll (Form-I)
- xvii. List of Tools & Plants owned by the Company. (Form-J)
- xviii. Information on litigation history, liquidated damages, disqualification etc (Form-K)



- xix. Declaration confirming knowledge about Site Conditions (Form-L)
- xx. Laboratory Equipments (Form-M)
- xxi. Compliance to Bid Requirement (Form – N)
- xxii. Integrity Pact (Annexure - K)
- xxiii. Documentary evidence of Permanent Account No. (PAN) with Income Tax Department.
- xxiv. Documentary evidence of GST registration and copy of Latest Filed Monthly / Quarterly GSTR-3B Return.
- xxv. Documentary evidence of P.F., ESI & Labour Licence with the concerned department. However, in case the bidder does not have ESI & PF Registration, he should submit a declaration on Company's Letter Head that he will get registered his firm / company under ESI & PF Authority on award of the job but before issuance of Work Order & release of payment whichever is earlier.
- xxvi. Documentary Evidence or Copy of **Screenshot of MCA Portal showing 'Active' Status of Bidder (for Private Limited / Limited Company).**
- xxvii. Format for Input Tax Credit as per Annexure –N
- xxviii. Constitution and legal status along with attested copies of Deeds/Articles and Memorandum of Association etc. as applicable.
- xxix. Name(s) of the Owner/Partners/Promoters and Directors of the Firm/Company.
- xxx. Documents pertaining to Qualifying Criteria furnished in Annexure–B of the TENDER.
- xxxi. All Exhibit (s) i.e. Exhibit – EA to EK
  - Due date of submission shall be written on all the covers / envelopes of the TENDER application / bid without fail.
  - Application / Bids received after the due date and time shall not be accepted. No request for extension of the due date indicated shall be entertained.
  - Telegraphic or Fax or Email offers shall not be accepted under any circumstances.
  - B AND R may, in its absolute discretion suspend or disqualify a Bidder / Bidders who, at any time, is considered to have breached any of the qualification conditions or has performed in an unsatisfactory manner without assigning any reason whatsoever.
  - The right to reject any or all offer(s) or split up the total requirement and award the contract to one or to more than one bidder if considered necessary or to cancel the bid rests with B AND R.

3.3. **Due date for submission of offer is 02.04.2024 upto 17.30 HR.**

3.4 **Intending bidder(s) may send their queries, if any, through e-mail ([commercial@bridgeroof.co.in](mailto:commercial@bridgeroof.co.in)) on or before 20.03.2024 by 11:00 hrs. positively for Clarification.**

4. The successful tenderer, whose tender is accepted, will be required to furnish Performance Guarantee of **5% (Five Percent) of the Contract Value** within 30 days from the date of issue of Letter of Intent/ Acceptance. This guarantee shall be in the form of Bank Guarantee (BG) in prescribed format. The Bank Guarantee shall also be valid for 12 months from the date of commissioning of solar plant with claim period of 3 months thereafter. The Contractor at his own cost shall arrange to keep BG valid up to Warranty period which is one year after completion of work. In case the work is not completed within stipulated period of completion the validity of SPBG shall be increased accordingly by the contractor. Failure of the successful bidder to submit the required Performance Security shall constitute sufficient grounds for the annulment of the award of the contract and forfeiture of EMD.

Contractor shall also be required to furnish Performance Guarantee of 2% (Two Percent) of the Contract Value including CMC Value for Comprehensive Maintenance Contract (CMC) Period for 10 years before starting of CMC and PBG shall be valid till CMC Period.

The successful tenderer will also be required to furnish additional Security Deposit / Retention Money amounting to 5% (Five Percent) of the contract value, which will be deducted from each of his running bill. The said security

deposit will be refunded without any interest after completion of CMC period of 10 Years.

5. **SITE VISIT:**

Tenderers are advised to inspect and examine the site and its surroundings and satisfy themselves before submitting their tenders about the nature of the ground and sub-soil (so far as is practicable), the form and nature of the site, the means of access to the site, the accommodation they may require and in general shall themselves obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their tender. A tenderer shall be deemed to have full knowledge of the site whether he inspects it or not and no extra charges consequent on any misunderstanding or otherwise shall be allowed. The tenderer shall be responsible for arranging and maintaining at his own cost all materials, tools & plants, water, electricity, access, facilities for workers and all other services required for executing the work unless otherwise specifically provided for in the contract document. Submission of a tender by tenderer implies that he has read these instructions and all other contract documents and has made himself aware of the scope and specifications of the work to be done and local conditions and other factors having a bearing on the execution of the work.

The Officer inviting e-NIT tender / Engineer-in-Charge will clarify queries on the Contract Data on requisition by the intending Bidder. The bidder may ask question; provided the questions are raised at least 7(days) before the due date of submission of e-NIT application.

**Bidder may visit the Site with intimation to B AND R prior to submission of their bid. Bidder should also submit the “Declaration confirming Knowledge about Site Conditions” as per Form-L duly signed by the Bidder alongwith the offer.**

**Prior to submission of offer, the interested Parties should visit Project Site after hosting / uploading of Tender in CPP Portal. Bidder should allow to visit the site on 18.03.2024 subject to submission of request. Thereafter, No bidder shall be allowed for Site Visit or no request shall be entertained. Prospective Bidder(s) may contact and report to :**

**For SMPK (Port Trust) Site Visit, Concerned Authorized Persons for BandR are (1) Shri Subhasis Ganguly (Deputy Construction Manager), Mobile No. 7001349177 .**

**It is in the interest of the Bidder(s) to participate in the site visit to have an overall idea of the project site.**

6. ***The Bidders are subject to be disqualified if they have:***

- a. Made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or
- b. Record of poor performance such as abandoning the works, not properly completing the Contract, inordinate delays in completion, litigation history, or financial failures etc.; and/or
- c. Participated in the previous bidding for the same work and had quoted unreasonable prices and could not furnish rational justification to the Engineer-in-Charge.
- d. Indulged in unlawful & corrupt means in obtaining bids.
- e. Been black listed / cancelled their registrations by the Competent Authority (i.e. Any Govt. Dept. / PSU / Semi Govt. / Local Govt. bodies etc.).
- f. If Bidder or any of Constituent Partner had been debarred to participate in Tender by Client i.e. SMPK / B AND R during the last 05 (Five) years prior to the date of this NIT, such debarment will be considered as disqualification towards eligibility. A Declaration in this respect has to be furnished by the Bidder as per prescribed format (Form – F) without which the Technical bid shall be treated as Non-Responsive. Technical Bid shall be treated as Non-Responsive if anything adverse has come to the Notice of the Tender Inviting Authority against Firm / Agency / Bidder so far as his performance within the jurisdiction of this company.
- g. If the tenderer deliberately gives wrong information / submit fake, false, fabricated, forged documents in his tender, B AND R reserves the right to reject such tender at any stage or to cancel the Contract if awarded and forfeit the Earnest Money / Retention Money / any other money due and to keep under black list / holiday list for 02 years.

7. **GENERAL INSTRUCTIONS :**

The description of the work is as mentioned under Invitation for Tender.

- a. The e-NIT / Tender hosted / uploaded by the Bid Inviting Officer may consist of PQ Criteria, Techno-commercial terms & Conditions of contract, Technical Specification and other necessary Documents etc. Bidder may download these documents and take out the print for detail study. The bidder is required to download all the documents including Techno-commercial Terms & Conditions. It is assumed that while participating in the bid, the bidder has referred to all documents uploaded by the Officer Inviting the Tender. Seeking any revision of documents or backing out of the bid claiming for not having referred to any or all documents provided in the eNIT / Tender document by the Officer Inviting Tender will be construed as plea to disrupt the bidding process and in such cases the EMD & retention amount shall be forfeited.
  - b. The bidder is expected to examine carefully all instructions, conditions of contract, Schedule, forms, Annexes etc in the NIT / Tender document. Failure to comply with the requirements of NIT / Tender document shall be at the bidder's own risk.
  - c. B AND R reserves the right to reject any or all the bids or to cancel the NIT without assigning any reasons whatsoever. Tenders in which any of the prescribed condition is not fulfilled or any condition including that of conditional rebate is put forth by the tenderer shall be liable for rejection.
  - d. Canvassing whether directly or indirectly, in connection with tenders is strictly prohibited and the tenders submitted by the Bidders who resort to canvassing will be liable to rejection and EMD submitted by bidder will be forfeited.
  - e. The Bidder shall not be permitted to tender for works in B AND R (responsible for award and execution of contracts) and SMPK Authority in which his near relative is posted as Accountant or as an officer in any capacity. He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to any officer in the SMPK Authority and B AND R. Any breach of this condition by the Contractor would render him liable to be removed from the approved list of Contractors of B AND R / SMPK Authority.
  - f. The tender for the works shall remain open for acceptance for a period of **(90) Ninety days** from the date of opening of techno-commercial part of tenders. If any tenderer withdraws his tender before the said period or issue of letter of intent, whichever is earlier, or makes any modifications in the terms and conditions of the tender or his rates (Quoted or Agreed) which are not acceptable to the B AND R, then **B AND R shall, without prejudice to any other right or remedy, be at liberty to forfeit 100% of the said earnest money as aforesaid.**
  - g. These Instructions to Bidders shall form a part of the contract document. The successful tenderer / Contractor, on issue of Letter of Intent of work by the Accepting Authority, shall, within **90(Ninety) days** from the date of LOI but in any case before submitting the first bill for payment, sign the contract consisting of:
  - h. The Instructions to Bidders, Tender document including Schedule of Quantities, Contract clauses, Special conditions, Technical Specifications and drawings, if any, forming part of the tender document as issued at the time of invitation of tender and acceptance thereof together with any correspondence leading thereto:
  - i. The B AND R's safety code shall be applicable for this work.
  - j. **Total work shall be awarded to one bidder on L1 Basis and Scope of Work shall not be split.**
8. On acceptance of the tender by the Competent Authority, Letter of Intent of work will be issued by B AND R on behalf of the SMPK.
9. **INTEGRITY PACT:** The Successful Bidder / Contractor is required to enter into an Integrity Pact with the Employer, in the Format at **Annexure – K**. The Integrity Pact enclosed as **Annexure-K** will be signed by B AND R for and on behalf of Employer as its Agent / Power of Attorney Holder at the time of execution of Agreement/Contract with the Successful Bidder. While submitting the Bid, the Integrity Pact shall be signed by the duly authorized signatory of the Bidder. In case of failure to submit the Integrity Pact duly signed and witnessed, along with the Bid, the Bid is likely to be rejected.

In case of any contradiction between the Terms and Conditions of the Bid Document and the Integrity Pact, the former will prevail.

For monitoring of the Integrity Pact, B AND R has appointed the following eminent personalities as Independent External Monitor(s) (IEM) :

(1) Sri Divya Prakash Sinha  
IPS (Retd.)  
83, Lodhi Estate,  
New Delhi - 110003  
Email : [dpsinha.ips@gmail.com](mailto:dpsinha.ips@gmail.com)

(2) Mrs. VijayaKanth  
IRAS (Retd.)  
Sterling Monor, Flat – F, No. 5,  
Sterling Road, 3<sup>rd</sup> Cross Street  
Nungambakkam, Chennai – 600034  
Email : [vkantmr12003@yahoo.com](mailto:vkantmr12003@yahoo.com)

10. **ORDER OF PRECEDENCE:**

These “**Notice Inviting e-Tender (e-NIT) No. B AND R/HO/SMPK/61038/SOLAR-WORK/NIT/CW/01DTD. 11.03.2024** with PQ Criteria and other provision including General Conditions of the Contract, Special Conditions of Contract are supplementary to & complementary with each other. However, in the event of any provisions of General Conditions are repugnant to or at variance with any provisions of Special Conditions of Contract’, then unless a different intention appears between the two, the provision given in Special Conditions of Contract’ shall be deemed to over-ride that provision of General Conditions and shall to the extent of such repugnancy or variation prevail & govern the Contract. Conditions of SCC shall override the Technical Specification. For any contradiction in bid documents, Technical Specifications and/or Letter of Intent (LOI) the following order of precedence shall be follows:

- Letter of Intent (LOI)
- Schedule of Quantities & Rates (SOQR) and preamble to SOQR
- Minimum Acceptable Limit
- Construction Drawings (AFC Drawings)
- Tender Drawing(s)
- Technical Specification given in Tender
- CPWD Technical Specification and other Technical Specifications / documents issued by B AND R
- Relevant IS Code
- Notice Inviting e-Tender (e-NIT)
- Special Condition of Contract (SCC)
- General Condition of Contract (GCC)

11. **ONE NIT APPLICATION / OFFER PER BIDDER:**

11.1 Each bidder shall submit only one Application / Bid / offer. A bid / offer bid is said to be responsive if accompanied by cost of eNIT Tender document.

12. **COST OF eNIT DOCUMENTS:**

12.1 The bidder shall bear all costs associated with the preparation and submission of his application / bid / offer, and the Engineer-in-Charge will in no case be responsible and liable for those costs.

13. **CLARIFICATION OF eNIT / TENDER DOCUMENT:**

13.1 eNIT Document consisting of PQ Criteria & Techno-Commercial Terms & Conditions of Contract, Technical Specifications etc to be complied with by the Contractor who intends to NIT application / offer.

13.2 **Hard paper copy of the NIT document shall not be normally sold unless specifically requested by bidder(s).**

13.3 **The bidder can seek clarification on the eNIT / tender** which B AND R receives earlier than **07 (Seven) days** prior to the deadline for submission of offer. The Employer's response will be forwarded through the e-mail ID ([commercial@bridgeroof.co.in](mailto:commercial@bridgeroof.co.in)) of the enquirer followed by confirmation copy.

14. **AMENDMENT OF eNIT / TENDER DOCUMENTS:**

14.1 Before the deadline for submission of eNIT application / offer, the officer inviting eNIT tender may modify the eNIT / Tender documents by issuing addenda.

14.2 Any **addendum / corrigendum** thus issued shall be part of the tender documents and shall be notified in the

website [www.bridgeroof.co.in](http://www.bridgeroof.co.in).

- 14.3 To give **prospective** bidders reasonable time in which to take an addendum / corrigendum into account in preparing their eNIT application / Bid / offers, the Officer inviting eNIT tender with the permission of the higher authority may, at his discretion, extend as necessary the dead line for submission of eNIT application offer.

#### **PREPARATION OF eNIT TENDER / PRE-QUALIFICATION BID**

#### **15. LANGUAGE OF THE eNIT/ TENDER DOCUMENT:**

- 15.1 All documents relating to the eNIT application / Tender shall be in the English. ENIT / offers submitted in any other language shall be summarily rejected.

#### **A. Cost of “eNIT Tender Document”**

- i) Cost of eNIT Tender Document

#### **B. “Techno-Commercial Part”.**

- i) Declaration as stipulated in eNIT/Tender  
ii) Qualification Information and supporting documents mentioned in Annexure – B& e-NIT/Tender  
iii) Certificates, undertakings, affidavits etc

#### **C. Price /Financial Part shall be opened after finalization of the Techno-Commercially Recommended / Qualified bidders through CPP Portal.**

- i) Priced Schedule of Quantities and Rates

#### **16. PROPOSAL TO THE BIDDER:**

- 16.1 For **Item / percentage** rate bids, the bidders shall fill in rates in figures and should not leave any cell blank.  
16.2 The bidders shall quote **Single Percentage Rate rounded upto two decimal places as per the Price Bid format in the allotted space only. Final Evaluation shall be made accordingly.**

#### **17. FORMAT AND SIGNING OF eNIT DOCUMENTS :**

- 17.1 The bidder can download the Tender documents and save it in his system and undertake the necessary preparatory work and submit the hard copy of completed documents at his convenience within the final date and time of submission.

The bidder shall only submit single copy of the required documents (i.e PQ Documents, Techno-Commercial Part & Technical Specification). The bidder cannot leave any figure blank.

- 17.2 The Bidder shall go through the Tender Documents carefully and list the documents those are asked for submission. Bidder shall prepare all documents including cost of Tender Document, Declaration form, Techno-commercial bid etc.

- 17.3 Non-submission of legible documents may render the bid non-responsive. However, the Officer inviting the Tender, if so desires, can ask for legible copies or original copies for verification within a stipulated period provided such document.

- 17.4 Tender application / offer cannot be submitted after due date and time. Therefore, only after satisfying that all the documents have been included, the Bidder should submit their bid / offer.

#### **18. DEADLINE FOR SUBMISSION OF THE TENDER APPLICATION / OFFER:**

- 18.1 Once the date and time is over, the bidder will not be able to submit the Tender / offer. The date & time of bid submission shall remain unaltered even if the specified date for the submission of bids declared a holiday for the

- Officer inviting tender.
- 18.2 The officer inviting tender may extend the deadline for submission of Tender / offer by issuing an amendment, in which case all rights and obligations of the officer inviting the offer & Engineer-in-Charge and the bidders previously subject to the original deadline will then be subject to the new deadline.
- 19.0 **LATE SUBMISSION / MODIFICATION / WITHDRAWAL OF BID / OFFER :**
- 19.1 **BID / Offer** received after the due date and time shall not be accepted. No request for extension of the due date indicated shall be entertained.
- 19.2 If any of the intending bidder wishes to withdraw from participation in the bid, he / she can freely withdraw from the participation before scheduled date and time of closure of Bid Submission. Bidder(s) may modify their bids before the deadline for submission of bids. However, if the bid is withdrawn, the re-submission of the bid is not allowed.
- 19.3 **No bid shall be modified or withdrawn after the deadline of submission of Bids.**
- 9.4 Withdrawal or Modification of bids between the deadline for submission of bids and the expiration of the original period of bid validity specified in Tender / Price Bid or extended will result in the forfeiture of EMD.
- D. **OPENING AND EVALUATION**
20. **OPENING OF TENDER / OFFER:**
- 20.1 **Tender / Offer** opening dates are specified during bid creation or can be extended vide corrigendum.
- 20.2 In the event of the specified date of Tender / Offer opening being declared a holiday for the Officer inviting tender / Engineer-in-Charge, the Tender / Offers will be opened at the appointed time on the next working day.
- 20.3 **Price Part of Techno-Commercially Recommended bidder shall be opened through CPP portal on the notified date & time as per On-line Portal System.**
- 20.4 Tender / Offer without Cost of Tender Document is liable to be rejected.
- 20.4.1 The Tender Documents accompanied with appropriate Tender document cost will be taken up for evaluation with respect to the qualification Information and other information furnished in the Tender Document.
- 20.5 The bidder will be asked in writing to clarify his Bid / Offer, if necessary.
- 20.6 The Techno-Commercial / Pre-Qualification Evaluation of all the Tender / offers will be taken up as per the information furnished by the Bidders. But evaluation of the offer does not exonerate the bidders from checking their original documents and if at a later date the bidder is found to have misled the Techno-commercial / Pre-Qualification evaluation through wrong information, necessary action shall be taken against the bidder / Contractor.
21. **EXAMINATION OF TENDER DOCUMENT / OFFER AND DETERMINATION OF RESPONSIVENESS:**
- 21.1 During the detailed evaluation of "Tender Documents", the Officer inviting tender will determine whether each Tender application / offer :-
- a. Whether the tender cost is issued by any Scheduled / Nationalized Bank.
  - b. Has submitted legible documents for evaluation.
  - c. Meets the **Qualifying Criteria** defined in **Annexure - A** and acceptance of Techno-Commercial Terms & Conditions & Technical Specification.
  - d. Is substantially responsive to the requirements of the Tender documents.
22. **RIGHT TO ACCEPT OR REJECT ANY OR ALL TENDER / OFFERS:**

- 22.1 B AND R does not bind him to accept the Tender application / offers or any other offer and reserves to him the authority to reject any or all the Tender application / offers received without assigning any reason.
- 22.2 All Tender / Offers in which any of the prescribed condition is not fulfilled or any condition including that of conditional rebate is put forth by the bidder shall be summarily rejected.
- 22.23 The Engineer-in-Charge will reject a proposal for award if he determines that the bidder recommended for award has been engaged in corrupt or fraudulent practices in competing for the contract in question. He will report to the Officer Inviting Tender / next higher authority.
- 23.0 **Bidder(s) who had a record of Court Case / Litigation History with the B AND R / SMPK against earlier tender / contracts shall not be considered for this tender.**

***Canvassing whether directly or indirectly, in connection with e-NIT is strictly prohibited and the bids submitted by the bidders who resort to canvassing will be liable for rejection and EMD submitted by bidder will be forfeited.***

- 24.0 **PURCHASE PREFERENCE TO MAKE IN INDIA (MII)** :-In line with Public Procurement (Preference to Make in India), Order 2017 dated 15.06.2017, 28.05.2018, 04.06.2020, 18.05.2023 and subsequent orders issued by the respective Nodal Ministry, Govt. of India by way of providing purchase preference, B AND R has implemented "Purchase Preference Policy". The "Purchase Preference" is applicable for the "Local Supplier" for the items / services covered in the tender subject to the following terms & conditions :

B AND R reserves right to consider Local supplier (i.e whose offered product or service meets the minimum local content of tender) in case, emerged L1 bidder is Non Local supplier & quoted prices of Local suppliers are in the bracket of L1 + 20% and if they agree to match with L1 prices as per the "Public Procurement (Preference to Make in India) order 2017 of GOI, Dept of DIPP".

#### **1. DEFINITIONS:**

**'Local content'** means the amount of value added in India which shall, unless otherwise prescribed by the Nodal Ministry, be the total value of the item procured (excluding net domestic indirect taxes) minus the value of imported content in the item (including all customs duties) as a proportion of the total value, in percent.

**'Class-I local supplier'** means a supplier or service provider, whose goods, services or works offered for procurement, has local content equal to or more than 50%, as defined under said Order

**'Class-II local supplier'** means a supplier or service provider, whose goods, services or works offered for procurement, has local content more than 20% but less than 50%, as defined under this Order.

**'Non-Local supplier'** means a supplier or service provider, whose goods, services or works offered for procurement, has local content less than or equal to 20%, as defined under this Order.

**'L 1'** means the lowest tender or lowest bid or the lowest quotation received in a tender, bidding process or other procurement solicitation as adjudged in the evaluation process as per the tender or other procurement solicitation

**'Margin of purchase preference'** means the maximum extent to which the price quoted by a "(Class-I local) supplier" may be above the L 1 price for the purpose of purchase preference.

**'Procuring entity'** means a Ministry or department or attached or subordinate office of, or autonomous body controlled by, the Government of India and includes Government companies as defined in the Companies Act.

**'Works'** means all works as per Rule 130 of GFR- 2017, and will also include turnkey works '.

#### **2. ELIGIBILITY OF 'CLASS-I LOCAL SUPPLIER' / 'CLASS-II LOCAL SUPPLIER' / 'NON-LOCAL SUPPLIERS' FOR DIFFERENT TYPES OF PROCUREMENT**

(a) In procurement of all goods, services or works in respect of which the Nodal Ministry / Department has communicated that there is sufficient local capacity and local competition, only **'Class-I local supplier'**, as defined under the Order, shall be eligible to bid irrespective of purchase value.

(b) In procurement of all goods, services or works, not covered by 2(a) above, and with estimated value of purchases less than Rs.200 Crore, in accordance with Rule 161(iv) of GFR, 2017, Global Tender Enquiry shall not be issued except with the approval of competent authority as designated by Department of Expenditure. Only 'Class-I local supplier' and 'Class-II local supplier', as defined under the Order, shall be eligible to bid in procurements undertaken by procuring entities, except when Global Tender Enquiry has been issued. In Global Tender Enquiries, 'Non-local suppliers' shall also be eligible to bid along with 'Class-I local suppliers' and 'Class-II local suppliers'.

(c) For the purpose of this Order, works includes Engineering, Procurement and Construction (EPC) contracts and services include System Integrator (SI) contracts.

### **3A. PURCHASE PREFERENCE :**

(a) Subject to the provisions of this Order and to any specific instructions issued by the Nodal Ministry or in pursuance of this Order, purchase preference shall be given to '**Class-I local supplier**' in procurements undertaken by procuring entities in the manner specified here under.

(b) In the procurements of goods or works, which are covered by para 2(b) above and **which are divisible in nature**, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

- i. Among all qualified bids, the lowest bid will be termed as L 1. If L 1 is 'Class-I local supplier', the contract for full quantity will be awarded to L 1.
- ii. If L 1 bid is not a 'Class-I local supplier', 50% of the order quantity shall be awarded to L 1. Thereafter, the lowest bidder among the 'Class-I local supplier' will be invited to match the L 1 price for the remaining 50% quantity subject to the Class-I local supplier's quoted price falling within the margin of purchase preference, and contract for that quantity shall be awarded to such 'Class-I local supplier' subject to matching the L 1 price, In case such lowest eligible 'Class-I local supplier' fails to match the L 1 price or accepts less than the offered quantity, the next higher 'Class-I local supplier' within the margin of purchase preference shall be invited to match the L 1 price for remaining quantity and so on, and contract shall be awarded accordingly. In case some quantity is still left uncovered on Class-I local suppliers, then such balance quantity may also be ordered on the L 1 bidder.

(c) In the procurements of goods or works, which are covered by para 2(b) above and **which are not divisible in nature**, and in procurement of services where the bid is evaluated on price alone, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

- i. Among all qualified bids, the lowest bid will be termed as L 1. If L 1 is 'Class-I local supplier', the contract will be awarded to L 1.
- ii. If L 1 is not 'Class-I local supplier', the lowest bidder among the 'Class-I local supplier', will be invited to match the L 1 price subject to Class-I local supplier's quoted price falling within the margin of purchase preference, and the contract shall be awarded to such 'Class-I local supplier' subject to matching the L 1 price.
- iii. In case such lowest eligible 'Class-I local supplier' fails to match the L 1 price, the 'Class-I local supplier' with the next higher bid within the margin of purchase preference shall be invited to match the L 1 price and so on and contract shall be awarded accordingly, In case none of the 'Class-I local supplier' within the margin of purchase preference matches the L 1 price, the contract may be awarded to the L 1 bidder.

**(d) "Class-II local supplier" will not get purchase preference in any procurement, undertaken by procuring entities.**

### **3B. APPLICABILITY IN TENDERS WHERE CONTRACT IS TO BE AWARDED TO MULTIPLE BIDDERS :**

In tenders where contract is awarded to multiple bidders subject to matching L1 rates or otherwise, the "Class-I local supplier" shall get purchase preference over 'Class-II local supplier' as well as "**Non-local supplier**" as per following procedure:

(a) In case there is sufficient local capacity and competition for the item to be procured as notified by the nodal Ministry, only Class-I local suppliers shall be eligible to bid. As such, the multiple suppliers, who would be awarded the contract, should be all and only 'Class-I local suppliers'.



- (b) In other cases, 'Class-I local suppliers' and 'Non local suppliers' may also participate in the bidding process along with " Class-I local suppliers' as per provisions of this Order.
- (c) If 'Class-I local suppliers' qualify for award of contract for at least 50% of the tendered quantity in any tender, the contract may be awarded to all qualified bidders as per award criteria stipulated in the bid documents. However, in case 'Class-I local suppliers' do not qualify for award of contract for at least 50% of the tendered quantity, purchase preference should be given to the 'Class-I local suppliers' over 'Class-II local suppliers'/ 'Non local suppliers' provided that their quoted rate falls within 20% margin of purchase preference of the highest quoted bidder considered for award of contract so as to ensure that the 'Class-I local suppliers' taken in totality are considered for award of contract for at least 50% of the tendered quantity.
- (d) First purchase preference has to be given to the lowest quoting 'Class-I local suppliers', whose quoted rates fall within 20% margin of purchase preference, subject to its meeting the prescribed criteria for award of contract as also the constraint of maximum quantity that can be sourced from any single supplier. If the lowest quoting 'Class-I local suppliers', does not accept the offered quantity, an opportunity may be given to next higher 'Class-I local suppliers', failing within 20% margin of purchase preference, and so on.
- (e) To avoid any ambiguity during bid evaluation process, the procuring entities may stipulate its own tender specific criteria for award of contract amongst different bidders including the procedure for purchase preference to 'Class-I local suppliers' within the broad policy guidelines stipulated in Sub-paras above.

**1. EXEMPTION OF SMALL PURCHASES:**

Procurements where the estimated value to be procured is less than Rs.5 Lakh shall be exempt from this Order. However, it shall be ensured by procuring entities that procurement is not split for the purpose of avoiding the provisions of this Order.

**Note : Sl. No. 3B(e) & 4 mentioned above will not be included in tenders as it is only for internal guidance / approval.**

**2. MARGIN OF PURCHASE PREFERENCE:**

The margin of purchase preference shall be **20%**

**3. VERIFICATION OF LOCAL CONTENT:**

- a) The 'Class-I local suppliers' / 'Class-II local suppliers' at the time of tender, bidding or solicitation shall be required to indicate percentage of local content and provide self-certification that the item offered meets the local content requirement for 'Class-I local suppliers' / 'Class-II local suppliers'.

In this connection, such bidders shall furnish following undertaking from the manufacturer(s) on Manufacturer's letter head along with their techno-commercial bid. The undertaking shall become a part of the contract :

"We \_\_\_\_\_ (Name of Manufacturer) undertake that we meet the mandatory minimum Local Content (LC) requirement i.e. \_\_\_\_\_ (to be filled as notified in tender as well as the said policy) for claiming purchase preference linked with Local Contents under the Govt. Policy against under tender no. \_\_\_\_\_."

- b) In cases of procurement for a value in excess of Rs. 10 crores, the 'Class-I local suppliers' / 'Class-II local suppliers' shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in case of companies) or from a practicing cost account or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content.

In this connection, such bidders shall furnish following undertaking shall be supported by the following certificate from Statutory Auditor engaged by the bidder, on the letter head of such Statutory Auditor (as per the provisions of the aforesaid policy):

"We \_\_\_\_\_ the statutory auditor of M/s \_\_\_\_\_ (name of the bidder) hereby certify that M/s \_\_\_\_\_ (name of manufacturer) meet the mandatory Local Content requirements of the Goods and/or Services i.e. \_\_\_\_\_ (to be filled as notified in tender as well as the said policy) quoted vide offer No. \_\_\_\_\_ dated \_\_\_\_\_ against the tender No. \_\_\_\_\_ by M/s \_\_\_\_\_ (Name of the bidder)."

- c) Local Suppliers must note that once the declaration / certification is committed by them at tender submission stage, the same cannot be altered at technical negotiation stage or after award of contract

otherwise would be treated / considered as false declaration by bidder. If it is identified that the is difference in price receive & declaration made and local content is now not meeting the specified tender requirement (i.e only on the quoted price without any loading) then such case is to be processed without any purchase preference as Non-Local Supplier.

**4. IN CASE OF PARTICIPATION OF MSE AND LOCAL SUPPLIER AGAINST A SAME TENDER.**

Office Memorandum (OM) dated 18.05.2023 issued by DOE, Ministry of Finance, Govt. of India shall be applicable.

**5. IN CASE OF PARTICIPATION OF BIDDER FROM COUNTRIES WHICH SHARES A LAND BORDER WITH INDIA**

Any bidder from a country which shares a land border with India will be eligible to bid in any procurement whether of goods, services (including consultancy services / non consultancy services) or works (including turnkey projects) only if the bidder is registered with the Competent Authority (as per OM dated 18.05.2023 issued by Ministry of Finance), relevant declaration format is enclosed as Annexure –1.

**ANNEXURE – 1**

**COMPLIANCE CERTIFICATE REGARDING BIDDERS FROM COUNTRIES WHICH SHARES A LAND BORDER WITH INDIA**

**(Submitted on Bidder's Letter Head)**

a. The bidder, (Name of the bidder) is not from a country which shares a land border with India;

(or)

The bidder, (Name of the bidder) is from a country, (Name of the Country) which shares a land border with India and are registered with the Competent Authority. Certificate of registration is attached with the bid;

(or)

The bidder, (Name of the bidder) is from a country, (Name of the Country) which shares a land border with India and Government of India has extended lines of credit or is engaged in developmental projects in this country, (Name of the Country) and hence do not require any separate registration for participation in this tender.

b. I have read the Clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority. I hereby certify that this bidder fulfils all requirements in this regard and is eligible to be considered. (Where applicable, evidence of valid registration by the Competent Authority shall be attached).

c. I have read the Clause regarding restrictions on procurement from a bidder of a country which shares a land border with India and on sub-contracting to contractors from such countries; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority and will not sub- contract any work to a contractor from such countries unless such contractor is registered with the Competent Authority. I hereby certify that this bidder fulfils all requirements in this regard and is eligible to be considered. [Where applicable, evidence of valid registration by the Competent Authority shall be attached].

(or)

Any Bidder (including an Indian Bidder) who has a specified Transfer of Technology(ToT) arrangement with an entity from a country which shares a land border with India will be eligible to bid in any procurement whether of goods, services (including consultancy services and non consultancy services) or works (including Turnkey Projects) only if the bidder is registered with the Competent Authority, **specified in Annexure-2 which is mentioned here:**

**Competent Authority and Procedure for Registration**

- A. The Competent Authority for the purpose of registration under this order shall be/ continue to be the Registration Committee constituted by the Department for Promotion of Industry and Internal Trade (DPIIT)\*. [This Committee was already constituted under Order (Public Procurement) No.1].
- B. The Registration Committee shall have the following members\*:
- i. An officer, not below the rank of Joint Secretary, designated for this purpose by DPIIT, who shall be the Chairman;
  - ii. Officers (ordinarily not below the rank of Joint Secretary) representing the Ministry of Home Affairs, Ministry of External Affairs, and of those Departments whose sectors are covered by applications under consideration;
  - iii. Any other officer whose presence is deemed necessary by the Chairman of the committee.
  - iv. With effect from 01.04.2023, an officer (ordinarily not below the rank of Joint Secretary) representing the National Security Council Secretariat.
- C. DPIIT shall lay down the method of application, format etc. for such bidders as covered by the Order.
- D. On receipt of an application seeking registration from a bidder covered by Para 2 and 3 of this order, the Competent Authority shall first seek political and security clearances from the Ministry of External Affairs and Ministry of Home Affairs, as per guidelines issued from time to time. Registration shall not be given unless political and security clearance have both been received.
- E. The Ministry of External Affairs and Ministry of Home Affairs may issue guidelines for internal use regarding the procedure for scrutiny of such applications by them.
- F. The decision of the Competent Authority, to register such bidder may be for all kinds of tenders or for a specified type(s) of goods or services, and may be for a specified or unspecified duration of time, as deemed fit. The decision of the Competent Authority shall be final.
- G. Registration granted by the Competent Authority of the Government of India shall be valid not only for procurement by the Central Government and its bodies specified in para 6 of this order, but also for procurement by State Governments and their agencies/ public enterprises etc. No fresh registration at the State level shall be required.
- H. The Competent Authority is empowered to cancel the registration already granted if it determines that there is sufficient cause. Such cancellation by itself, however, will not affect the execution of contracts already awarded. Pending cancellation, it may also suspend the registration of a bidder, and the bidder shall not be eligible to bid in any further tenders during the period of suspension.
- I. For national security reasons, the Competent Authority shall not be required to give reasons for rejection/cancellation of registration of a bidder.

[\*Note:

- (i) In respect of application of the Order to procurement by/ under State Governments, all functions assigned to DPIIT shall be carried out by the State Government concerned through a specific department or authority designated by it. The composition of the Registration Committee shall be as decided by the State Government. However, the requirement of political and security clearance as per para D shall remain and no registration shall be granted without such clearance.
- (ii) Registration granted by State Governments shall be valid only for procurement by the State Government and its agencies/ public enterprises etc. and shall not be valid for procurement in other states or by the Government of India and their agencies/ public enterprises etc.]

Details of Vendor's authorized representative

Signature:

Name:

Stamp:

## SCOPE OF WORK

“Construction Work” consists of the following activities which will be under the scope of “Contractor”:-

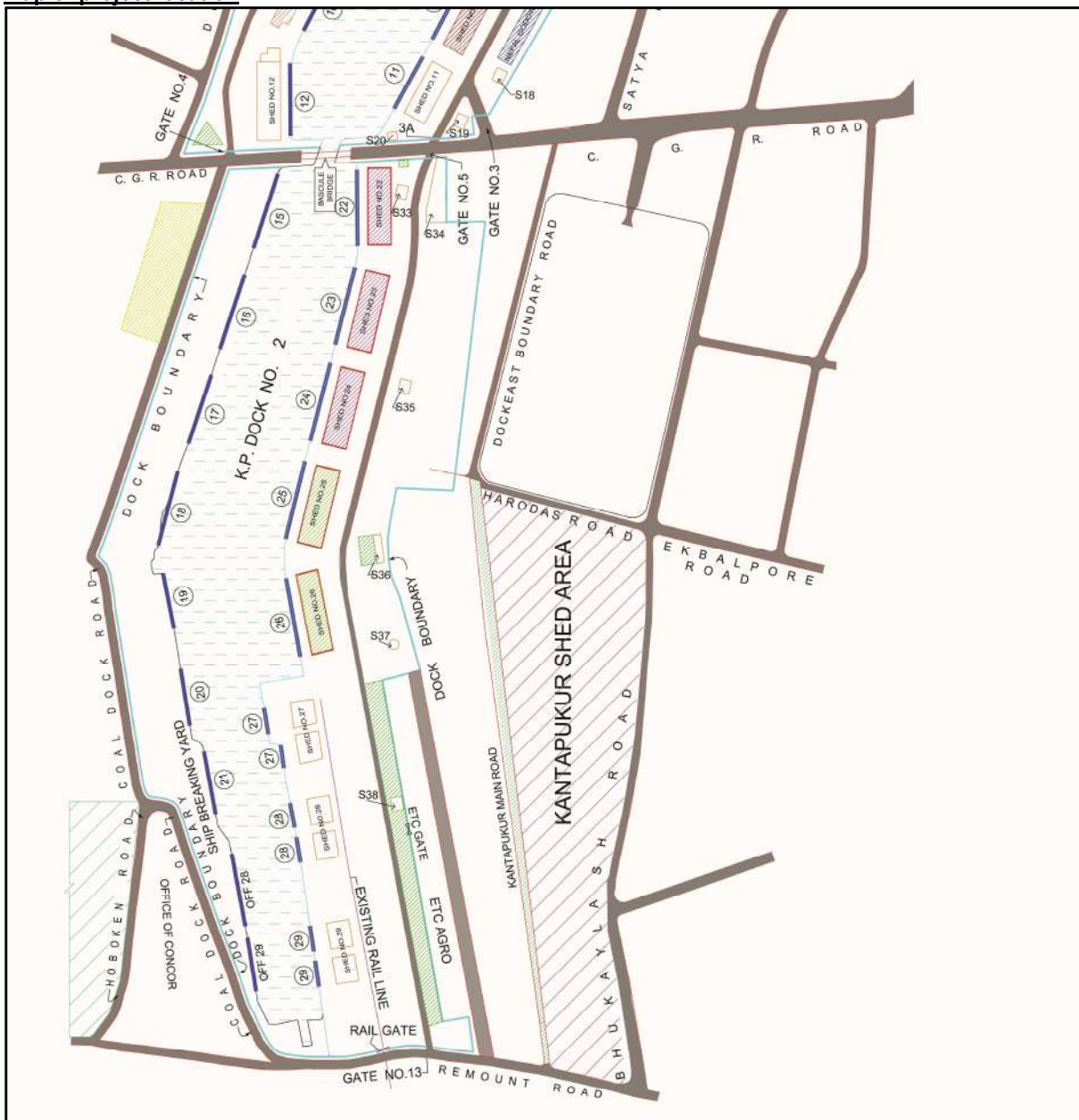
### Name of Work:

“Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.”

### 1. Project Brief

The proposed project for generation of 2.3 MWp Rooftop Solar power plant situated upon 5 individual warehouse terrace will generate electricity from non-conventional sources, using mono-crystalline technology with blast type fixed tilt (15 degree) module mounting structure solution. This solar power plant will generation of safe and reliable electricity in an environment friendly way with zero pollution.

### Map of project location



## A. Project Detail:

- **Plant Capacity** : 2.30MWp
- **Plant Type** : Grid Connected Solar PV Power Plant
- **Surface Type** : Rooftop (Flat Roof)
- **Type of Roof Shed 22 to Shed 25** : Flat Roof mounted on structural member, with lime terracing on top & water proofing APP membrane applied over it.
- **Type of Roof Shed 26** : Sheet metal deck slab mounted on structural member, with lime terracing on top & water proofing APP membrane applied over it.
- **Height of Roof** : Ground Floor + First Floor (Approx 10.3 mtrs)
- **Site Location** : Kidderpore Dock-II, Syama Prasad Mookerjee Port, Kolkata.

The available cumulative roof area including all five shed (Shed no 22 to shed no 26) is 24,699 SqMtr (approx.) to implement 2.3 MW power plant. The distance from substation location to nearest shed that is Shed No 22 is nearly 21 Meters. The site has a decent irradiation level of 4.88 kWh/m<sup>2</sup>/day.

### System components:

A Grid Tied Solar Rooftop Photo Voltaic (SPV) power plant consists of SPV array, Module Mounting Structure, Power Conditioning Unit (PCU) consisting of Maximum Power Point Tracker (MPPT), Inverter and Controls & Protections, interconnect cables, Junction boxes, Distribution boxes and switches. PV Array is mounted on a suitable structure. Grid tied SPV system is without battery and should be designed with necessary features to supplement the grid power during day time. Components and parts used in the SPV power plants including the PV modules, metallic structures, cables, junction box, switches, PCUs etc., should conform to the BIS or IEC or international specifications, wherever such specifications are available and applicable. The entire roof top solar power plant up to its feeding point i.e. 6KV grid of Calcutta Electric Supply Corporation shall consist of following equipments/components.

- Solar PV Modules
- Module Mounting Structure
- Inverter cum Controller
- LT panels (ACDB Panel/ Junction Boxes)
- Cables
- Connectors
- Lightning Protection System
- Earthing and Surge Protections
- PV Module Cleaning System
- Monitoring System.
  - a) SCADA
  - b) Solar Radiation and Environment Monitoring System
- Solar Sub Station
  - a) Duty Transformer
  - b) HV Switchgear
  - c) MV Switchgear
  - d) DC UPS System And Batteries
- Control Room Building & Substation Building
- Civil Work
  - a) Foundation for Transformer & other Electrical equipment
  - b) Area fencing
  - c) Cable trench

### **Special Case for Existing Services:-**

- 1 All material and execution of works shall be subjected to an approved quality assurance plan. The contractor has to submit a quality manual/quality assurance plan within 15 (fifteen) days of issuance of LOI and this quality assurance plan shall be approved by the Engineer-in Charge. In this QAP the details of testing, checking, quality monitoring & ensuring systems with frequency of testing and the stages for inspection by the Engineer-in-charge (B AND R) or his representative shall be mentioned elaborately. Notwithstanding any previous approvals the engineer-in-charge shall reserve the right for surprise/ unannounced inspections as well as additions/ alterations to the QAP of the pending works/ supplies of material giving reasonable notice to the contractor.
- 2 The contractor shall arrange for testing of samples of materials from an approved testing laboratory, as instructed by Engineer-in-Charge. The cost and charges for samples of materials and delivering the same to the testing laboratory including all incidentals in connection with the same as directed by the Engineer-in-charge and the testing charges thereof shall be borne by the contractor and shall be deemed to be included in the rates and prices quoted. The results of the tests carried out shall be binding on the contractor who shall comply with any rectification measures that the Engineer-in-charge may deem fit and order to be executed by the contractor as a result of testing.
- 3 Contractor shall arrange for Site Office, store, material storage yard, fabrication yard etc. and for labour hutments including land / area at their own cost and such cost should be included in their quoted rates. However the same may be provided to the Contractor, if available on chargeable basis (if required) by SMPK Authority at a nearby location.
- 4 The contractor will have to make his own arrangement for water and power supply for execution and testing of all works. Electric connection for site office and area lighting may be provided by SMPK Authority at a single point from the nearby substation on chargeable basis. Contractor will make his own arrangements for availing this single point connection. Arrangement of Construction Water is within the scope of Contractor. Point for drinking water may be provided by SMPK Authority.
- 5 Any damage done to the other installations during the execution of work shall be made good by the contractor free of cost. In the event of his failure to do so within in a reasonable time the same shall be got rectified by B AND R through another agency at the risk and cost of the contractor.
- 6 The contractor or his authorized representative will have to sign site order book to acknowledge the instruction issued by Engineer-in-Charge or his authorized representative for all matters relating to the execution of work. The instructions noted in the site order book shall have to be complied within reasonable time as decided by the Engineer-in-Charge.
- 7 Apart from Electrical Engineers, Electrical supervisors/ Electricians with proper, requisite, valid electrical supervisory license will be engaged for all electrical works.
- 8 The Engineer-in-Charge reserves the right to test the material at manufacturer's place, site of work, any independent Laboratory/ Test House. If at any stage during the execution of work, the Engineer-in-Charge is not satisfied with the quality of materials brought/ used at the site of work, he shall be at liberty to reject all such materials. The rejected materials shall have to be removed from the site of work immediately. The decision of the Engineer-in-Charge regarding makes of the materials selected shall be final and binding on the contractor.
- 9 The contractor shall stand guarantee/ warranty during defects liability period from the date of completion of work or after taking over the installations by the department whichever is later, against any manufacturing defect in material, unsatisfactory performance / working and / or breakdown, workmanship.  
The material/ equipment/ installation so found defective shall be replaced/ repaired free of cost to the satisfaction of the Engineer-in-Charge. The delay in rectification/replacement shall not be accepted. B AND R reserves the right to get it done at the risk and cost of the contractor. The decision of the Engineer-in-Charge, shall be final & binding to the contractor.

The contractor must carry out routine inspection/ testing once in every three months during the defects liability period and attend to the defects taking place during this period. Sufficient number of trained and experienced staff

shall be made available to meet any exigency/ emergency at site of work during the defects liability period.

- 10 Care shall be taken by the contractor to avoid damage to the adjoining existing installations/ buildings during execution of his part of the work. Any dismantling, if required, should be done in consultation with the engineer-in-charge. The contractor shall be responsible for repairing all damages and restoring the same to their original finish at his own cost. The contractor shall also remove at his cost all unwanted and waste materials arising out of his work from the site.
- 11 **Existing Utilities:**  
Notwithstanding anything to the contrary contained herein, the Contractor shall ensure that the respective entities owning the existing roads, right of way, level crossings, structures, or utilities on, under or above the Site are enabled by it to keep them in continuous satisfactory use, if necessary, by providing suitable temporary diversions with the authority of the controlling body of that road, right of way or utility. No extra cost will be provided by B AND R in this regard.
- 12 **Shifting of Obstructing Utilities:**  
The Contractor shall, in accordance with Applicable Laws and with assistance of the Engineer-In-Charge, cause shifting of any utility (including electric lines, telephone lines, OFC cables and other public utilities) to an appropriate location or alignment, if such utility or obstruction adversely affects the execution of Works or Maintenance of the Project Location in accordance with this Agreement. The actual cost of such shifting, as approved and communicated by the entity owning the utility as per the rates of the entity owning the utility, shall be paid by the Contractor without any extra claim. However, this expenditure incurred by contractor may be reimbursed by the Engineer-in-Charge to the contractor subject to approval of the same by Owner (SMPK Authority).
- 13 The Contractor shall prepare and submit as-built drawings by way of making modifications/ changes carried out with respect to the approved drawings issued prior to the execution of respective elements.
- 14 Deviation, Extra Items and Pricing: All final decisions / finalizations are subject to the approval of our Client / Owner i.e. SMPK Authority.
- 15 Deviation, Deviated Quantities, Pricing: All final decisions / finalizations are subject to the approval of our Client / Owner i.e. SMPK Authority.
- 16 In all the aforesaid clauses Engineer-in-charge means B AND R's Site in charge.

**DETAILS OF INFORMATION TO BE FURNISHED BY THE BIDDER  
(To be submitted in Bidders Letter Head only)**

Bidders are requested to furnish the following information along with their offer.

**A) Name of the Bidder:**

- i) Postal Address :
- ii) Telephone / Mobile Number :
- iii) Telefax Number :
- iv) e-mail Address :
- v) Contact Person :

**B) Contact person at Kolkata**

- i) Postal Address :
- ii) Telephone / Mobile Number :
- iii) Telefax Number :
- iv) e-mail Address :
- v) Contact Person :

**C) DGS&D / SSI / NSIC / MSME Registered Party :**

- i) Registration No. Dated
- ii) Registration under Works / Manufacture & Category :
- iii) Valid upto :
- iv) Owner under General / SC / ST / WOMEN  
Category :



**LETTER OF SUBMISSION**  
**(To be submitted in Bidders Letter Head only)**

- A. **Online Single Percentage Rate Offer(s) for “Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.”**

**[Notice Inviting e-Tender (e-NIT) No. B AND R/HO/SMPK/61038/SOLAR-WORK/NIT/CW/01 DTD. 11.03.2024]**

I / We have read and examined the tender document alongwith Instructions to Bidders, Annexure(s), Exhibits, Form( A to M ), General Conditions of Contract, Special Condition of Contract, Technical Specification, Schedule of Quantities & Rates (SOQR), other documents and Rules referred to in the conditions of contract and all other contents in the tender document for the work.

I/We hereby tender for the execution of the work specified for the **SMPK, Govt. of India / B AND R** within the time specified in **Table – 1** and in accordance in all respects with the specifications and instructions in writing referred to in Tender Document and with such materials as are provided for, by, and in respects in accordance with, such conditions so far as applicable.

We agree to keep the **tender open for Ninety (90) days from the due date of opening of tender** thereof and not to make any modifications in its terms and conditions.

The cost of Tender document of value **Rs. 20,000.00 + GST @18% = Rs. 23,600.00 (Rupees Twenty Three Thousand and Six Hundred only)** in the form of Demand Draft (D.D.) / Pay Order / Banker's Cheque has been deposited from a scheduled bank issued in favour of Bridge and Roof Co. (I) Ltd alongwith the Tender Application and the Earnest Money of **Rs. 26.85 Lakhs (Rupees Twenty Six Lakhs and Eighty Five Thousand only)** in the form of in the form of Demand Draft (D.D.) / Pay Order / Banker's Cheque valid for minimum 90 (Ninety) days / Bank Guarantee (BG) in prescribed format valid for minimum 06 (Six) months / Term Deposit Receipt valid for minimum 45 days beyond the validity of bid issued by a scheduled bank pledged in favour of “Bridge and Roof Co. (India) Ltd” along with Offer. If I/we, fail to furnish the prescribed Performance Guarantee within prescribed period, I/We agree that the said Bridge & Roof Co. (I) Ltd or his successors in office shall without prejudice to any other right or remedy, be at liberty to forfeit the said Earnest Money absolutely / I/we will be kept under black list / holiday list for 02 (Two) years. Further, if I/we fail to commence work as specified, I/we agree that Bridge & Roof Co. (I) Ltd or his successors in office shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said Earnest Money and PBG (if submitted) / I/we will be kept under black list / holiday list for 02 (Two) years and the Performance Guarantee absolutely, otherwise the said earnest money (if any) shall be retained by him towards retention money to execute all the works referred to in the Tender documents upon the terms and conditions contained or referred to therein and to carry out such deviations as may be ordered, upto maximum of the percentage mentioned in '**Tender document**' and those in excess of that limit at the rates to be determined in accordance with the provision specified in Tender document.

I / we have also visited the Project Site, ascertained the Site Conditions.

I / We undertake, if our bid is accepted, to commence the work within the stipulated time and to complete the whole of the works comprised in the Contract within the stipulated time calculated from the start date.

I / We is / are aware that in the event of delay in execution of the Project, beyond the agreed timelines due to reasons attributable to us, liquidated damages shall be recovered from us.

If our bid is accepted, we understand that we are to be held solely responsible for the due performance of the Contract.

I/We hereby declare that I/we shall treat the tender documents, drawings and other records connected with the work as secret/ confidential documents and shall not communicate information derived there from to any person other than a person to whom I/we am/are authorized to communicate the same or use the information in any manner prejudicial to the safety of the State.

I/We enclosed:-

- a) All documents as per Tender requirement.
- b) Demand Draft (D.D.) / Pay Order / Banker's Cheque for Rs. 20,000.00 + GST @18% = Rs. 23,600.00 (Rupees Twenty Three Thousand and Six Hundred only) issued by ..... (Name of Bank) valid upto ..... towards Cost of Tender Document.
- c) Demand Draft (D.D.) / Pay Order / Banker's Cheque / Bank Guarantee (B.G.) / Term Deposit Receipt for Rs. 26.85 Lakhs (Rupees Twenty Six Lakhs and Eighty Five Thousand only) issued by ..... (Name of Bank) valid upto ..... towards EMD.

Date : \_\_\_\_\_

Signature of Contractor  
Postal Address

Witness:

Address :

Occupation :

# ***EXHIBITS***

## SUB : INDEX OF EXHIBITS TO BE FURNISHED BY BIDDER

Sl. No.	Exhibit No.	Details to be furnished
1.	EXHIBIT – EA	Deployment schedule of supervisory personnel. Bidder shall submit this list duly filled in for all applicable disciplines. Bidder shall be required to modify this list and add any additional supervisory personnel required for the work covered under this contract (to be submitted by the bidder package wise).
2.	EXHIBIT – EB	Deployment schedule of direct + indirect labour (to be submitted by the bidder package wise).
3.	EXHIBIT – EC	Deployment schedule of construction equipments including shuttering material. This exhibit includes list of construction equipments for various disciplines of work. Bidder shall submit this list duly filled in for all applicable disciplines. Bidder shall be required to modify this list and add any additional equipment required for the work covered under this contract (to be submitted by the bidder package wise).).
4.	EXHIBIT – ED	Site Organization Chart (to be submitted by the Bidder).
5.	EXHIBIT – EE	Curriculum Vitae (to be submitted by the bidder)  This will be furnished for Project Manager, Construction Manager, Lead Engineer, Site Engineers & QC/QA Engineer.
6.	EXHIBIT-EF	The Bidder has to submit “ <b>No Deviation Certificate</b> ” as per exhibit EF, duly signed.
7	EXIBIT – EG	In case bidder requires some clarifications with respect to the stipulations of the bidding document, they may submit the same as per this exhibit within the cutoff date mentioned in Letter Inviting Bid. Bidder should ensure that the queries are sent in a consolidation manner and not in piece meal.
8.	EXHIBT-EH	Details of PF Registration
9.	EXHIBIT – EI	Declaration by the Bidder
10.	EXHIBIT – EJ	Integrated Bar Chart
11.	EXHIBIT – EK	Check list

Note : 1. Bidders will be required to submit / upload all the details as per Exhibits enclosed in TENDER Document. The details must fulfill the requirements specified in, **Annexure – A to Q, Exhibits & Annexure-I & II and Form A to O**. In case details are not submitted as per these Exhibits and/or the details submitted are inadequate /not compatible with the requirements specified in **e-NIT-Documents**, such offers shall be treated as non-responsive and are liable to be rejected. B AND R/SMPK’s decision in this regard shall be final & binding.

**DEPLOYMENT SCHEDULE OF TECHNICAL & SUPERVISORY PERSONNEL**

The Bidder shall submit the details deployment of all Supervisory Personnel specified in Schedule-F / Annexure-II the following format

Sl. No.	Description	MONTH-WISE DEPLOYMENT SCHEDULE												Total (Man Months)
		1	2	3	4	5	6	7	8	9	10	---	----	
1.														
2.														
3.														
4.														
5.														

**SIGNATURE OF BIDDER :**

**NAME OF BIDDER :**

**COMPANY SEAL:**

**SUB : EXHIBIT FOR DEPLOYMENT SCHEDULE OF DIRECT + INDIRECT LABOUR**

Sl. No.	Description	MONTH-WISE DEPLOYMENT SCHEDULE												Total (Man Months)
		1	2	3	4	5	6	7	8	9	10	....	....	
1.	Un-skilled													
2.	Semi-skilled													
3.	Skilled													

**Note :** Bidder shall furnish the Deployment Schedule (in months) as per the time schedule of completion of this work.

**SIGNATURE OF BIDDER:**

**NAME OF BIDDER :**

**COMPANY SEAL :**

**DEPLOYMENT SCHEDULE OF CONSTRUCTION EQUIPMENTS**

The Bidder shall submit the details deployment schedule of all Proposed Construction Equipments specified in Annexure-I of Special Conditions of Contract in the following format

Sl. No.	Description	Capacity	MONTH-WISE DEPLOYMENT SCHEDULE												Total (Man Months)
			1	2	3	4	5	6	7	8	9	10	---	---	
1.															
2.															
3.															
4.															
5.															

Bidder may make additions/deletions in the Equipment List as above based on his Requirement

**SIGNATURE OF BIDDER:**

**NAME OF BIDDER :**

**COMPANY SEAL :**

**DETAILS OF PROPOSED SITE ORGANIZATION**

The bidder shall submit on a separate sheet details of Head Office and Site Organization proposed to be deployed for execution of the work. Bidder shall also furnish the bio-data of site-in-charge and key personnel to be deployed.

Bidder agrees to augment the above chart with additional number/categories, as directed by Engineer-in-Charge, to complete the work within the completion time schedule and quoted price.

**SIGNATURE OF BIDDER :**

**NAME OF BIDDER :**

**COMPANY SEAL :**

**Note: Bidder to include Planning Engineer, Quality Control Engineer, Safety Officer and Store Keeper/ Office in proposed Site Organization.**



**SUB EXHIBIT – ‘EE’ FOR CURRICULAM VITAE  
AS PER ANNEXURE - II**

1. NAME
2. POSITION HELD IN ORGANISATION CHART, PROPOSED FOR THIS WORK
3. DATE & PLACE OF BIRTH
4. NATIONALITY
5. EDUCATIONAL QUALIFICATION
6. SPECIAL COURSES UNDERGONE
7. TOTAL NO. OF YEARS EXPERIENCE
8. SUMMARY OF EXPERIENCE (TO BE SUBMITTED EMPLOYER WISE)

Sl. No.	Name of Employer Company	Name of Project	Positions Held	Major Activity	Years

**SIGNATURE OF BIDDER :**

**NAME OF BIDDER :**

**COMPANY SEAL :**

**NO DEVIATION CERTIFICATE /  
COMPLIANCE TO BID REQUIREMENT**

**(To be submitted in Bidder's Letter Head)**

We hereby agree to fully comply with, abide by and accept without variation, deviation or reservation all technical, commercial and other conditions whatsoever of the TENDER Documents and Addendum to the TENDER Documents, if any, for subject work issued by Bridge And Roof Co. (I) Ltd.

We hereby further confirm that any terms and conditions if mentioned in our TENDER Application / offer shall not be recognized and shall be treated as null and void.

**SIGNATURE OF BIDDER** :

**NAME OF BIDDER** :

**COMPANY SEAL** :

**BIDDER’S QUERIES**

Sl.No.	Bidding Document		Subject	Bidder’s Query	Employer’s Reply
	Page No.	Clause No.			

Note : Bidder’s Queries may be sent by fax to fax numbers **033-2217-2106** and also by e -mail to [commercial@bridgeroof.co.in](mailto:commercial@bridgeroof.co.in) & [delhi@bridgeroof.co.in](mailto:delhi@bridgeroof.co.in)

**DETAILS OF P.F. REGISTRATION**

Bidder to furnish details of Provident Fund Registration:

P.F. Registration No. :

District & State :

We hereby confirm that the above PF Account is under operation presently and shall be used for all PF related activities for the labour engaged by us in the present work (if awarded to us).

**(SIGNATURE OF BIDDER)**

**DECLARATION BY THE BIDDER**  
**(To be submitted in Bidder's Letter Head)**

We (**Name of the Bidder** ..... ) hereby represent that we have gone through and understood the tender Document, which in 02 (Two) Part in **Part-I** (Commercial Section and Technical Section) and **Part-II** (Schedule of Quantities of Rates) including Compliance to / Bid Requirement that our Bid / Tender has been prepared accordingly in compliance with the requirement stipulated in the said documents.

We are submitting a copy of Tender Document marked "Original" as part of our Bid / Tender duly signed and stamped on each page in token of our acceptance. We undertake that Tender Document (Part-I & Part-II) shall be deemed to form part of our bid and the event of award of work to us, the same shall be considered for constitution of Contract. Further, we shall sign and stamp each page of this document (Part-I & Part-II) including No Deviation Certificate/ Compliance to tender/ Bid Requirement as a token of Acceptance and as a part of the Contract in the event of award of Contract to us.

We further confirm that we have gone through the Tender Documents, including PQ Criteria, All Techno-commercial Terms & Conditions, Schedule of Quantities & Rates (SOQR) and accordingly we have indicated Prices & uploaded in CPP Portal. We confirm that our quoted rates shall include the price for all works /activities / supply etc. as per the item description of the items in Schedule of Quantities & Rates.

**SIGNATURE OF BIDDER :**

**NAME OF BIDDER :**

**COMPANY SEAL :**

**Note: This Declaration should be signed by the Bidder's Representative who is signing the eNIT / Bid.**

**INTEGRATED BAR CHART**

[To be submitted by Bidder(s) alongwith their offer]

Sl. No.	Description	MONTH-WISE DEPLOYMENT SCHEDULE										Total (Man Months)
		1	2	3	4	5	6	7	8	9	10	
1.												
2.												
3.												
4.												
5.												
6.												
7.												
8.												

**SIGNATURE OF BIDDER :**

**NAME OF BIDDER :**

**COMPANY SEAL :**

**CHECK LIST FOR SUBMISSION OF BID**

Bidder is requested to fill this check list and ensure that all details/documents have been furnished as called for in the Bidding Document duly filled in, signed & stamped checklist with each copy of the "Un-priced bid (Part – I)".

Please tick the box and ensure compliance:

- (A.1) Bid Forwarding Letter / Letter of Submission  
Submitted
- (A.2) Power of Attorney in Favour of the person who has signed the bid **on Stamp Paper of Appropriate value.**  
Submitted
- (A-3) Partnership Deed in case of partnership firm and Article of Association in case of limited company.  
Submitted
- (A-4) Deployment schedule of Supervisory Personnel as per Exhibit- EA  
Submitted
- (A-5) Deployment schedule of direct + indirect labouras per Exhibit- EB  
Submitted
- (A-6) Deployment Schedule of Construction Equipments as per Exhibit- EC  
Submitted
- (A-7) Details of Proposed Site Organization as per Exhibit- ED  
Submitted
- (A-9) Curriculum Vitae as per Exhibit- EE  
Submitted
- (A-10) No Deviation Certificate / Compliance to Bid Requirement as per Exhibit- EF  
Submitted
- (A-11) Bidder's Queries as per Exhibit – EG  
Submitted
- (A-12) Declaration regarding PF as per Exhibit- EH  
Submitted
- (A-13) Declaration by the bidder as per Exhibit – EI  
Submitted
- (A-14) Integrated Bar Chart as per Exhibit – EJ  
Submitted
- (A-15) All pages of the bid have been page numbered in sequential manner  
Submitted
- (A-16) Schedule - A To M alongwith relevant documents/certificates etc.  
Submitted

**SIGNATURE OF BIDDER :**  
**NAME OF BIDDER :**  
**COMPANY SEAL :**

# GENERAL CONDITIONS OF THE CONTRACT



## **GENERAL RULES AND DIRECTIONS**

### **BRIDGE AND ROOF CO. (INDIA) LIMITED**

**KANKARIA CENTRE (4<sup>TH</sup> & 5<sup>TH</sup> FLOOR),  
2/1, RUSSEL STREET,  
KOLKATA – 700071**

1. This Instruction to Bidder(s) will state the work to be carried out, as well as the date for submitting and opening tender(s) and the time allowed for carrying out the work, also the amount of cost of tender document & Earnest Money to be deposited by the tenderer along with their offer. The Performance Guarantee to be deposited by the successful tenderer and the amount of Retention Money to be deducted from bills.
2. In the event of the tender being submitted by a firm, it must be signed separately by each partner thereof or in the event of the absence of any partner, it must be signed on his behalf by a person holding a Power of Attorney authorizing him to do so. Such Power of Attorney to be produced with the tender and it must disclose that the firm is duly registered under the Indian Partnership Act, 1952.
3. Receipts for payment made on account of work, when executed by a firm, must also be signed by all the partners, except where Contractors are described in their tender as a firm, in which case, the receipts must be signed in the name of the firm by one of the partners, or by some other person having due authority to give effectual receipts for the firm.
4. **The Bidder should quote as “above / below / at par(0%) in single percentage basis” as per the Price Bid format in the allotted space only.**

**Amount for “Rate Only” item(s), if any, shall not be considered in Total Evaluation of Price.** The percentage so derived shall be applicable on the value of the work executed as per the estimated rate mentioned in the Schedule of Quantities & Rates. Tenderers who propose any alteration in the work specified in the said form of invitation to tender, or in the time allowed for carrying out the work, or which contain any other conditions of any sort, including conditional rebates, will be liable for rejection.

In case the lowest tendered amount (Estimated Cost +/- Amount worked on the basis of percentage above / below / At par) of two or more contractors is same, such lowest contractors will be asked to submit sealed revised offer in the form of letter mentioning percentage above / below / at par on the estimated cost of tender including sub-sections / sub-heads as the case may be, but the revised percentage quoted above / below / at par on estimated cost of tender including all sub-sections / subheads should not be higher than the percentage quoted at the time of submission of tender. The lowest tender will be decided on the basis of “Revised Offer(s)”.

In case any of such Contractors refuses to submit “Revised Offer(s)”, then it shall be treated as “withdrawal” of the tender before acceptance.

In case all the lowest Contractors those have quoted same tendered amount, refuse to submit “Revised Offer(s)”, then tender(s) are to be re-called.

5. The officer inviting tender or his duly authorized representatives will open tenders through CPP Portal (On-line) at the specific time, and a comparative statement will be generated from CPP Portal in a suitable form.
6. The Officer inviting tenders shall have the right of rejecting all or any of the tenders and will not be bound to accept the lowest or any other tender.
7. The tenderers shall sign a declaration under the officials Secret Act 1923, for maintaining secrecy of the tender documents drawings or other records connected with the work given to them.
8. i) The Contractor whose tender is accepted shall be required to deposit an amount equal to **5% (Five Percent)** of the contract value of the work as **Performance Guarantee in the form of Demand Draft / Pay Order / Banker’s Cheque / an Irrevocable Bank Guarantee. In case Performance Guarantee bond in form of an Irrevocable Bank Guarantee shall be drawn from any Nationalized / Scheduled Bank in accordance with the form prescribed within Thirty (30) days from the date of issue of Letter of Intent (LOI).**



- ii) The successful tenderer will also be required to furnish additional **Security Deposit / Retention Money amounting to 5% (Five Percent) of the contract value**, which will be deducted from each of his running bill. The said security deposit will be refunded without any interest after completion of CMC Period of 10 years.
9. On acceptance of the tender, the name of the accredited representative(s) of the Contractor who would be responsible for taking instructions from the Engineer-in-Charge shall be communicated in writing to the Engineer-in-Charge.
10. All taxes & duties (except GST) on material and all other incidental **expenditure including Environmental & Pollution Clearance Charges etc. if any** in respect of this contract shall be payable and arranged by the Contractor within their quoted rate and B AND R/Employer will not entertain any claim whatsoever in respect of the same.
11. The Contractor shall give a list of B AND R/SMPK employees related to him, if any.
12. The tender for the work shall not be witnessed by a Contractor or Contractors who himself/ themselves has/ have tendered or who may has/ have tendered for the same work. Failure to observe this condition would render, tenders of the Contractors tendering, as well as witnessing the tender, liable to summarily rejected.
13. The tender for the work includes all Civil Work including electrical related to building work. The tenderer must associate himself with agencies, which are eligible to tender for electrical work etc.
14. The Contractor shall comply with the provisions of the Apprentices Act 1961, and the rules and orders issued there under from time to time. If he fails to do so, his failure will be a breach of the contract and B AND R/ Employer may in his discretion, without prejudice to any other right or remedy available in law, cancel the contract. The Contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions of the said Act.
15. **BandR's Bank Details :**  
Beneficiary Name :**Bridge And Roof Co. (India) Ltd.**  
Bank Name :**State Bank of India**  
Bank Address :**24, Park Street, Kolkata – 700016, (Contact No. 033-2229-6046 / 5461 / 6761 / 6762 / 2698)**  
Cash Credit A/c No.:**10945133624**  
IFSC Code No.:**SBIN0007502**  
SWIFT Code :**SBINBB108**  
MICR Code :**700002120**  
PAN No.:**AACB3166E**
16. **Communication & Billing Address :**  
Bridge And Roof Co. (India) Ltd.  
Kolkata Office

## BRIDGE AND ROOF CO. (I) LIMITED

### GENERAL CONDITIONS OF THE CONTRACT

#### **Definitions:**

1. The Contract means the documents forming the tender and acceptance thereof and the formal Agreement / Work Order (W.O.) executed between the competent authority on behalf of Bridge And Roof Co. (India) Ltd. and the Contractor, together with the documents referred to therein including these conditions, the specifications, designs, drawings and instructions issued from time to time by the Engineer-in-Charge and all these documents taken together, shall be deemed to form one contract and shall be complementary to one another.
2. In the contract, the following expressions shall, unless the context otherwise requires, have the meanings, hereby respectively assigned to them:
  - i) The expression **works** or **work** shall, unless there be something either in the subject or context repugnant to such construction, be construed and taken to mean the works by or by virtue of the contract contracted to be executed whether temporary or permanent, and whether original, altered, substituted or additional.
  - ii) The **Site** shall mean the land / or other places on, into or through which work is to be executed under the contract or any adjacent land, path or street through which work, is to be executed under the contract or any adjacent land, path or street which may be allotted or used for the purpose of carrying out the contract.
  - iii) The **Bidder / Tenderer** shall mean the firm / party who shall tender quotation to the Employer.
  - iv) The **Contractor** shall mean the individual, firm or company, whether incorporated or not, undertaking the works and shall include the legal personal representative of such individual or the persons composing such firm or company, or the successors of such firm or company and the permitted assigns of such individual, firm or company.
  - v) The **Owner / Employer** shall mean “**SMPK, Govt. of India**” represented by Bridge And Roof Co. (India) Ltd. (hereinbefore / hereinafter referred to as B AND R) having their registered Office at Kankaria Centre, 2/1 Russel Street, Kolkata-700071.
  - vi) The **Engineer-in-Charge** means the Officer/Engineer nominated and authorized by B AND R for the time being, acting for and on behalf of the Employer for the purpose of operating the contract or any work covered there under.
  - vii) **Engineer** means the Officer / Engineer nominated and authorized by Engineer-in-charge to act on his behalf and performed any or all the functions of the Engineer-in-charge under the contract.
  - viii) **Accepting Authority** means Chairman Cum Managing Director(CMD)of B AND R.
  - ix) **Accepted Risk** are risks due to riots (other than those on account of Contractor's employees), war (whether declared or not) invasion, act of foreign enemies, hostilities, civil war, rebellion revolution, insurrection, military or usurped power, any acts of Government, damages from aircraft, acts of God, such as earthquake, lightening and unprecedented floods, and other causes over which the Contractor has no control and accepted as such by the Accepting Authority or causes solely due to use or occupation by Employer of the part of the works in respect of which a certificate of completion has been issued or a cause solely due to Employer's faulty design of works.
  - x) **Market Rate** shall be the rate as decided by the Engineer-in-Charge on the basis of the cost of materials and labour at the site where the work is to be executed plus the percentage mentioned in Schedule 'F' to cover, all overheads and profits.
  - xi) **Schedule(s)** referred to in these conditions shall mean the relevant schedule(s) annexed to the tender papers or the standard Schedule of Rates of the government mentioned in Schedule 'F' hereunder, with the amendments

thereto issued upto the date of receipt of the tender.

- xii) **Tendered value** means the value of the entire work as stipulated in the Letter of Intent.
- xiii) **'Approval'** shall mean and include the written consent, either manuscript, type written or printed statement, under signature or seal, as the case may be, given from time to time by 'OWNER' or their authorized representative on documents, drawings or particulars in relation to this Tender.
- xiv) **'Commencement Date of Contract'** with reference to work contract for actual execution of work shall mean the date on which the land for the work is handed over to Contractor or date of issuance of LOI by B AND R whichever is later.
- xv) **'Completion Period'** with reference to Work Contracts shall mean the period from the commencement date of contract to Physical completion of the Project.
- xvi) **'Contract'** shall mean this 'Agreement' including all exhibits hereto and all documents herein specification and amendments which the parties may here after agree in writing to be made to this Agreement..
- xvii) **'Coordinating Officer'** shall mean the official selected by 'Owner' to whom all the matter related to the Project shall be referred to by B AND R for views, decision, help, approvals etc as per Scope of service of the Contract and who shall provide and communicate such views decision, help, approvals etc to contractor on behalf of OWNER / B AND R.
- xviii) **'Design Engineering Consultant'** shall mean the Architect / Design Consultant appointed by the 'SMPK' to whom all the matters of engineering drawing, sketches showing plans, sections and elevation and corresponding detail schedule of item and quantities ( DSR and Non – DSR items) related to the Project shall be provided to B AND R and to whom B AND R may approach for views, decision, help, approvals etc as per Scope of services of the Contract and who shall provide and communicate such views, decisions, help, approvals etc to B AND R.
- xix) **'Drawing'** shall mean and include engineering drawings, sketches, showing plans, section and elevation related to the Project together with modification and / or revision thereto.
- xx) **'Month'** shall mean calendar month.
- xxi) **'Project'** shall mean the **"Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal."**
- xxii) **'Project Completion'** with reference to Works Contract shall mean the readiness of all the works in all respects for use, after attending to minor repairs / adjustments.
- xxiii) **'SERVICES'** shall mean the responsibilities to be discharged by B AND R for fulfilling the obligations under the agreement.
- xxiv) **'SPECIFICATIONS'** shall mean and include schedules, detailed descriptions and statement of technical data, performance characteristics and standards as applicable and specified in the Works Contract.
- xxv) **'STANDARD'** – The goods and equipments, utilized for the works in the Project shall confirm to the standards mentioned in the Technical Specifications or such other standards, which ensure an equal or higher quality. When no application standard is mentioned, the authoritative standard appropriate to the Goods / Equipments utilized in the concerned Institution like Bureau of Indian Standards etc.
- xxvi) **'Test'** shall mean such process or processes to be carried out by B AND R as prescribed in the Works Contract in order to ascertain quality, workmanship, performance and efficiency of goods / equipments or part thereof.
- xxvii) **'WORDS'** in the singular include the plural and vice versa.

- xxviii) **'WRITING'** includes matter either in whole or in part, in manuscript, typewritten, lithographed, cyclostyled, photographed or printed form under or over signature or seal as the case may be.

#### **Scope and Performance:**

3. Where the context so requires, words imparting the singular only also include the plural and vice versa. Any reference to masculine gender shall whenever required include feminine gender and vice versa.
4. Headings and Marginal notes to these General Conditions of Contract shall not be deemed to form part thereof or be taken into consideration in the interpretation or construction thereof or of the contract.
5. The Contractor shall within 60 days from the date of LOI but in any case before submitting his first bill for payment, enter into and execute a contract agreement (to be prepared at the cost of the Contractor).

The Contract will be signed in original & duplicate and the Contractor shall be provided with one (1) signed original and the rest will be retained by B AND R. These General Conditions together with the specifications, tender drawings and technical particulars, tender date with subsequent agreed modification thereof, tender, all correspondences with B AND R and signed agreement and other supporting documents shall constitute the contract document(s). No variation or modification of terms and conditions of the contract documents or waiver of any of these terms and conditions shall be deemed valid unless agreed in writing and signed by B AND R and the Contractor.

The failure of either party to endorse at any time of the provisions of the contract or any right thereto or to an option herein provided shall in no way be construed to be a waiver of such provisions, rights or option or in any way to affect the validity of the Contract. The exercise by either party of any of his rights herein shall not preclude or prejudice either party from exercising the same or any other right that may have hereunder.

The contract shall in all respects be deemed to be and shall be construed and shall operate as an Indian contract as defined in the Indian Contract Act 1872 and all payments there under shall be made in Indian Rupees unless otherwise specified.

The contract shall be considered to come into force on the date of notification of Award by the B AND R to the Contractor which shall be in the form of a Letter of Intent.

The law applicable to the Contract shall be the law in force in India. The Calcutta High Court under this Contract shall have exclusive Jurisdiction in all matters arising under this Contract, including Arbitration Awards.

#### **Works to be carried out**

6. The work to be carried out under the Contract shall, except as otherwise provided in these conditions, include all labour, materials, tools, plants, equipment and transport which may be required in preparation of and for and in the full and entire execution and completion of the works. The descriptions given in the Schedule of Quantities shall, unless otherwise stated, be held to include wastage on materials, carriage and cartage, carrying and return of empties, hoisting, setting, fitting and fixing in position and all other labours necessary in and for the full and entire execution and completion of the work as aforesaid in accordance with good practice and recognized principles.

#### **Sufficiency of Tender**

7. The Contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the rates and prices quoted in the Schedule of Quantities, which rates and prices shall, except as otherwise provided, cover all his obligations under the Contract and all matters and things necessary for the proper completion and maintenance of the works.

#### **Discrepancies and Adjustment of Errors**

8. The several documents forming the Contract are to be taken as mutually explanatory of one another, detailed drawings being followed in preference to small scale drawing and figured dimensions in preference to scale and special conditions in preference to General Conditions.

- 8.1 In the case of discrepancy between the Schedule of Quantities, the Specifications and/or the Drawings, the following order of preference shall be observed:
- **Letter of Intent (LOI)**
  - **Schedule of Quantities & Rates (SOQR) and preamble to SOQR**
  - **Minimum Acceptable Limit**
  - **Construction Drawings (AFC Drawings)**
  - **Tender Drawing(s)**
  - **Technical Specification given in Tender**
  - **CPWD Technical Specification and other Technical Specifications / documents issued by B AND R**
  - **Relevant IS Code**
  - **Notice Inviting e-Tender (e-NIT)**
  - **Special Condition of Contract (SCC)**
  - **General Condition of Contract (GCC)**
- 8.2 If there are varying or conflicting provisions made in any one document forming part of the contract, the Accepting Authority shall be the deciding authority with regard to the intention of the document and his decision shall be final and binding on the Contractor.
- 8.3 Any error in description, quantity or rate in Schedule of Quantities or any omission there from shall not vitiate the Contract or release the Contractor from the execution of the whole or any part of the works comprised therein according to drawings and specifications or from any of his obligations under the contract.
- 9.0 The contractor shall be responsible for posting of security guards for safe guarding of plants & equipments, construction materials and other materials brought by him for construction. The safe guarding of B AND R's materials if any, B AND R's office are in the scope of contractor. The contractor shall include all the above cost in their quoted rate.

## **CLAUSES OF CONTRACT**

### **CLAUSE 1[Based on the approval of M/s SMPK]**

- i) The Contractor shall submit an Irrevocable Performance Guarantee of **5% (Five Percent)** of the Contract Value in addition to other deposits mentioned elsewhere in the contract for his proper performance of the contract agreement, (not withstanding and/or without prejudice to any other provisions in the contract) within **30(Thirty) days** or specified in **Schedule – F** i.e. from the date of issue of Letter of Intent (LOI). This period can be further extended by Engineer-in-Charge upto a maximum period on written request of the Contractor stating reason for delays in procuring the Performance Guarantee, to the satisfaction of the Engineer-in-Charge.
- ii) The Performance Guarantee shall be valid upto 12 months from the date of commissioning of solar plant with claim period of 3 months thereafter. The Contractor at his own cost shall arrange to keep BG valid up to Warranty period which is one year after completion of work. In case the work is not completed within stipulated period of completion the validity of SPBG shall be increased accordingly by the contractor. Failure of the successful bidder to submit the required Performance Security shall constitute sufficient grounds for the annulment of the award of the contract and forfeiture of EMD.

Contractor shall also be required to furnish Performance Guarantee of 2% (Two Percent) of the Contract Value including CMC Value for Comprehensive Maintenance Contract (CMC) Period for 10 years before starting of CMC and PBG shall be valid till CMC Period.

- iii) The Engineer-in-Charge shall make a claim under the Performance Guarantee except for amounts to which SMPK/ B AND R is entitled under the contract (not withstanding and/or without prejudice to any other provisions in the contract agreement) in the event of:
  - a) Failure by the Contractor to extend the validity of the Performance Guarantee as described herein above, in which event the Engineer-in-Charge may claim the full amount of the Performance Guarantee.
  - b) Failure by the Contractor to pay SMPK/ B AND R any amount due, either as agreed by the Contractor or determined under any of the Clauses/ Conditions of the agreement, within 30 days of the serving of notice to this effect by Engineer-in-Charge.
- iv) In the event of the contract being determined or rescinded under provision of any of the Clause/ Condition of the agreement, the performance guarantee shall stand forfeited in full and shall be absolutely at the disposal of SMPK/ B AND R.
- v) On substantial Completion of any work which has been completed to such an extent that the intended purpose of the work is met and ready to use, then a Provisional Completion Certificate shall be recorded by the Engineer-in-Charge of B AND R. The Provisional Certificate shall have appended with a list of outstanding balance item of work that need to be completed in accordance with the provisions of the contract.

This provisional completion certificate shall be recorded by the Engineer-in-charge of B AND R with the approval of Competent Authority, if required. After recording of the provisional Completion Certificate for the work by the competent authority, the 80 % of performance guarantee shall be returned to the contractor, without any interest.

However in case of contracts involving Maintenance of building and services / any other work after construction of same building and services / other work, then 40% of Performance Guarantee shall be returned to the Contractor, without any interest after recording the Provisional Completion certificate.

### **CLAUSE 1A**

#### **Recovery of Retention Money /Security Deposit:**

The successful tenderer will also be required to furnish additional **Security Deposit / Retention Money amounting to 5% (Five Percent) of the contract value**, which will be deducted from each of his running bill. The said security deposit will be refunded without any interest after completion of CMC Period of 10 years.

## CLAUSE 2

### Compensation for Delay

If the Contractor fails to maintain the required progress in terms of clause 5 or to complete the work and clear the site on or before the contract or justified extended date of completion, as per clause 5 (excluding any extension under Clause 5.5) as well as any extension granted under clauses 12 and 15, he shall, without prejudice to any other right or remedy available under the law to B AND R on account of such breach, pay as agreed compensation the amount calculated at the rates stipulated below as the Engineer-in-charge (B AND R) (whose decision in writing shall be final and binding) may decide on the amount of accepted tendered value of the work for every completed day/month (as applicable) that the progress remains below that specified in Clause 5 or that the work remains incomplete.

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 **Delay in Commissioning:** 2% of the Contract Price per month of delay, subject to maximum upto 10% of the Contract Price even if Extension of Time (EoT) is allowed by SMPK or its authorized representative.

**Delay in CMC:** Penalty is at the rate of INR 6.78/- per unit generation loss.

Provided always that the total amount of compensation for delay to be paid under this Condition shall not exceed 10% (Ten Percent) of the accepted Tendered Value of work or of the accepted Tendered Value of the Sectional part of work as mentioned in **Schedule 'F'** for which a separate period of completion is originally given.

In case no compensation has been decided by the authority in **Schedule 'F'** during the progress of work, this shall be no waiver of right to levy compensation by the said authority if the work remains incomplete on final justified extended date of completion. If the Engineer-in-Charge decides to give further extension of time allowing performance of work beyond the justified extended date, the contractor shall be liable to pay compensation for such extended period. If any variation in amount of contract takes place during such extended period beyond justified extended date and the contractor becomes entitled to additional time under clause 12, the net period for such variation shall be accounted for while deciding the period for levy of compensation. However, during such further extended period beyond the justified extended period, if any delay occurs by events under sub clause 5.2, the contractor shall be liable to pay compensation for such delay.

Provided that Compensation during the progress of work before the justified extended date of Completion for delay under this clause shall be for non-achievement of Sectional Completion or part handing over of work on stipulated / justified extended date for such part work or if delays affects any other works / services. This is without prejudice to right to action by the Engineer-in-Charge under Clause 3 for delay in performance and claim of Compensation under this Clause.

In case action under Clause 2 has not been finalized and the work has been determined under Clause 3, the right of action under this Clause shall remain post determination of contract but levy of compensation shall be for days the progress is behind the schedule on date of determination, as assessed by the Authority in Schedule – F, after the consideration of justified extension. The Compensation for Delay, if not decided before the determination of contract, shall be decided after of determination of Contract.

The amount of compensation may be adjusted or set off against any sum payable to the Contractor under this or any other Contract with SMPK/ B AND R. In case, the Contractor does not achieve a particular milestone mentioned in **Schedule – F** or the re-scheduled milestone(s) in terms of Clause 5.4, the amount shown against that milestone shall be withheld, to be adjusted against the compensation levied as above. With-holding 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.

## CLAUSE 3

### When Contract can be Determined

Subject to other provisions contained in this clause, the Engineer-in-Charge may, without prejudice to his any other rights or remedy against the Contractor in respect of any delay, not following safety norms, inferior workmanship, any claims for damages and/or any other provisions of this contract or otherwise, and whether the date of completion has or has not elapsed, by notice in writing absolutely determine the contract in any of the following cases:

- i) If the Contractor having been given by the Engineer-in-charge a notice in writing to rectify, reconstruct or replace any defective work or that the work is being performed in an inefficient or otherwise improper or un-workman like manner shall omit to comply with the requirement of such notice for a period of seven days thereafter.
- ii) If the contractor has, without reasonable cause, suspended the progress of the work or has failed to proceed with the work with due diligence and continues to do so after a notice in writing of seven days from the Engineer-in-Charge.
- iii) If the contractor fails to complete the work or section of work with individual date of completion on or before the stipulated or justified extended date, on or before such date of completion; and the Engineer in Charge without any prejudice to any other right or remedy under any other provision in the contract has given further reasonable time in a notice given in writing in that behalf as either mutually agreed or in absence of such mutual agreement by his own assessment making such time essence of contract and in the opinion of Engineer-in-Charge the contractor will be unable to complete the same or does not complete the same within the period specified.
- iv) If the Contractor persistently neglects to carry out his obligations under the contract and/or commits default in complying with any of the terms and conditions of the contract and does not remedy it or take effective steps to remedy it within 7 days after a notice in writing is given to him on behalf by the Engineer-in-Charge.
- v) If the contractor shall offer or give or agree to give to any person in Government service or to any other person on his behalf any gift or consideration of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any act in relation to the obtaining or execution of this or any other contract for Government.
- vi) If the contractor shall enter into a contract with Government in connection with which commission has been paid or agreed to be paid by him or to his knowledge, unless the particulars of any such commission and the terms of payment thereof have been previously disclosed in writing to the Engineer-in-Charge.
- vii) If the contractor had secured the contract with Government as a result of wrong tendering or other non-bonafide methods of competitive tendering or commits breach of Integrity Agreement.
- viii) If the contractor being an individual, or if a firm, any partner thereof shall at any time be adjudged insolvent or have a receiving order or order for administration of his estate made against him or shall take any proceedings for liquidation or composition (other than a voluntary liquidation for the purpose of amalgamation or reconstruction) under any Insolvency Act for the time being in force or make any conveyance or assignment of his effects or composition or arrangement for the benefit of his creditors or purport so to do, or if any application be made under any Insolvency Act for the time being in force for the sequestration of his estate or if a trust deed be executed by him for benefit of his creditors.
- ix) If the contractor being a company shall pass a resolution or the court shall make an order that the company 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 entitle the court to make a winding up order.
- x) If the contractor shall suffer an execution being levied on his goods and allow it to be continued for a period of 21 days.
- xi) If the contractor assigns (excluding part(s) of work assigned to other agency(s) by the contractor as per terms of contract), transfers, sublets (engagement of labour on a piece-work basis or of labour with materials not to be incorporated in the work, shall not be deemed to be subletting) or otherwise parts with or attempts to assign, transfer, sublet or otherwise parts with the entire works or any portion thereof without the prior written approval of



the Engineer -in-Charge. When the contractor has made himself liable for action under any of the cases aforesaid, the Engineer in-Charge on behalf of the Employer / SMPK /B AND R shall have powers:

- a) To determine the contract as aforesaid so far as performance of work by the Contractor is concerned (of which determination notice in writing to the contractor under the hand of the Engineer-in-Charge shall be conclusive evidence). Upon such determination, the Earnest Money Deposit, Security Deposit already recovered, Retention Money / Security Deposit payable and Performance Guarantee under the contract shall be liable to be forfeited and shall be absolutely at the disposal of the B AND R.
- b) After giving notice to the contractor to measure up the work of the contractor and to take such whole, or the balance or part thereof, as shall be un-executed out of his hands and to give it to another contractor to complete the work. The contractor, whose contract is determined as above, shall not be allowed to participate in the tendering process for the balance work including any new items needed to complete the work. In the event of above courses being adopted by the Engineer-in-Charge, the contractor shall have no claim to compensation for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements or made any advances on account or with a view to the execution of the work or the performance of the contract. And in case action is taken under any of the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum for any work thereof or actually performed under this contract unless and until the Engineer-in-Charge has certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

### **CLAUSE 3A**

In case, the work cannot be started due to reasons not within the control of the contractor within 1/8th of the stipulated time for completion of work or one month whichever is higher, either party may close the contract by giving notice to the other party stating the reasons. In such eventuality, the Performance Guarantee of the contractor shall be refunded within following time limits :

- (i) If the Tendered value of work is up to Rs. 1.00 Cr. : 15 days.
- (ii) If the Tendered value of work is more than 1.00 Cr. and up to Rs. 10 Cr. : 21 days.
- (iii) If the Tendered value of work exceeds Rs. 10 Cr. :30 days.

Neither party shall claim any compensation for such eventuality. This clause is not applicable for any breach of the contract by either party.

### **CLAUSE 4**

#### **Contractor liable to pay Compensation even if action not taken under Clause 3**

In any case in which any of the powers conferred upon the Engineer-in-Charge by Clause-3 thereof, 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 Engineer-in-Charge putting in force all or any of the powers vested in him under the preceding clause he may, if he so desires after giving a notice in writing to the Contractor, take possession of (or at the sole discretion of the Engineer-in-Charge 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 Engineer-in-Charge) 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 Engineer-in-Charge, whose certificate thereof shall be final, and binding on the Contractor, clerk of the works, foreman or other authorized agent to remove such tools, plant, materials, or stores from the premises (within a time to be specified in such notice) in the event of the Contractor failing to comply with any such requisition, the Engineer-in-Charge may remove them at the Contractor's expense or sell them by auction or private sale on account of the Contractor and his risk in all respects and the certificate of the Engineer-in-Charge 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.

### **CLAUSE 5**

## Time and Extension for Delay

The time allowed for execution of the Works as specified in the **Schedule 'F'** or the extended time in accordance with these conditions shall be the essence of the Contract. The execution of the work shall commence from such time period as mentioned in **schedule 'F'** or from the date of handing over of the site, notified by the Engineer-in-Charge, whichever is later. If the Contractor commits default in commencing the execution of the work as aforesaid, the performance guarantee shall be forfeited by the Engineer in Charge and shall be absolutely at the disposal of the SMPK / B AND R without prejudice to any other right or remedy available in law.

5.1 As soon as possible but within 07 (Seven) working days of award of work and in consideration of

- a) Schedule of handing over of site as specified in the **Schedule 'F'**
- b) Schedule of issue of designs as specified in the **Schedule 'F'** (if applicable)

(i) the Contractor shall submit a Time and Progress Chart for each mile stone. The Engineer-in-Charge may within 07 (Seven) working days thereafter, if required modify, and communicate the program approved to the contractor failing which the program submitted by the contractor shall be deemed to be approved by the Engineer-in-Charge. The work programme shall include all details of balance drawings and decisions required to complete the contract with specific dates by which these details are required by contractor without causing any delay in execution of the work. 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 the forecast of the dates of commencement and completion of various trades of sections of the work and may be amended as necessary by agreement between the Engineer-in-Charge and the Contractor within the limitations of time imposed in the Contract documents.

(i) In case of non submission of construction programme by the contractor, the program approved by the Engineer-in-Charge shall be deemed to be final.

(ii) The approval by the Engineer-in-Charge of such programme shall not relieve the contractor of any of the obligations under the contract.

(iii) The contractor shall submit the Time and Progress Chart and progress report using the mutually agreed software or in other format decided by Engineer-in-Charge for the work done during previous month to the Engineer-in-charge on or before 5th day of each month failing which a recovery as per **Schedule – F** to be decided by the NIT approving authority shall be made on per week or part basis in case of delay in submission of the monthly progress report.

5.2 If the work(s) be delayed by:

- i) force Majeure, or.
- ii) abnormally bad weather, or.
- iii) serious loss or damage by fire, or.
- iv) civil commotion, local commotion of workmen, strike or lockout, affecting any of the trades employed on the work, or.
- v) delay on the part of other Contractors or tradesmen engaged by Engineer-in-Charge in executing work not forming part of the Contract, or.
- vi) any other cause like above, which in the reasoned opinion of the Engineer-in-Charge (EIC) is beyond the Contractor's control.

Then upon the happening of any such event causing delay, the Contractor shall immediately give notice thereof in writing to the Engineer-in-Charge but shall nevertheless use constantly his best endeavors to prevent or make good the delay and shall do all that may be reasonably required to the satisfaction of the Engineer-in-Charge to proceed with the works.

The contractor shall have no claim of damages for extension of time granted or re-scheduling of milestone(s) if any for events listed in Sub-clause 5.2.

5.3 In case the work is hindered by the Department or for any reason/event, for which the Department is

responsible, the authority as indicated in **Schedule 'F'** shall, if justified, give a fair and reasonable extension of time and reschedule the mile stones for completion of work. Such extension of time or rescheduling of milestone/s shall be without prejudice to any other right or remedy of the parties in contract or in law; provided further that for concurrent delays under this sub clause and sub clause 5.2 to the extent the delay is covered under sub clause 5.2 the contractor shall be entitled to only extension of time and no damages.

- 5.4 Request for rescheduling of Mile stones or extension of time, to be eligible for consideration, shall be made by the Contractor in writing within fourteen days of the happening of the event causing delay on the prescribed forms i.e. Form of application by the contractor for seeking rescheduling of milestones (Appendix-XVI of CPWD's Manual) or Form of application by the contractor for seeking extension of time (Appendix -XVII of CPWD's Manual) respectively to the authority as indicated in **Schedule 'F'**. The Contractor shall indicate in such a request the period by which rescheduling of milestone/s or extension of time is desired.

With every request for rescheduling of milestones, or if at any time the actual progress of work falls behind the approved programme by more than 10% of the stipulated period of completion of contract, the contractor shall produce a revised programme which shall include all details of pending drawings and decisions required to complete the contract and also the target dates by which these details should be available without causing any delay in execution of the work. A recovery as specified in **Schedule 'F'** shall be made on per day basis in case of delay in submission of the revised programme.

- 5.4.1 In any such case the authority as indicated in **Schedule 'F'** may give a fair and reasonable extension of time for completion of work or reschedule the mile stones. Engineer-in-Charge shall finalize / reschedule a particular mile stone before taking an action against subsequent mile stone. Such extension or rescheduling of the milestones shall be communicated to the Contractor by the authority as indicated in **Schedule 'F'** in writing, within 21 days of the date of receipt of such request from the Contractor in prescribed form. In event of non application by the contractor for extension of time EIC after affording opportunity to the Contractor may give, supported with a programme (as specified under 5.4 above), a fair and reasonable extension within a reasonable period of occurrence of the event.

- 5.5 In case the work is delayed by any reasons, in the opinion of the Engineer-in-Charge, by the contractor for reasons beyond the events mentioned in clause 5.2 or clause 5.3 or clause 5.4 and beyond the justified extended date; without prejudice to right to take action under Clause 3, the Engineer-in-Charge (EIC) may grant extension of time required for completion of work without rescheduling of milestones. The contractor shall be liable for levy of compensation for delay for such extension of time.

## **CLAUSE 6**

### **Computerized Measurement Book**

Engineer-in-Charge shall, except as otherwise provided, ascertain and determine by measurement the value of work done in accordance with the contract.

All measurements of all items having financial value shall be entered by the contractor and compiled in the shape of the Computerized Measurement Book having pages of A-4 size **or suitable size as per direction of EIC** so that a complete record is obtained of all the items of works performed under the contract.

All such measurements and levels recorded by the contractor or his authorized representative from time to time, during the progress of the work, shall be got checked by the contractor from the Engineer-in-Charge or his authorized representative as per interval or program fixed in consultation with Engineer-in-Charge or his authorized representative. After the necessary corrections made by the Engineer-in-Charge, the measurement sheets shall be returned to the contractor for incorporating the corrections and for resubmission to the Engineer-in-Charge for the dated signatures by the Engineer-in- Charge and the contractor or their representatives in token of their acceptance.

Whenever bill is due for payment, the contractor would initially submit draft computerized measurement sheets and these measurements would be got checked/test checked from the Engineer-in-Charge and/or his authorized representative. The contractor will, thereafter, incorporate such changes as may be done during these

checks/test checks in his draft computerized measurements, and submit to the department a computerized measurement book, duly bound, and with its pages machine numbered. The Engineer-in-Charge and/or his authorized representative would thereafter check this MB, and record the necessary certificates for their checks/test checks.

The final, fair, computerized measurement book given by the contractor, duly bound, with its pages machine numbered, should be 100% correct, and no cutting or over-writing in the measurements would thereafter be allowed. If at all any error is noticed, the contractor shall have to submit a fresh computerized MB with its pages duly machine numbered and bound, after getting the earlier MB cancelled by the department. Thereafter, the MB shall be taken in the Office records, and allotted a number as per the Register of Computerized MBs. This should be done before the corresponding bill is submitted to the Office for payment. The contractor shall submit two spare copies of such computerized MB's for the purpose of reference and record by the various officers of the department.

The contractor shall also submit to the department separately his computerized Abstract of Cost and the bill based on these measurements, duly bound, and its pages machine numbered along with two spare copies of the "bill. Thereafter, this bill will be processed by the Office and allotted a number as per the computerized record in the same way as done for the measurement book meant for measurements.

The contractor shall, without extra charge, provide all assistance with every appliance, labour and other things necessary for checking of measurements/levels by the Engineer-in- Charge or his representative.

Except where any general or detailed description of the work expressly shows to the contrary, measurements shall be taken in accordance with the procedure set forth in the specifications notwithstanding any provision in the relevant Standard Method of measurement or any general or local custom. In the case of items which are not covered by specifications, measurements shall be taken in accordance with the relevant standard method of measurement issued by the Bureau of Indian Standards and if for any item no such standard is available then a mutually agreed method shall be followed.

The contractor shall give not less than seven days' notice to the Engineer-in-Charge or his authorized representative in charge of the work before covering up or otherwise placing beyond the reach of checking and/or test checking the measurement of any work in order that the same may be checked and/or test checked and correct dimensions thereof be taken before the same is covered up or placed beyond the reach of checking and/or test checking measurement and shall not cover up and place beyond reach of measurement any work without consent in writing of the Engineer-in-Charge or his authorized representative in charge of the work who shall within the aforesaid period of seven days inspect the work, and if any work shall be covered up or placed beyond the reach of checking and/or test checking measurements without such notice having been given or the Engineer-in-Charge's consent being obtained in writing the same shall be uncovered at the Contractor's expense, or in default thereof no payment or allowance shall be made for such work or the materials with which the same was executed.

Engineer-in-Charge or his authorized representative may cause either themselves or through another officer of the department to check the measurements recorded by contractor and all provisions stipulated herein above shall be applicable to such checking of measurements or levels.

It is also a term of this contract that checking and/or test checking the measurements of any item of work in the measurement book and/or its payment in the interim, on account of final bill shall not be considered as conclusive evidence as to the sufficiency of any work or material to which it relates nor shall it relieve the contractor from liabilities from any over measurement or defects noticed till completion of the defects liability period.

## **CLAUSE 7**

### **Payment on Intermediate Certificate to be regarded as Advances**

No payment shall be made for work, estimated to **10% of Awarded Value** or less till after the whole of the work shall have been completed and certificate of completion given. For works estimated to cost over **10% of Awarded Value**, the interim or running account bills shall be submitted by the Contractor for the work executed on the basis of such recorded measurements giving abstract and detailed measurements on the format approved by the Engineer-in-Charge in six copies on or before the date of every month fixed for the same by the Engineer-in-Charge. The Contractor shall not be entitled to be paid any such interim payment if the gross work done together with net payment/ adjustment of advances for material collected, if any, since the last such payment is less than the amount specified in **Schedule 'F'**, in which case the interim bill shall be prepared on the appointed date of the month after the requisite progress is achieved. Engineer-in-Charge shall arrange to have the bill verified by taking or causing to be taken, where necessary, the requisite measurements of the work. In the event of the failure of the Contractor to submit the bills, Engineer-in-Charge shall prepare or cause to be prepared such bills in which event no claims whatsoever due to delays on payment including that of interest shall be payable to the Contractor. Payment on account of amount admissible shall be made by the Engineer-in-Charge certifying the sum to which the Contractor is considered entitled by way of interim payment at such rates as decided by the Engineer-in-Charge. The amount admissible shall be paid within **30<sup>th</sup> to 60<sup>th</sup> day** after the day of presentation of the complete bill by the Contractor to the Engineer-in-Charge, **subject to availability of fund from Owner i.e. SMPK Authority.**

All such interim payments shall be regarded as payment by way of advances against final payment only and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be rejected, removed, taken away and reconstructed or re-erected. Any certificate given by the Engineer-in-Charge relating to the work done or materials delivered forming part of such payment, may be modified or corrected by any subsequent such certificate(s) or by the final certificate and shall not by itself be conclusive evidence that any work or materials to which it relates is/are in accordance with the contract and specifications. Any such interim payment, or any part thereof shall not in any respect conclude, determine or affect in any way powers of the Engineer-in-Charge under the contract or any of such payments be treated as final settlement and adjustment of accounts or in any way vary or affect the contract.

Pending consideration of extension of date of completion, interim payments shall continue to be made as herein provided without prejudice to the right of the Employer to take action under the terms of this contract for delay in the completion of work, if the extension of date of completion is not granted by the competent authority.

The Engineer-in-Charge of B AND R in his sole discretion on the basis of a certificate from B AND R to the effect that the work has been completed upto the level in question make interim advance payments without detailed measurements for work done (other than foundations, items to be covered under finishing items) up to lintel level (including sunshade etc.) and slab level, for each floor working out at 75% of the assessed value. The advance payments so allowed shall be adjusted in the subsequent interim bill(s) to be submitted by the contractor within 10 days of the interim payment. In case of delay in submission of bill by the contractor a simple interest @ 10% per annum on the advance payment made shall be paid to the Government from the date of expiry of prescribed time limit which will be compounded on yearly basis.

### **Payments in Composite Contracts**

In case of composite tenders, running payment for the major component shall be made by EIC of major discipline to the main contractor. Running payment for minor component shall be made by the Engineer-in-Charge of the discipline of minor component directly to the main contractor.

In case main contractor fails to make the payment to the contractor associated by him within 15 days of receipt of each running account payment, then on the written complaint of contractor associated for such minor component, Engineer in charge of minor component shall serve the show cause to the main contractor and if reply of main contractor either not received or found unsatisfactory, he may make the payment directly to the contractor associated for minor component as per the terms and conditions of the agreement drawn between main contractor and associate contractor fixed by him. Such payment made to the associate contractor shall be recovered by Engineer-in-charge of major or minor component from the next R/A/ final bill due to main contractor as the case may be.

## **CLAUSE 7A**

**No Running Account Bill shall be paid for the work till the applicable labour licenses, registration with EPFO, ESIC and BOCW Welfare Board, whatever applicable are submitted by the contractor to the Engineer-in-Charge.**

## **CLAUSE 8**

### **Completion Certificate and Completion Plans.**

Within ten days of the completion of the work, the Contractor shall give notice of such completion to the Engineer-in-Charge and within thirty days of the receipt of such notice the Engineer-in-Charge shall inspect the work and if there is no defect in the work, shall furnish the Contractor with a final certificate of completion, otherwise a provisional certificate of physical completion indicating defects (a) to be rectified by the Contractor and/or (b) for which payment will be made at reduced rates, shall be issued. But no final certificate of completion shall be issued, nor shall the work be considered to be complete until the Contractor shall have removed from the premises on which the work shall be executed all scaffolding, surplus materials, rubbish and all huts and sanitary arrangements required for his/their work people on the site in connection with the execution of the works as shall have been erected or constructed by the Contractor(s) and cleaned off the dirt from all wood work, door, windows, walls, floor or other parts of the building, in, upon, or about which the work is to be executed or of which he may have had possession for the purpose of the execution thereof, and not until the work shall have been measured by the Engineer-in-Charge. If the Contractor fails to comply with the requirements of this Clause as to removal of scaffolding, surplus materials and rubbish and all huts and sanitary arrangements as aforesaid and cleaning off dirt on or before the date fixed for the completion of work, the Engineer-in-Charge may at the expense of the Contractor remove such scaffolding, surplus materials and rubbish etc., and dispose of the same as he thinks fit and clean off such dirt as aforesaid, and the Contractor shall have no claim in respect of scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

## **CLAUSE 8A**

### **Completion Plans to be Submitted by the Contractor**

The contractor shall submit completion plans for internal and external Civil, Electrical and Mechanical Services within thirty days of the completion of the work, provided that the service plans having been issued for execution by the Engineer-in-charge, unless the contractor, by virtue of any other provision in the contract, is required to prepare such plans.

- Detailed as-built drawings **4 (four) sets** for all the works carried out by the Contractor.
- Certificates of satisfactory performance test carried out for the various works.
- Guarantee/ Operation & Maintenance Manual shall be supplied by the vendor. (if required)

In case, the contractor fails to submit the completion plan as aforesaid, he shall be liable to pay a sum of 0.1 % (Zero point One Percent) of accepted Tendered Value or limit prescribed in Schedule F whichever is more as may be fixed by B AND R as mentioned in Schedule – F and in this respect the decision of the B AND R shall be final and binding on the contractor.

## **CLAUSE 9**

### **Payment of Final Bill**

The final bill shall be submitted by the Contractor in the same manner as specified in interim bills within three months of physical completion of the work or within one month of the date of the final certificate of completion furnished by the Engineer-in-Charge whichever is earlier. No further claims shall be made by the Contractor after submission of the final bill and these shall be deemed to have been waived and extinguished. Payments of those items of the bill in respect of which there is no dispute and of items in dispute, for quantities and rates as approved by Engineer-in-Charge, will, as far as possible be made within the period of six months, the period being reckoned from the date of receipt of the bill by the Engineer-in-Charge or his authorized representative.

## **CLAUSE 9A**

### **Payment of Contractor's Bills to Bank**

Contractor shall raise monthly R/A Bills substantiating all the requisite documents within 1<sup>st</sup> week of every month for the work done during the last month. This bill shall be checked and certified by B AND R. After necessary checking, review and finalization, this certified bill shall be furnished to SMPK Authority and the Payment will be released within 60 days from the date of certified bill by B AND R, **subject to availability of fund from Owner i.e. SMPK Authority.**

Payments due to the Contractor shall be released in the form of RTGS/NEFT in favour of the Contractor. Bank charges, if any, to be on Contractor's account and the Contractor shall submit the following details to the company.

- i) Name of the company
- ii) Name of Bank
- iii) Name of Bank Branch
- iv) City
- v) Account Number
- vi) Account Type
- vii) IFSC Code of the Bank Branch
- viii) MICR Code of the Bank Branch

## **CLAUSE 10A**

### **Materials to be provided by the Contractor**

The Contractor shall, at his own expense, provide all materials, required for the works, other than those which are stipulated to be supplied by SMPK / B AND R.

The Contractor shall, at his own expense and without delay; supply to the Engineer-in-Charge samples of materials to be used on the work and shall get these approved in advance. All such materials to be provided by the Contractor shall be in conformity with the specifications laid down or referred to in the contract. The Contractor shall, if requested by the Engineer-in-Charge furnish proof, to the satisfaction of the Engineer-in-Charge that the materials so comply. The Engineer-in-Charge shall within thirty days of supply of samples or within such further period as he may require intimate to the Contractor in writing whether samples are approved by him or not. If samples are not approved, the Contractor shall forthwith arrange to supply to the Engineer-in-Charge for his approval fresh samples complying with the specifications laid down in the contract. When materials are required to be tested in accordance with specifications, approval of the Engineer-in-Charge shall be issued after the test results are received.

The Contractor shall at his risk and cost submit the samples of materials to be tested or analyzed and shall not make use of or incorporate in the work any materials represented by the samples until the required tests or analysis have been made and materials finally accepted by the Engineer-in-Charge. The Contractor shall not be eligible for any claim or compensation either arising out of any delay in the work or due to any corrective measures required to be taken on account of and as a result of testing of materials.

The Contractor shall, at his risk and cost, make all arrangements and shall provide all facilities as the Engineer-in-Charge may require for collecting, and preparing the required number of samples for such tests at such time and to such place or places as may be directed by the Engineer-in-Charge and bear all charges and cost of testing unless specifically provided for otherwise elsewhere in the contract or specifications. The Engineer-in-Charge or his authorized representative shall at all times have access to the works and to all workshops and places where work is being prepared or from where materials, manufactured articles or machinery are being

obtained for the works and the Contractor shall afford every facility and every assistance in obtaining the right to such access.

The Engineer-in-Charge shall have full powers to require the removal from the premises of all materials which in his opinion are not in accordance with the specifications and in case of default, the Engineer-in-Charge shall be at liberty to employ at the expense of the Contractor, other persons to remove the same without being answerable or accountable for any loss or damage that may happen or arise to such materials. The Engineer-in-Charge shall also have full powers to require other proper materials to be substituted thereof and in case of default, the Engineer-in-Charge may cause the same to be supplied and all costs which may attend such removal and substitution shall be borne by the Contractor.

The Contractor shall at his own expenses, provide a material testing lab at the site for conducting routine field tests. The lab shall be equipped at least with the testing equipment as specified in **Schedule – F**.

#### **CLAUSE 10B**

**i) Secured Advance on Materials**

**NOT APPLICABLE**

**ii) Mobilization Advance**

**NA**

**iii) Interest & Recovery**

**NA**

#### **CLAUSE 10C**

**Payment on Account of Increase in Prices / Wages due to Statutory Order(s)**

**NOT APPLICABLE**

#### **CLAUSE 10CA**

**Payment due to variation in prices of materials after last date of submission of tender**

**NOT APPLICABLE**

#### **CLAUSE 10CC**

**Payment due to Increase / Decrease in Prices / Wages (excluding materials covered under clause 10 CA) after submission of Tender for Works**

**NOT APPLICABLE**

#### **CLAUSE 10D**

**Dismantled Material Govt. Property**

The Contractor shall treat all materials obtained during dismantling of a structure, excavation of the site for a work, etc. as SMPK's property and such materials shall be disposed off to the best advantage of SMPK according to the instructions in writing issued by the Engineer-in-Charge.

#### **CLAUSE 11**

**Work to be Executed in Accordance with Specifications, Drawings, Orders etc.**

The Contractor shall execute the whole and every part of the work in the most substantial and workmanlike manner both as regards materials and otherwise in every respect in strict accordance with the specifications. The Contractor shall also conform exactly, fully and faithfully to the design, drawings and instructions in writing in



respect of the work signed by the Engineer-in-Charge and the Contractor shall be furnished free of charge one copy of the contract documents together with specifications, designs, drawings and instructions as are not included in the standard specifications of Central Public Works Department specified in **Schedule 'F'** or in any Bureau of Indian Standard or any other, published standard or code or, Schedule of Rates of any other printed publication referred to elsewhere in the contract.

The Contractor shall comply with the provisions of the contract and with the care and diligence execute and maintain the works and provide all labour and materials, tools and plants including for measurements and supervision of all works, structural plans and other things of temporary or permanent nature required for such execution and maintenance in so far as the necessity for providing these, is specified or is reasonably inferred from the contract. The Contractor shall take full responsibility for adequacy, suitability and safety of all the works and methods of construction.

## **CLAUSE 12**

### **Deviations/Variations Extent and Pricing**

The Engineer -in-Charge shall have power (i) to make alteration in, omissions from, additions to, or substitutions for the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work, and (ii) to omit a part of the works in case of non-availability of a portion of the site or for any other reasons and the Contractor shall be bound to carry out the works in accordance with any instructions given to him in writing signed by the Engineer-in-Charge and such alterations, omissions, additions or substitutions shall form part of the contract as if originally provided therein and any altered, additional or substituted work which the Contractor may be directed to do in the manner specified above as part of the works, shall be carried out by the Contractor on the same conditions in all respects including price on which he agreed to do the main work except as hereafter provided.

- 12..1 The time of completion of the works shall, in the event of any deviations resulting in additional cost over the tendered value sum being ordered, be extended, if requested by the Contractor, as follows:
- i) In the proportion which the additional cost of the altered, additional or substituted work, bears to the original tendered value plus.
  - ii) 25% of the time calculated in (i) above or such further additional time as may be considered reasonable by the Engineer-in-Charge.

### **12.2 Deviation, Extra Items and Pricing**

In case of extra item(s) (items which are not available in the contract), the contractor may within fifteen days of the receipt of order or occurrence of the item(s), submit claim for market rate(s), supported with proper analysis of rate and manufacturer's specification for the work, invoices, vouchers, etc. (as applicable), failing which the rate(s) approved later by the Engineer-in-Charge shall be final and binding. Where the contractor submits claim for market rate(s) in the manner prescribed above, the Engineer-in-Charge shall, within 45 days of the receipt of the claims, after giving consideration to the analysis of rates and other documents submitted by the contractor, determine the rates on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

The rate(s) of extra items so determined by the Engineer-in-Charge shall be final and binding on the contractor, and shall not be arbitrable.

### **Deviation, Deviated Quantities, Pricing**

In the case of contract items which exceed the limit laid down in **Schedule F**, the contractor may within fifteen days of the receipt of order or occurrence of the excess, claim revision of the rates, supported with proper analysis of rate and invoices, vouchers, etc. (as applicable), for the quantity in excess of the above mentioned limit. The Engineer-in-Charge shall within 45 days of receipt of the claims, after giving consideration to the analysis of rates and other documents submitted by the contractor, determine the rates on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

The rate(s) so determined by the Engineer-in- Charge shall be final and binding on the contractor, and shall not

be arbitrable.

- 12.3 In the case of contract items which exceed the limit laid down in **Schedule F**, the Engineer-in-Charge shall after giving notice to the contractor within 30 days of submission of that bill by the contractor which contains such item(s), and after taking into consideration any reply received from the contractor within 15 days of the issue of such notice, reduce the rate for quantity in excess of the abovementioned limit on the basis of market rates, within 30 days of the expiry of the said period of 15 days, and the contractor shall be paid in accordance with the rates so determined. The rate(s) so determined by the Engineer-in-Charge shall be final and binding on the contractor, and shall not be arbitrable.
- 12.4 The cost of any operation necessarily in contemplation of tenderer while quoting tender or necessary or incidental to proper execution of an item of work included in the Schedule of Quantities or in the Schedule of Rates mentioned in Schedule F, whether or not specifically indicated in the description of the item and the relevant specifications, shall be deemed to be included in the rates quoted by the tenderer or the rate given in the said Schedule of Rates, as the case may be. Nothing extra shall be admissible for such operations.

### **CLAUSE 13**

#### **Foreclosure of Contract due to Abandonment or Reduction in Scope of work**

If at any time after acceptance of the tender or during the progress of work, the purpose or object for which the work is being done changes due to any supervening cause and as a result of which the work has to be abandoned or reduced in scope the Engineer-in-Charge shall give notice in writing to that effect to the contractor stating the decision as well as the cause for such decision 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 he might have derived from the execution of the works in full but which he did not derive in consequence of the foreclosure of the whole or part of the works.

The Contractor shall be paid at contract rates full amount for works executed at site and, in addition, a reasonable amount as certified by the Engineer-in-Charge for the items hereunder mentioned which could not be utilized on the work to the full extent in view of the foreclosure:

- i) Any expenditure incurred on preliminary site work, e.g. temporary access roads, temporary labour huts, staff quarters and site office; storage accommodation and water storage tanks.
- ii) Employer shall have option to take over Contractor's materials or any part thereof either brought to site or of which the Contractor is legally bound to accept delivery from suppliers (for incorporation in or incidental to the work) provided, however, Employer shall be bound to take over the materials or such portions thereof as the Contractor does not desire to retain. For materials taken over or to be taken over by employer, cost of such materials as detailed by Engineer-in-Charge shall be paid. The cost shall, however, take into account purchase price, cost of transportation and deterioration or damage which may have been caused to materials whilst in the custody of the Contractor.
- iii) Reasonable compensation for transfer of T & P from site to Contractor's permanent stores or to his other works, whichever is less. If T & P are not transported to either of the said places, no cost of transportation shall be payable.
- iv) Reasonable compensation for repatriation of Contractor's site staff and imported labour to the extent necessary.

The Contractor shall, if required by the Engineer-in-Charge, furnish to him, books of account, wage books, time sheets and other relevant documents and evidence as may be necessary to enable him to certify the reasonable amount payable under this condition.

The reasonable amount of items on (i), (iii) and (iv) above shall not be in excess of 2% of the cost of the work remaining incomplete on the date of closure, i.e. total stipulated cost of the work as per accepted tender less the cost of work actually executed under the contract and less the cost of Contractor's materials at site taken over by Employer as per item (ii) above. Provided always that against any payments due to the Contractor on this account or otherwise, the Engineer-in-Charge shall be entitled to recover or be credited with any outstanding

balances due from the Contractor for advance paid in respect of any tool, plants and materials and any other sums which at the date of termination were recoverable by Employer from the Contractor under the terms of the contract.

In the event of action being taken under Clause 13 to reduce the scope of work, the contractor may furnish fresh Performance Guarantee on the same conditions, in the same manner and at the same rate for the balance tendered amount and initially valid up to the extended date of completion or stipulated date of completion if no extension has been granted plus 60 days beyond that. Wherever such a fresh Performance Guarantee is furnished by the contractor the Engineer-in-Charge may return the previous Performance Guarantee.

#### **CLAUSE 14**

##### **Carrying out part work at risk & cost of contractor**

If Contractor :

- i) at any time makes default during currency of work or does not execute any part of the work with the due diligence and continues to do so even after a notice in writing of 7 working days in this respect from the Engineer-in-Charge; or
- ii) commits default in complying with any of the terms and conditions of the contract and does not remedy it or take effective steps to remedy it within 7 working days even after a notice in writing is given to him in that behalf by the Engineer-in-Charge; or

Fails to complete the works 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 Engineer-in-Charge; or

- iii) The Engineer-in-Charge without invoking action under clause 3 may, without prejudice to any other right or remedy against the contractor which have either accrued or accrue thereafter to Government, by a notice in writing to take the part work / part incomplete work of any item(s) out of his hands and shall have powers to:
  - (a) Take possession of the site and any materials, constructional plant, implements, stores, etc., thereon; and/or
  - (b) Carry out the part work / part incomplete work of any item(s) by any means at the risk and cost of the contractor.

The Engineer-in-Charge shall determine the amount, if any, is recoverable from the contractor for completion of the part work/ part incomplete work of any item(s) taken out of his hands and execute at the risk and cost of the contractor, the liability of contractor on account of loss or damage suffered by B AND R/SMPK Authority because of action under this clause shall not exceed 10% of the tendered value of the work.

In determining the amount, credit shall be given to the contractor with the value of work done in all respect in the same manner and at the same rate as if it had been carried out by the original contractor under the terms of his contract, the value of contractor's materials taken over and incorporated in the work and use of plant and machinery belonging to the contractor.

The certificate of the Engineer-in-Charge as to the value of work done shall be final and conclusive against the contractor provided always that action under this clause shall only be taken after giving notice in writing to the contractor. Provided also that if the expenses incurred by the department are less than the amount payable to the contractor at his agreement rates, the difference shall not be payable to the contractor.

Any excess expenditure incurred or to be incurred by Employer (SMPK / B AND R) in completing the part work/ part incomplete work of any item(s) or the excess loss of damages suffered or may be suffered by Employer (SMPK / B AND R) as aforesaid after allowing such credit shall without prejudice to any other right or remedy available to Owner in law or per as agreement 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 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 Engineer-in-Charge shall have the right to sell any or all of the contractors' 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 above course being adopted by the Engineer-in-Charge, the contractor shall have no claim to compensation for any loss sustained by him by reason of his 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.

#### **CLAUSE 15**

##### **Suspension of Work**

- i) The Contractor shall, on receipt of the order in writing of the Engineer-in-Charge (**All final decisions / finalizations are subject to the approval of Client / Owner i.e. SMPK**), suspend the progress of the works or any part thereof for such time and in such manner as the Engineer-in-Charge may consider necessary so as not to cause any damage or injury to the work already done or endanger the safety thereof for any of the following reasons :
- a) on account of any default on the part of the Contractor or;
  - b) for proper execution of the works or part thereof for reasons other than the default of the Contractor; or
  - c) for safety of the works or part thereof.

The Contractor shall, during such suspension, properly protect and secure the works to the extent necessary and carry out the instructions given in that behalf by the Engineer-in-Charge.

- ii) If the suspension is ordered is ordered for reasons (b) and (c) in sub-para (i) above:
- a) the Contractor shall be entitled to an extension of time equal to the period of every such suspension PLUS 25%, for completion of the item or group of items of work for which a separate period of completion is specified in the contract and of which the suspended work forms a part, and;
  - b) If the total period of all such suspensions in respect of an item or group of items or work for which a separate period of completion is specified in the contract exceeds thirty days, the Contractor shall, in addition, be entitled to such compensation as the Engineer-in-Charge may consider reasonable in respect of salaries and/or wages paid by the Contractor to his employees and labour at site, remaining idle during the period of suspension, adding thereto 2% to cover indirect expenses of the Contractor. Provided the Contractor submits his claim supported by details to the Engineer-in-Charge within fifteen days of the expiry of the period of 30 days.
- iii) If the works or part thereof is suspended on the orders of the Engineer-in-Charge for more than three months at a time, except when suspension is ordered for reason (a) in sub-para (i) above, the Contractor may after receipt of such order serve a written notice on the Engineer-in-Charge requiring permission within fifteen days from receipt by the Engineer-in-Charge of the said notice, to proceed with the work or part thereof in regard to which progress has been suspended and if such permission is not granted within that time, the Contractor, if he intends to treat the suspension, where it affects only a part of the works as an omission of such part by Employer or where it affects whole of the works, as an abandonment of the works by Employer, shall within ten days of expiry of such period of 15 days given notice in writing of his intention to the Engineer-in-Charge. In the event of the Contractor treating the suspension as an abandonment of the contract by Employer, he shall have no claim to payment of any compensation on account of any profit or advantage which he might have derived from the execution of the work in full but which he could not derive in consequence of the abandonment. He shall, however, be entitled to such compensation, as the Engineer-in-Charge may consider reasonable, in respect of salaries and/or wages paid by him to his employees and labour at site, remaining idle in consequence adding to the total thereof 2% to cover indirect expenses of the Contractor provided the Contractor submits his claim supported by details to the Engineer-in-Charge within 30 days of the expiry of the period of 3 months. All final decisions/finalizations are subject to approval from Owner/ i.e. SMPK Authority.

## **CLAUSE 16**

### **Action in case Work not done as per Specifications**

All works under or in course of execution or executed in pursuance of the contract, shall at all times be open and accessible to the inspection and supervision of the Engineer-in-Charge, his authorized Representative of the work and all the superior officers, Officers of Employer, officer of the Quality Control Organization of the Employer including Third party inspection and of the Chief Technical Examiner's Office, and the Contractor shall, at all times, during the usual working hours and at all other times at which reasonable notice of the visit of such officers has been given to the Contractor, either himself be present to receive orders and instructions or have a responsible agent duly accredited in writing, present for that purpose. Orders given to the Contractor's agent shall be considered to have the same force as is they had been given to the Contractor himself.

If it shall appear to the Engineer-in-Charge or his authorized subordinates in-charge of the work or to the Chief Engineer-in-Charge of Quality Control or his subordinate officers or to the Chief Technical Examiner or his subordinate officers, that any work has been executed with unsound, imperfect, or unskillful workmanship, or with materials or articles provided by him for the execution of the work which are unsound or of a quality inferior to that contracted or otherwise not in accordance with the contract, the Contractor shall, on demand in writing which shall be made within six months of the completion of the work from the Engineer-in-Charge specifying the work, materials or articles complained of notwithstanding that the same may have been passed, certified and paid for forthwith rectify, or remove and reconstruct the work so specified in whole or in part, as the case may require or as the case may be, remove the materials or articles so specified and provide other proper and suitable materials or articles at his own charge and cost. In the event of the failing to do so within a period specified by the Engineer-in-Charge in his demand aforesaid, then the Contractor shall be liable to pay compensation at the same rate as under clause 2 of the contract (for non-completion of the work in time) for this default.

In such case the Engineer-in-Charge may not accept the item of work at the rates applicable under the contract but may accept such items at reduced rates as the competent authority may consider reasonable during the preparation of on account bills or final bill if the item is so acceptable without detriment to the safety and utility of the item and the structure or he may reject the work outright without any payment and/or get it and other connected and incidental items rectified, or removed and re-executed at the risk and cost of the Contractor. Decision of the Engineer-in-Charge to be conveyed in writing in respect of the same will be final and binding on the Contractor.

## **CLAUSE 17**

### **Contractor Liable for Damages, defects during Defect Liability period**

If the Contractor or his working people or servants shall break, deface, injure or destroy any part of building in which they may be working, or any building, road, road kerb, fence, enclosure, water pipe, cables, drains, electric or telephone post or wires, trees, grass or grassland, or cultivated ground contiguous to the premises on which the work or any part is being executed, or if any damage shall happen to the work while in progress, from any cause whatever or if any defect, shrinkage or other faults appear in the work **within 12 (Twelve) months** after a certificate final or otherwise of its completion shall have been given by the Engineer-in-Charge as aforesaid arising out of defect or improper materials or workmanship the Contractor shall upon receipt of a notice in writing on that behalf make the same good at his own expense or in default the Engineer-in-Charge cause the same to be made good by other workmen and deduct the expense from any sums that may be due or at any time thereafter may become due to the Contractor, or from his retention money or the proceeds of sale thereof or of a sufficient portion thereof. The Retention Money of the Contractor shall not be refunded before the expiry of **twelve months** after handing over or completed work to owner i.e. SMPK Authority without any interest, or till the final bill has been prepared and passed whichever is later.

## **CLAUSE 18**

### **Contractor to Supply Tools & Plants etc.**

The Contractor shall provide at his own cost all materials (except such special materials, if any, as may in accordance with the contract be supplied from the Engineer-in-Charge's stores), plant, tools, appliances, implements, ladders, cordage, tackle, scaffolding and temporary works required for the proper execution of the

work, whether original, altered or substituted as stipulated in **Schedule-F** and whether included in the specifications or other documents forming part of the contract or referred to in these conditions or not, or which may be necessary for the purpose of satisfying or complying with the requirements of the Engineer-in-Charge as to any matter as to which under these conditions he is entitled to be satisfied, or which he is entitled to require together with carriage therefore to and from the work. The Contractor shall also supply without charge the requisite number of persons with the means and materials, necessary for the purpose of setting out works, and counting, weighing and assisting the measurement for examination at any time and from time to time of the work or materials. Failing his so doing, the same may be provided by the Engineer-in-Charge at the expense of the Contractor and the expenses may be deducted, from any money due to the Contractor, under this contract or otherwise and/or from his retention money or the proceeds of sale thereof, or a sufficient portions thereof.

#### **CLAUSE 18A**

##### **Recovery of Compensation paid to Workmen**

In every case in which by virtue of the provisions sub-section (1) of Section 12, of the Workmen's Compensation Act, 1923, Employer is obliged to pay compensation to a workman employed by the Contractor, in execution of the works, Employer will recover from the Contractor, the amount of the compensation so paid; and, without prejudice to the rights of the Employer under sub-section (2) of Section 12, of the said Act, Employer shall be at liberty to recover such amount or any part thereof by deducting it from the retention money or from any sum due by Employer to the Contractor whether under this contract or otherwise. Employer shall not be bound to contest any claim made against it under sub-section (1) Section 12, of the said Act, except on the written request of the Contractor and upon his giving to Employer full security for all costs for which Employer might become liable in consequence in contesting such claim.

#### **CLAUSE 18B**

##### **Ensuring Payment and Amenities to Workers if Contractor fails**

In every case in which by virtue of the provisions of the Contract Labour (Regulation and Abolition) Act, 1970, and of the Contract Labour (Regulation and Abolition) Central Rules, 1971, Employer is obliged to pay any amounts of wages to a workman employed by the Contractor in execution of the works, or to incur any expenditure in providing welfare and health amenities required to be provided under the above said Act and the rules under Clause 19H or under the Contractor's Labour Regulations, or under the Rules framed by Employer from time to time for the protection of health and sanitary arrangements for workers employed by Employer. Contractors, Employer will recover from the Contractor, the amount of wages so paid or the amount of expenditure so incurred; and without prejudice to the rights of the Employer under sub-section (2) of Section 20, and sub-section (4) of Section 21, of the Contract Labour (Regulation and Abolition) Act, 1970, Employer shall be at liberty to recover such amount or any part thereof by deducting it from the retention money or from any sum due by Employer to the Contractor whether under this contract or otherwise Employer shall not be bound to contest any claim made against it under sub-section (1) of Section 20, sub-section (4) of Section 21, of the said Act, except on the written request of the Contractor and upon his giving to the Employer full security for all costs for which Employer might become liable in contesting such claim.

#### **CLAUSE 19**

##### **Labour Laws to be complied by the Contractor**

The contractor shall comply with the provisions of the Contract Labour (Regulation and Abolition) Act, 1970, and the contract Labour (Regulation and Abolition) Central Rules, 1971. The contractor shall also obtain a valid licence under the said Act before the commencement of the work, and continue to have a valid licence until its completion. **The contractor shall also comply with provisions of the Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979.**

The Contractor shall also abide by the provisions of the Child and Adolescent Labour (Prohibition and Regulation) Act, 1986.

The Contractor shall also comply with the provisions of the building and other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 and the building and other Construction Workers Welfare Cess Act, 1996.

Any failure to fulfill these requirements shall attract the penal provisions of this contract arising out of the

resultant non-execution of the work.

#### **CLAUSE 19A**

No labour below the age of Fourteen years shall be employed on the work.

#### **CLAUSE 19B**

##### **Payment of Wages**

Payment of wages:

- i) The Contractor shall pay to labour employed by him either directly or through sub Contractors, wages not less than fair wages as defined in the B AND R Contractor's Labour Regulations or as per the provisions of the Contract Labour (Regulation and Abolition) Act 1970 and the contract Labour (Regulation and Abolition) Central Rules, 1971, wherever applicable
- ii) The Contractor shall, notwithstanding the provisions of any contract to the contrary, cause to be paid fair wage to labour indirectly engaged on the work, including any labour engaged by his sub-Contractors in connection with the said work, as if the labour had been immediately employed by him.
- iii) In respect of all labour directly or indirectly employed in the works for performance of the Contractor's part of this contract, the Contractor shall comply with or cause to be complied with the Central Public Works Employer Contractor's Labour Regulations made by Government from time to time in regard to payment of wages, wage period, deductions from wages recovery of wages not paid and deductions non-authorizedly made, maintenance of wage books or wage slips, publication of scale of wages and other terms of employment, inspection and submission of periodical returns and all other matters of the like nature or as per the provisions of the Contract Labour (Regulation and Abolition) Act 1970, and the Contract Labour (Regulation and Abolition) Central Rules, 1971, wherever applicable.
- iv a) The Engineer-in-Charge concerned shall have the right to deduct from the moneys due to the Contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of non-fulfillment of the conditions of the contract for the benefit of the workers, non-payment of wages or of deductions made from his or their wages which are not justified by their terms of the contract or non-observance of the Regulations.
- b) Under the provision of Minimum Wages (Central) Rules 1950, the Contractor is bound to allow to the labours directly or indirectly employed in the works one day rest for 6 days continuous work and pay wages at the same rate as for duty. In the event of default, the Engineer-in-Charge shall have the right to deduct the sum or sums not paid on account of wages for weekly holidays to any labours and pay the same to the persons entitled thereto from any money due to the Contractor by the Engineer-in-Charge concerned.  
  
In the case of Union Territory of Delhi, however, as the all inclusive minimum daily wages fixed under Notification of the Delhi Administration No.F.12(162)MWO/DAB/ 43884-91, dated 31.12.1979 as amended from time to time are inclusive of wages for the weekly day of rest, the question of extra payment for weekly holiday would not arise.
- v) The Contractor shall comply with the provisions of the Payment of Wages Act, 1936, Minimum Wages Act, 1948, Employees Liability Act, 1938, Workmen's Compensation Act, 1923, Industrial Disputes Act, 1947, Maternity Benefits Act 1961 and the Contractor's Labour (Regulation and Abolition) Act 1970, or the modifications thereof or any other laws relating thereto and the rules made there under from time to time.
- vi) The Contractor shall indemnify and keep indemnified Employer against payments to be made under and for the observance of the laws aforesaid and the B AND R Contractor's Labour Regulations without prejudice to his right to claim indemnify from his sub-contractors.
- vii) The laws aforesaid shall be deemed to be a part of this contract and any breach thereof shall be deemed to be a breach of this contract.
- viii) Whatever is the minimum wage for the time being, or if the wage payable is higher than such wage, such wage

shall be paid by the Contractor to the workmen directly without the intervention of Jamadar and that Jamadar shall not be entitled to deduct or recover any amount from the minimum wage payable to the workmen as and by way of commission or otherwise.

- ix) The Contractor shall ensure that no amount by way of commission or otherwise is deducted or recovered by the Jamadar from the wage of workmen.

#### **CLAUSE 19C**

In respect of all labour directly or indirectly employed in the work for the performance of the Contractor's part of this contract, the Contractor shall at his own expense arrange for the safety provisions as per B AND R/relevant Safety Code framed from time to time and shall at his own expense provide for all facilities in connection therewith. In case the Contractor fails to make arrangement and provide necessary facilities as aforesaid, he shall be liable to pay a penalty as decided by the authority mentioned in **Schedule – F** for each default and in addition, the Engineer-in-Charge shall be at liberty to make arrangement and provide facilities as aforesaid and recover the costs incurred in that behalf from the Contractor.

#### **CLAUSE 19D**

The Contractor shall submit by the 4<sup>th</sup> and 19<sup>th</sup> of every month, to the Engineer-in-Charge a true statement showing in respect of the second half of the preceding month and the first half of the current month respectively:

- 1) the number of labourers employed by him on the work.
- 2) their working hours
- 3) the wages paid to them
- 4) the accidents that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused by them, and
- 5) the number of female workers who have been allowed maternity benefit according to Clause 19F and the amount paid to them.

Failing which the Contractor shall be liable to pay to Employer, a sum as decided by the authority mentioned in **Schedule – F** for each default or materially incorrect statement. The decision of the Engineer in charge shall be final in deducting from any bill due to the Contractor; the amount levied as fine and be binding on the Contractor.

#### **CLAUSE 19E**

In respect of all labour directly or indirectly employed in the works for the performance of the Contractor's part of this contract, the Contractor shall comply with or cause to be complied with all the rules framed by Employer from time to time for the protection of health and sanitary arrangements for workers employed by the Employer and its Contractors.

#### **CLAUSE 19F**

**Leave and pay during leave shall be regulated as follows:**

1. Leave :
  - i) in the case of delivery – maternity leave not exceeding 8 weeks, 4 weeks upto and including today of delivery and 4 weeks following that day,
  - ii) in the case of miscarriage – upto 3 weeks from the date of miscarriage.
2. Pay :



- i) in the case of delivery – leave pay during maternity leave will be at the rate of the women's average daily earnings, calculated on total wages earned on the days when full time work was done during a period of three months immediately preceding the date on which she given notice that she expects to be confined or at the rate of Rupee one only a day whichever is greater.
- ii) In the case of miscarriage – leave pay at the rate of average daily earning calculated on the total wages earned on the days when full time work was done during a period of three months immediately preceding the date of such miscarriage.

3. Conditions for the grant of Maternity Leave :

No maternity leave benefit shall be admissible to a woman unless she has been employed for a total period of not less than six months immediately preceding the date on which she proceeds on leave.

4. The Contractor shall maintain a register of Maternity (Benefit) in the Prescribed Form as shown in Appendix -I and II, and the same shall be kept at the place of work.

### **CLAUSE 19G**

In the event of the Contractor(s) committing a default or breach of any of the provisions of the Central Public Works Employer, Contractor's Labour Regulations and Model Rules for the protection of health and sanitary arrangements for the workers as amended from time to time or furnishing any information or submitting or filing and statement under the provisions of the above Regulations and Rules which is materially incorrect, he/they shall, without prejudice to any other liability, pay to the Employer a sum as decided by the authority mentioned in **Schedule – F** for every default, breach or furnishing, making, submitting, filing such materially incorrect statements and in the event of the Contractor(s) defaulting continuously in this respect, the penalty may be enhanced to as decided by the authority mentioned in **Schedule – F** per day for each day of default subject to a maximum of 5 percent of the estimated cost of the work put to tender. The decision of the Engineer-in-Charge shall be final and binding on the parties.

Should it appear to the Engineer-in-Charge that the Contractor(s) is/are not properly observing and complying with the provisions of the B AND R Contractor's Labour Regulations and Model Rules and the provisions of the Contract Labour (Regulation and Abolition) Act 1970, and the Contract Labour (R&A) Central Rules 1971, for the protection of health and sanitary arrangements for work people employed by the Contractor(s) (hereinafter referred as "the said Rules") the Engineer-in-Charge shall have power to give notice in writing to the Contractor(s) requiring that the said Rules be complied with and the amenities prescribed therein be provided to the work people within a reasonable time to be specified in the notice. If the Contractor(s) shall fail within the period specified in the notice to comply with and/observe the said Rules and to provide the amenities to the work people as aforesaid, the Engineer-in-Charge shall have the power to provide the amenities hereinbefore mentioned at the cost of the Contractor(s). The Contractor(s) shall erect, make and maintain at his/their own expense and to approved standards all necessary huts and sanitary arrangements required for his/their work people on the site in connection with the execution of the works, and if the same shall not have been erected or constructed, according to approved standards, the Engineer-in-Charge shall have power to give notice in writing to the Contractor(s) requiring that the said huts and sanitary arrangements be remodeled and/or reconstructed according to approved standards, and if the Contractor(s) shall fail to remodel or reconstruct such huts and sanitary arrangements according to approved standards within the period specified in the notice, the Engineer-in-Charge shall have the power to remodel or reconstruct such huts and sanitary arrangements according to approved standards at the cost of the Contractor(s).

### **CLAUSE 19H**

The Contractor(s) shall at his/their own cost provide his/their labour with a sufficient number of huts (hereinafter referred to as the camp) of the following specifications on a suitable plot of land to be approved by the Engineer-in-Charge.

- i) a) The minimum height of each hut at the eaves level shall be 2.10m (7 ft) and the floor area to be provided with be at the rate of 2.7 sq.m (30 sq.ft.) for each member of the worker's family staying with the labourer.

- b) The Contractor(s) shall in addition construct suitable cooking places having a minimum area of 1.80m x 1.50m (6'x5') adjacent to the hut for each family.
  - c) The Contractor(s) shall also construct temporary latrines and urinals for the use of the labourers each on the scale of not less than four per each one hundred of the total strength, separate latrines and urinals being provided for women.
  - d) The Contractor(s) shall construct sufficient number of bathing and washing places, one unit for every 25 persons residing in the camp. These bathing and washing places shall be suitably screened.
- ii) a) All the huts shall have walls of sun-dried or burnt-bricks laid in mud mortar or other suitable local materials as may be approved by the Engineer-in-Charge. In case of sun-dried bricks, the walls should be plastered with mud gobi on both sides. The floor may be kutcha but plastered with mud gobi and shall be at least 15 cm (6") above the surrounding ground. The roofs shall be laid with thatch or any other materials as may be approved by the Engineer-in-Charge and the Contractor shall ensure that throughout the period of their occupation the roofs remain water-tight.
- b) The Contractor(s) shall provide each hut with proper ventilation.
  - c) All doors, windows, and ventilators shall be provided with suitable leaves for security purposes.
  - d) There shall be kept an open space of at least 7.2m (8 yards) between the rows of huts which may be reduced to 6m (20 ft.) according to the availability of site with the approval of the Engineer-in-Charge. Back to back construction will be allowed.
- iii) **Water supply** – the Contractor(s) shall provide adequate supply of water for the use of labourers. The provisions shall not be less than two gallons of pure and wholesome water per head per day for drinking purposes and three gallons of clean water per head per day for bathing and washing purposes. Where piped water supply is available, supply shall be at stand posts and where the supply is from wells or river, tanks which may be of metal or masonry, shall be provided. The Contractor(s) shall also at his/their own cost make arrangements for laying pipe lines for water supply to his/their labour camp from the existing mains wherever available, and shall pay all fees and charges therefore.
- iv) The site selected for the camp shall be high ground, removed from jungle.
- v) **Disposal of Excreta** – The Contractor(s) shall make necessary arrangements for the disposal of excreta from the latrines by trenching or incineration which shall be according to the requirements laid down by the Local Health Authorities. If trenching or incineration is not allowed, the Contractor(s) shall make arrangements for the removal of the excreta through the Municipal Committee/ authority and inform it about the number of labourers employed so that arrangements may be made by such Committee/authority for the removal of the excreta. All charges on this account shall be borne by the Contractor and paid direct by him to the Municipality/ authority. The Contractor shall provide one sweeper for every eight seats in case of dry system.
- vi) **Drainage** – The Contractor(s) shall provide efficient arrangements for draining away silage water so as to keep the camp neat and tidy.
- vii) The Contractor(s) shall make necessary arrangements for keeping the camp area sufficiently lighted to avoid accidents to the workers.
- viii) **Sanitation** – The Contractor(s) shall make arrangements for conservancy and sanitation in the labour camps according to the rules of the Local Public Health and Medical Authorities.

#### **CLAUSE 19I**

The Engineer-in-Charge may require the Contractor to dismiss or remove from the site of the work any person or persons in the Contractors' employ the work who may be incompetent or misconduct himself and the Contractor shall forthwith comply with such requirements. In respect of Maintenance / Repair or Renovation Works etc.

where labour have an easy access to the individual houses, the contractor shall issue identity card to the labourers, whether temporary or permanent and he shall be responsible for any untoward action on the part of such labour.

#### **CLAUSE 19J**

It shall be the responsibility of the Contractor to see that the building under construction is not occupied by anybody unauthorized during construction, and is handed over to the Engineer-in-Charge with vacant possession of complete building. If such building though completed is occupied illegally, then the Engineer-in-Charge 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 upto 5% of tendered value of work may be imposed by the Employer whose decision shall be final both with regard to the justification and quantum and be binding on the Contractor.

However, the Engineer-in-charge of B AND R, through a notice, may require the Contractor to remove the illegal occupation any time on or before construction and delivery.

#### **CLAUSE 19K**

##### **Employment of skilled/semi skilled workers**

The contractor shall, at all stages of work, deploy skilled/semi skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute/Industrial Training Institute/National Institute of construction Management and Research (NICMAR)/ National Academy of Construction, CIDC or any similar reputed and recognized Institute managed/ certified by State/Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled/semi skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each trade, its scheduling and the list of qualified tradesmen along with requisite certificate from recognized Institute to Engineer in charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer in- Charge. Failure on the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate specified in **Schedule -F** per such tradesman per day. Decision of Engineer in Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.

Provided always, that the provisions of this clause, shall not be applicable for works with estimated cost put to tender being less than Rs. 5 Crore.

For work costing more than Rs. 10 Crores, and upto Rs. 50 Crores, the Contractor shall arrange on site training as per National Skill Development Corporation (NSDC) Norms for at least 20% of the unskilled workers engaged in the project in co-ordination with the CPWD Regional Training Institute & National Skill Development Corporation (NSDC) for certification at the level of Skilled / Semi Skilled tradesmen.

For work costing more than Rs. 50 Crores, the Contractor shall arrange on site training as per National Skill Development Corporation (NSDC) norms for at least 30% of the unskilled worker engaged in the project in co-ordination with the CPWD Regional Training Institute & National Skill Development Corporation (NSDC) for certification at the level of skilled / semi skilled tradesmen. The cost of such training as stated above shall be borne by the Employer. The necessary space and workers shall be provided by the contractor and no claim whatsoever shall be entertained.

#### **CLAUSE 19L**

##### **Contribution of EPF and ESI**

The ESI and EPF contributions on the part of Contractor on actual basis in respect of this contract shall be paid by the contractor. These contributions on the part of the Contractor paid by the contractor are inclusive of Quoted rates on actual basis. **The applicable and eligible amount of EPF&ESI shall be intimated to EIC within 7 days but not later than 30 days of submission of documentary proof of payment provided same are in order.**

#### **CLAUSE 20**

##### **Minimum Wages Act to be Complied with**

The Contractor shall comply with all the provisions of the Minimum Wages Act, 1948, and Contract Labour (Regulation and Abolition) Act, 1970, amended from time to time and rules framed there under and other labour laws affecting contract labour that may be brought into force from time to time.

#### **CLAUSE 21**

##### **Work not to be sublet. Action in case of insolvency**

The Contractor shall not assigned or sublet without the written approval of the Engineer-in-Charge. And if the Contractor shall assign or sublet this contract, or attempt to do so, or become insolvent or commence any insolvency proceedings or make any composition with his creditors or attempt to do so, or if any bribe, gratuity, gift, loan, perquisite, reward or advantage pecuniary or otherwise, shall either directly or indirectly, be given, promised or offered by the Contractor, or any of his servants or agent to any public officer or employment, or if any such officer or person shall become in any way directly or indirectly interested in the contract, the Engineer-in-Charge on behalf of the Employer shall have power to adopt the course specified in Clause 3 hereof in the interest of Employer and in the event of such course being adopted, the consequences specified in the said Clause 3 shall ensue.

#### **CLAUSE 22**

All sums payable by way of compensation under any of these conditions shall be considered as reasonable compensation to be applied to the use of Employer without reference to the actual loss or damage sustained and whether or not any damage shall have been sustained.

#### **CLAUSE 23**

##### **Changes in firm's Constitution to be intimated**

Where the Contractor is a partnership firm, the previous approval in writing of the Engineer-in-Charge shall be obtained before any change is made in the constitution of the firm. Where the Contractor is an individual or a Hindu undivided family business concern such approval as aforesaid shall likewise be obtained before the Contractor enters into any partnership agreement where under the partnership firm would have the right to carry out the works hereby undertaken by the Contractor. If previous approval as aforesaid is not obtained, the contract shall be deemed to have been assigned in contravention of Clause 21 hereof and the same action may be taken, and the same consequences shall ensue as provided in the said Clause 21.

#### **CLAUSE 24**

##### **Life Cycle Cost**

The Contractor shall have obligation to rectify construction defects minimum upto 5 (Five) years from the date of completion of work. The defects have to be rectified within a reasonable time not exceeding three months after issue of notice by Engineer-in-Charge.

#### **CLAUSE 25**

##### **Settlement of Disputes & Arbitration**

B AND R confidently feel that there shall not arise any disputes or differences during execution and completion of the order / Contract by the Contractor(s).

However, in the event of any dispute arising between the Company and the Contractor (hereinafter referred individually as "the Party" and collectively as "the Parties"), concerning the interpretations of any terms and conditions of the Contract and / or contractual obligations / performance / liabilities / responsibilities of the Parties to the said Contract, the disputing Party shall refer the matter to the other Party for holding a mutual discussion for resolving the dispute. In case the Parties fail to arrive to any settlement through mutual discussion, either of the Parties may avail the following remedies :

##### **Resolution of Dispute through Conciliation :-**

Any party may refer the dispute for Conciliation under Rules of Conciliation and Arbitration under SCOPE Forum of Conciliation and Arbitration (SFCA), 2003 and amendments made thereto from time to time. (hereinafter

referred as “the Rules”) by making application to the Secretariat of the SCOPE Forum.

The Party initiating conciliation shall send to the other party a written invitation to conciliate under the Rules, briefly identifying the subject matter of the dispute.

The settlement so rendered between the Parties in pursuance thereof shall be final and binding on the Parties.

If the other party rejects the invitation, there will be no conciliation proceedings at all.

#### **Resolution of Dispute through Arbitration :-**

In case the dispute is not settled by conciliation within 30 days of the initiation of conciliation or such further period as the parties shall agree in writing, the dispute shall be referred to and finally resolved by Arbitration, in accordance with the Rules of Arbitration of SCOPE Forum of Conciliation and Arbitration, 2003 and amendments made thereto from time to time.

The entire proceedings of Arbitration shall be governed under the Arbitration and Conciliation Act, 1996.

The venue of Arbitration shall be mutually decided by the Parties.

In case the Parties do not agree for resolution of dispute through Conciliation and Arbitration by the above-mentioned SCOPE Forum, the disputing Party shall opt for stipulated rules laid down under the Arbitration and Conciliation Act, 1996.

The Contract and the Parties therein shall be governed under the jurisdiction of Calcutta High Court.

In the event of any dispute or difference relating to the interpretation and application of the provisions of the contracts and commercial agreements (except Income Tax, Customs, Excise duty and also concerning DPCL) between company (B AND R) and any other Public Sector Undertaking/Government Department/Bank/Port Trust etc., such dispute or difference shall be referred by either party for Arbitration to the sole Arbitrator in the Department of Public Enterprises to be nominated by the Secretary of the Government of India in-charge of the Department of Public Enterprises. **The Arbitration and Conciliation Act, 1996 shall not be applicable to arbitration under this clause.** The award of the Arbitrator shall be binding upon the parties to the dispute, provided, however, any party aggrieved by such award may take a further reference for setting aside or revision of the award to the Law Secretary, Department of Legal Affairs, Ministry of Law & Justice, Government of India.

Upon such reference the dispute shall be decided by the Law Secretary or the Special Secretary/ Additional Secretary, when so authorized by the Law Secretary, whose decision shall bind the Parties finally and conclusively. The parties to the dispute will share equally the cost of arbitration as intimated by the Arbitrator.

Subject to any amendment that may be carried out by the Government of India from time to time, the procedure to be followed in the arbitration shall be as mentioned above, which is as per O.M. No. 4(1)/2011-DPE(PMA)GL dated 12.06.2013. of Department of Public Enterprises, Ministry of Heavy Industries and Public Enterprises, Govt. of India or any modification issued in this regard.

#### **JURISDICTION:**

In regard to all disputes or claims arising out of this Contract of whatever nature, only the **High Court at Calcutta** shall alone have the exclusive jurisdiction.

#### **CLAUSE 26**

The Contractor shall fully indemnify and keep indemnified the Employer against any action, claim or proceeding relating to infringement or use of any patent or design or any alleged patent or design rights and shall pay any royalties which may be payable in respect of any article or part thereof included in the contract. In the event of any claims made under or action brought against Employer in respect of any such matters as aforesaid, the Contractor shall be immediately notified thereof and the Contractor shall be at liberty, at his own expense, to settle any dispute or to conduct any litigation that may arise therefrom, provided that the Contractor shall not be liable to indemnify the Employer if the infringement of the patent or design or any alleged patent or design right is the direct result of an order passed by the Engineer-in-Charge in this behalf.

## **CLAUSE 27**

### **Lump sum Provisions in Tender**

When the estimate on which a tender is made includes lump sum in respect of parts of the work, the Contractor shall be entitled to payment in respect of the items of work involved or the part of the work in question at the same rates as are payable under this contract for such items, or if the part of the work in question is not, in the opinion of the Engineer-in-Charge payable of measurement, the Engineer-in-Charge may at his discretion pay the lump sum amount entered in the estimate, and the certificate in writing of the Engineer-in-Charge shall be final and conclusive against the Contractor with regard to any sum or sums payable to him under the provisions of the clause.

## **CLAUSE 28**

### **Action where no Specifications are specified**

In the case of any class of work for which there is no such specifications as referred to in Clause 11, such work shall be carried out in accordance with the Bureau of Indian Standards Specifications. In case there are no such specifications in Bureau of Indian Standards, the work shall be carried out as per manufacturer's specifications, if not available then as per State / District 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 Engineer-in-Charge.

## **CLAUSE 29**

### **With-holding and lien in respect of sums due from Contractor**

- i) Whenever any claim or claims for payment of a sum of money arises out of or under the contract or against the Contractor, the Engineer-in-Charge 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 retention, if any deposited by the Contractor and for the purpose aforesaid, the Engineer-in-Charge or the Employer shall be entitled to withhold the retention money, if any, furnished as the case may be and also have a lien over the same pending finalization or adjudication of any such claim. In the event of the retention being insufficient to cover the claimed amount or amounts or if no retention has been taken from the Contractor, the Engineer-in-Charge 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 Employer or any contracting person through the Employer pending finalization 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 to above by the Engineer-in-Charge or Employer will be kept withheld or retained as such by the Engineer-in-Charge or Employer till the claim arising out of or under the contract is determined by the arbitrator (if the contract is governed by the arbitration clause) by the competent court, as the case may be 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. For the purpose of this clause, where the Contractor is a partnership firm or a limited company, the Engineer-in-Charge or the Employer shall be entitled to withhold and also have a lien to retain towards such claimed amount or amounts in whole or in part from any sum found payable to any partner/ limited company as the case may be, whether in his individual capacity or otherwise.

- ii) Employer shall have the right to cause an audit and technical examination of the works and the final bills of the Contractor including all supporting vouchers, abstract, etc., to be made after payment of the final bill 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 him 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 Employer to recover the same from him in the manner prescribed in sub clause (i) of this clause or in any other manner legally permissible; and if it is found that the Contractor was paid less than what was due to him under the contract in respect of any work executed by him under it, the amount of such under payment shall be duly paid by Employer to the Contractor, with any interest thereon whatsoever.

Provided that the employer shall not be entitled to recover any sum overpaid, nor the Contractor shall be entitled to payment or any sum paid short where such payment has been agreed upon between the Employer on the one hand and the Contractor on the other under any term of the contract permitting payment for work after assessment by the Employer.

#### **CLAUSE 29A**

##### **Lien in respect of claims in other Contracts**

Any sum of money due and payable to the Contractor (including the retention money returnable to him) under the contract may be withheld or retained by way of lien by the Engineer-in-Charge or any other contracting person or persons through Engineer-in-Charge against any claim of the Engineer-in-Charge or such other person or persons in respect of payment of a sum of money arising out of or under any other contract made by the Contractor with Employer or with such other person or persons.

It is an agreed term of the contract that the sum of money so withheld or retained under this clause by the Engineer-in-Charge will be kept withheld or retained as such by the Engineer-in-Charge or till his claim arising out of the same contract or any other contract is either mutually settled or determined by the arbitration clause or by the competent court, as the case may be and that the Contractor shall have no claim for interest or damages whatsoever on this account or on any other ground in respect of any sum of money withheld or retained under this clause and duly notified as such to the Contractor.

#### **CLAUSE 29B**

##### **Employment of coal mining or controlled area labour not permissible**

The Contractor shall not employ coal mining or controlled area labour falling under any category whatsoever on or in connection with the work or recruit labour from area within a radius of 32 km (20 miles) of the controlled area. Subject as above the Contractor shall employ imported labour only i.e., deposit imported labour or labour imported by Contractors from area, from which import is permitted.

Where ceiling price for imported labour has been fixed by State or Regional Labour Committees not more than that Employer price shall be paid to the labour by the Contractor.

The Contractor shall immediately remove any labourer who may be pointed out by the Engineer-in-Charge as being a coal mining or controlled area labourer. Failure to do so shall render the Contractor liable to pay to Employer a sum calculated at the rate of Rs.10/- per day per labourer. The certificate of the Engineer-in-Charge about the number of coal mining or controlled area labourer and the number of days for which they worked shall be final and binding upon all parties to this contract.

It is declared and agreed between the parties that the aforesaid stipulation in this clause is one in which the public are interested within the meaning of the exception in Section 74 of Indian Contract Act, 1872.

##### **Explanation : - Controlled Area means the following areas:**

Districts of Dhanbad, Hazaribagh, Jamtara – a Sub -Division under Santhal Pargana Commissionery, Districts of Bankuara, Birbhum, Burdwan, District of Bilaspur.

Any other area which may be declared a Controlled Area by or with the approval of the Central Government.

#### **CLAUSE 30**

##### **Unfiltered water supply**

The Contractor(s) shall make his/their own arrangements for water required for the work by providing bore wells within the site of work with required discharge capacity to fulfill their requirement of construction water and nothing extra will be paid on this account. This will be subject to the following conditions:

i) That the water used by the Contractor(s) shall be fit for construction purposes to the satisfaction of the Engineer-in-Charge.

#### **CLAUSE 30A**

## **Alternate Water Arrangements**

**Deleted**

### **CLAUSE 31**

#### **Hire of Plant & Machinery**

**The Contractor shall arrange at his own expense all tools, plants, machinery and equipments (herein after referred to as T&P) required for execution of the work.**

### **CLAUSE 32**

#### **Employment of Technical Staff and employees**

Contractors Superintendence, Supervision, Technical Staff & Employees

- i) The Contractor shall immediately after receiving the letter of Intent and before commencement of work provide all necessary superintendence during execution of the work and all along thereafter as may be necessary for proper fulfilling of the obligations under the contract.

The Contractor shall intimate in writing to the Engineer -in-Charge the name(s), qualifications, experience, age, address(s) and other particulars along with certificates, of the principal technical representative to be in charge of the work and other technical representative(s) who will be supervising the work, minimum requirement of such technical representative(s) and their qualifications and experience shall not be lower than specified in **Schedule 'F'**. Even of the Contractor (or Partner(s) in case of firm / company) is himself / herself an Engineer, it is necessary on the part of the Contractor to Employ principal technical representative / technical representative(s) as per the stipulation in **Schedule – F**.

The Engineer-in-Charge shall within 3 days of receipt of such communication intimate in writing his approval or otherwise of such a representative(s) to the Contractor. Any such approval may at any time be withdrawn and in case of such withdrawal, the Contractor shall appoint another such representative(s) according to the provisions of this clause. Decision of the tender accepting authority shall be final and binding on the Contractor in this respect. Such a principal technical representative and other technical representative(s) shall be appointed by the Contractor soon after receipt of the approval from Engineer-in-Charge and shall be available at site before start of work.

All the provisions applicable to the principal technical representative under the Clause will also be applicable to other technical representative(s). The principal technical representative and other technical representative(s) shall be present at the site of work for supervision at all times when any construction activity is in progress and also present himself/ themselves, as required, to the Engineer-in-Charge and/or his designated representative, to take instructions. Instructions given to the principal technical representative or other technical representative(s) shall be deemed to have the same force as if these have been given to the Contractor. The principal technical representative and other technical representative(s) shall be actually available at site fully during all stages of execution of work, during recording/checking/ test checking of measurements of works and whenever so required by the Engineer-in-Charge and shall also note down instructions conveyed by the Engineer-in-Charge or his designated representative(s) in the site order book and shall affix his/their signature in token of noting down the instructions and in token of acceptance of measurements/checked measurement/ test checked measurements. The representative(s) shall not look after other work. Substitutes, duly approved by Engineer-in-Charge of the work in similar manner as aforesaid shall be provided in event of absence of any of the representative(s) by more than two days.

If the Engineer-in-Charge, whose decision in this respect is final and binding on the Contractor, is convinced that no such technical representative(s) is/are effectively appointed or is/are effectively attending or fulfilling the provision of this clause, a recovery (non-refundable) shall be effected from the Contractor as specified in **Schedule 'F'** and the decision of the Engineer-in-Charge as recorded in the site order book and measurement recorded checked/test checked in Measurement Books shall be final and binding on the Contractor. Further if the Contractor fails to appoint suitable technical Principal technical representative and/or other technical representative(s) and if such appointed persons are not effectively present or are absent by more than two days without duly approved substitute or do not discharge their responsibilities satisfactorily, the Engineer-in-Charge shall have full powers to suspend the execution of the work until such date as suitable other technical



representative(s) is/are appointed and the Contractor shall be held responsible for the delay so caused to the work. The Contractor shall submit a certificate of employment of the technical representative(s) along with every one account bill/final bill and shall produce evidence if at any time so required by the Engineer-in-Charge.

- ii) The Contractor shall provide and employ on the site only such technical assistants as are skilled and experienced in their respective fields and such foremen and supervisory staff as are competent to give proper supervision to the work.

The Contractor shall provide and employ skilled, semiskilled and unskilled labour as is necessary for proper and timely execution of the work.

The Engineer-in-Charge shall be at liberty to object to and require the Contractor to remove from the works any person who in his opinion misconducts himself, or is incompetent or negligent in the performance of his duties or whose employment is otherwise considered by the Engineer-in-Charge to be undesirable. Such person shall not be employed again at works site without the written permission of the Engineer-in-Charge and the persons so removed shall be replaced as soon as possible by competent substitutes.

### **CLAUSE 33**

#### **Levy/Taxes payable by Contractor**

- i) **TAXES AND DUTIES:**

The Sub-Contractor should be registered with GST authority, Sub-Contractor shall be exclusively responsible for payment of all Taxes, Royalties etc. (Except Goods and Services Tax) that may be levied from time to time according to the Laws & Regulation now in force & also hereafter to be imposed, increased or modified from time to time. Nothing will be payable extra by the company in respect of any duties/taxes to be imposed on procurement of materials for execution of works contract.

#### **GST-TDS:**

GST-TDS will be deducted by cash at source from Sub-Contractor's Invoice value before GST under GST Law w.e.f. 01.10.2018 as per Govt Notification No.50/2018-Central Tax dated 13.09.2018 for Taxable Services as per Act & Rules framed there under at such rates as may be applicable from time to time.

- ii) **ROYALTY :**

Payment of Royalty will be the responsibility of the Contractor within his quoted price every month the Contractor shall submit Royalty paid challan issued by the Competent Authority for Stone chips and Sand purchased by the Contractor and used in the job. It is mandatory for the Contractor to submit to the Company Royalty Certificate from the Mining Department before release of final bill payment due to him.

- iii) **THIRD PARTY INSURANCE :**

Before commencing the execution of the works the Contractor, but without limiting his obligations and responsibilities under Clause hereof, shall insure against his liability for any material or physical damage, loss or injury which may occur to any property including that of the Employer, or to any person, including that of the Employee of the employer, by or arising out of the execution of the works or in the carrying out of the contract.

#### **Minimum Amount of Third Party Insurance :**

Such insurance shall be effected with an insurer and in terms approved by the Company, which approval shall not be unreasonable with-held, and for atleast the amount stated in the sub para (iv) hereunder. The Contractor shall whenever required, produced to the Engineer-in-Charge the policy or policies of insurance and the receipts of payment of the current premiums.

#### **Provision to Indemnify Employer :**

The terms shall include a provision whereby, in the event of any claim in any respect of which the Contractor would be entitled to receive indemnity under the policy being brought or made against the Company, the insurer will indemnify the Company against such claims and any cost, charges and expenses in respect thereof.

Amount of Such insurance shall be decided by our Engineer-in-Charge, Whose decision in this regard shall be final & binding upon the Contractor.

iv) **INSURANCE :**

Before commencing the execution of work, the Contractor shall , without in any way limiting his obligations and liabilities, insure at his own cost and expense against any damage or loss or injury, which may be caused to any person or property, at site of work. The Contractor shall obtain and submit to the B AND R, proper Contractor's All Risk Insurance Policy (CAR) for an amount 1.25 times the contract amount for this work, with Employer as the first beneficiary. The insurance shall be obtained in joint names of Employer and the Contractor (who shall be second beneficiary). Also, he shall indemnify the Employer from any liability during the execution of the work. Further, he shall obtain and submit to the Employer, a third party Insurance Policy for maximum Rs. 2.50 Lac for each accident, with the Employer as the first beneficiary. The Insurance shall be obtained in joint names of Employer and the Contractor (who shall be second beneficiary). The Contractor shall, from time to time, provide documentary evidence as regards payment of premium for all the Insurance Policies for keeping them valid till the completion of the work. The Contractor shall ensure that similar insurance Policies are also taken by his Sub-Contractors / specialized agencies. The Contractor shall however be responsible, to the Employer, for any claim or loss resulting from the failure of his Sub-contractors / specialized agencies in obtaining such Insurance Policies. Without prejudice to any of its obligations and responsibilities specified above, the Contractor shall within 10 days from the date of letter of acceptance / letter of indent of the tender and thereafter at the end of each quarter submit a report to the Employer giving details of the Insurance Policies alongwith Certificate of these Insurance Policies being valid, along documentary evidences as required by the Employer. No work shall be commenced by the Contractor unless he obtains the Insurance Policies as mentioned above. Also, no payment shall be made to the Contractor on expiry of insurance policies unless renewed by the Contractor. Nothing extra shall be payable on this account. No claim of hindrance ( or any other claim) shall be entertained from the Contractor on these accounts.

v). **OTHER TAXES & LEVIES**

Any other taxes and duties viz. Entry Tax, Octroi, Seignior age, Licenses, Deposits, Royalty, Cess (Labour & Swachh Bharat), Stamp Duty, other charges/levies, etc. prevailing/applicable on the date of opening of technical bids and any variation thereof during the tenure of the contract are in the scope of bidder. In case B AND R is forced to pay any such taxes, B AND R shall have the right to recover the same from the bidder either from running bills or otherwise as deemed fit.

However in case of difference of cost due to variation in the existing taxes & duties, made by the competent / statutory authority in the post order stage, the same shall be forwarded to B AND R's client based on contractor's appeal with documentary evidences such as notifications, payment certificates, challan etc The same shall be jointly pursued with the client (here it is **SMPK Authority**) in good faith and in case of acceptance / payment , made by client on this account, the same shall be passed on to the contractor proportionately. All other conditions shall remain unaltered as specified in the Tender document.

vi). **NEW LEVIES / TAXES**

In case Government imposes any new levy /tax after award of the work during the contractual tenure of the contract, B AND R shall reimburse the same at actual on submission of documentary proof of payment subject to the satisfaction of B AND R that such new levy/tax is applicable to this contract. Other than works contract service, all services are taxable under service tax rules.

vii) **LABOUR CESS**

Payment of Labour Cess is within the scope of the contractor and shall be included in their quoted rates.

#### **CLAUSE 34**

##### **Conditions for reimbursement of levy / taxes if levied after receipt of tenders**

- (i) All tendered rates shall be inclusive of all taxes and levies (except GST) payable under respective statutes. However, if any further tax or levy or cess is imposed by Statute, after the last stipulated date for the receipt of tender including extensions if any and the contractor thereupon necessarily and properly pays such taxes/levies/cess, the contractor shall be reimbursed the amount so paid, provided such payments, if any, is not, in the opinion of the Authority of SMPK (whose decision shall be final and binding on the contractor) attributable to delay in execution of work within the control of the contractor.
- (ii) The contractor shall keep necessary books of accounts and other documents for the purpose of this condition as may be necessary and shall allow inspection of the same by a duly authorized representative of the Government and/or the Engineer-in-Charge and shall also furnish such other information/document as the Engineer-in-Charge may require from time to time.
- (iii) The contractor shall, within a period of 30 days of the imposition of any such further tax or levy or cess, or variation or repeal of such tax or levy or cess give a written notice thereof to the Engineer-in-charge that the same is given pursuant to this condition, together with all necessary information relating thereto.

#### **CLAUSE 35**

##### **Termination of Contract on death of Contractor**

Without prejudice to any of the rights or remedies under this contract if the Contractor dies, B AND R shall have the option of terminating the contract without compensation to the Contractor.

#### **CLAUSE 36**

##### **If relative working in Employer then the Contractor not allowed to tender**

The Contractor shall not be permitted to tender for works in the Employer on circle (responsible for award and execution of contracts) in which his near relative is posted as Divisional Accountant or as an officer in any capacity between the grades of the Executive Engineer and Assistant Engineer (both inclusive). He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to any Officer in the Employer. Any breach of this condition by the Contractor would render him liable to be removed from the approved list of Contractors of this Employer. If however the Contractor is registered in any other Employer, he shall be debarred from tendering in Employer for any breach of this condition.

Note: By the term "Near relatives" is meant wife, husband, parents and grandparents, children and grand children, brothers and sisters, uncles, aunts and cousins and their corresponding in-laws.

#### **CLAUSE 37**

##### **No Gazetted Engineer to work as Contractor within one year of retirement**

No engineer of gazetted rank or other gazetted officer employed in engineering or administrative duties in an engineering Employer of the Government of India shall work as a Contractor or employee of a Contractor for a period of two years after his retirement from Government service without the previous permission of Government of India in writing. This contract is liable to be cancelled if either the Contractor or any of his employees is found at any time to be such a person who had not obtained the permission of Government of India as aforesaid, before submission of the tender or engagement in the Contractor's service, as the case may be.

#### **CLAUSE 38**

##### **Theoretical Conception of Material**

- (i) After completion of the work and also at any intermediate stage in the event of Non reconciliation of materials issued theoretical quantity of materials used in the work shall be calculated on the basis and method given hereunder:-
  - (a) Quantity of cement & bitumen shall be calculated on the basis of quantity of cement & bitumen required for different items of work as shown in the Schedule of Rates mentioned in Schedule 'F'. In case any item is executed for which standard constants for the consumption of cement or bitumen are not available in the above mentioned schedule/statement or cannot be derived from the same

shall be calculated on the basis of standard formula to be laid down by the Engineer-in-Charge.

- (b) Theoretical quantity of steel reinforcement or structural steel sections shall be taken as the quantity required as per design or as authorized by Engineer-in-Charge, including authorized lappages, chairs etc. plus 3% wastage due to cutting into pieces, such theoretical quantity being determined and compared with the actual, each diameter wise, section wise and category wise separately.
- (c) Theoretical quantity of G.I. & C.I. or other pipes, conduits, wires and cables, pig lead and G.I./M.S. sheets shall be taken as quantity actually required and measured plus 5% for wastage due to cutting into pieces (except in the case of G.I./M.S. sheets it shall be 10%), such determination & comparison being made diameter wise & category wise.
- (d) For any other material as per actual requirements.

Over the theoretical quantities of materials so computed a variation shall be allowed as specified in Schedule 'F' For non scheduled items, the decision of the SE/ Superintending Engineer cum PD/ CE/ CPM cum ED regarding theoretical quantities of materials which should have been actually used, shall be final and binding on the contractor.

- (ii) The said action under this clause is without prejudice to the right of the Government to take action against the contractor under any other conditions of contract for not doing the work according to the prescribed specifications.

#### **CLAUSE 39**

##### **Compensation during warlike situations**

The work (whether fully constructed or not) and all materials, machines, tools and plants, scaffolding, temporary buildings and other things connected therewith shall be at the risk of the Contractor until the work has been delivered to the Engineer-in-Charge and a certificate from him to that effect obtained. In the event of the work or any materials properly brought to the site for incorporation in the work being damaged or destroyed in consequence of hostilities or warlike operation, the Contractor shall when ordered (in writing) by the Engineer-in-Charge to remove any debris from the site, collect and properly stack or remove in store all serviceable materials salvaged from the damaged work and shall be paid at the contract rates in accordance with the provision of this agreement for the work of clearing the site of debris, stacking or removal of serviceable material and for reconstruction of all works ordered by the Engineer-in-Charge, such payments being in addition to compensation upto the value of the work originally executed before being damaged or destroyed and not paid for. In case of works damaged or destroyed but not already measured and paid for, the compensation shall be concerned for a higher amount. The Contractor shall be paid for the damages/ destruction suffered and for the restoring the material at the rate based on analysis of rates tendered for in accordance with the provision of the contract. The certificate of the Engineer-in-Charge regarding the quality and quantity of materials and the purpose for which they were collected shall be final and binding on all parties to this contract.

Provided always that no compensation shall be payable for any loss in consequence of hostilities or warlike operations (a) unless the Contractor had taken all such precautions against air raid as are deemed necessary by the Engineer-in-Charge (b) for any material etc. not on the site of the work or for any tools, plant, machinery, scaffolding, temporary building and other things not intended for the work.

#### **CLAUSE 40**

##### **Apprentices Act provisions to be complied with**

The Contractor shall comply with the provisions of the Apprentices Act, 1961 and the rules and orders issued there under from time to time. If he fails to do so, his failure will be a breach of the contract and the Employer may, in his discretion, cancel the contract. The Contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions of the said Act.

#### **CLAUSE 41**

##### **Release of PBG / Retention Money after Defect Liability Period**

PBG / Retention money of the work shall be refunded to the Contractor after completion of Defect Liability Period. Additionally, if required by Engineer-in-Charge of B AND R, the Contractor has to produce a clearance certificate from the Labour Officer for release of retention money completion of work. As soon as the work is virtually complete the Contractor shall apply for the clearance certificate to the Labour Officer under intimation to the Engineer-in-Charge. The Engineer-in-Charge, on receipt of the said communication, shall write to the Labour Officer to intimate if any complaint is pending against the Contractor in respect of the work. If no complaint is pending, on record till expiry of defect liability period / operation & maintenance period and / or no communication is received from the Labour Officer to this effect till expiry of defect liability period, it will be deemed to have received the clearance certificate and the Retention money / PBG will be released after completion of Defect Liability Period.

## B AND R'S SAFETY CODE

1. Suitable scaffolds should be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short period work as can be done safely from ladders. When a ladder is used, an extra mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well suitable footholds and hand-hold shall be provided on the ladder and the ladder shall be given an inclination not steeper than  $\frac{1}{2}$  to 1 (1.4 horizontal and 1 vertical).
2. Scaffolding of staging more than 3.6m (12ft.) above the ground or floor, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached or bolted, braced and otherwise secured at least 90 cm. (3ft.) high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such opening as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.
3. Working platforms, gangways and stairways should be so constructed that they should not sag unduly or unequally, and if the height of the platform or the gangway or the stairway is more than 3.6m (12ft.) above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as described in (2) above.
4. Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of person or materials by providing suitable fencing or railing whose minimum height shall be 90 cm (3ft.).
5. Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9m. (30ft.) in length while the width between side rails in rung ladder shall in no case be less than 29 cm. (11½") for ladder upto and including 3m. (10ft.) in length. For longer ladder, this width should be increased at least  $\frac{1}{4}$ " for each additional 30cm. (1 foot) of length. Uniform step spacing of not more than 30 cm shall be kept. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites or work shall be so stacked or placed as to cause danger or inconvenience to any person or the public. The Contractor shall provide all necessary fencing and lights to protect the public from accident and shall be bound to bear the 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 cost which may be awarded in any such suit, action or proceedings to any such person or which may, with the consent of the Contractor, be paid to compensate any claim by any such person.
6. Excavation and Trenching – All trenches 1.2m. (4ft.) or more in depth, shall at all times be supplied with at least one ladder for each 30m. (100ft.) in length or fraction thereof Ladder shall extend from bottom of the trench to at least 90 cm. (3ft.) above the surface of the ground. The side of the trenches which are 1.5m. (5ft.) or more in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides collapsing. The excavated materials shall not be placed within 1.5m.(5ft.) of the edges of the trench or half of the depth of the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or undercutting shall be done.
7. Demolition – Before any demolition work is commenced and also during the progress of the work,
  - i) All roads and open areas adjacent to the work site shall either be closed or suitably protected.
  - ii) No electric 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.
  - iii) All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render it unsafe.
8. All necessary personal safety equipment as considered adequate by the Engineer-in-Charge should be kept available for the use of the person employed on the site and maintained in a condition suitable for immediate

use, and the Contractor should take adequate steps to ensure proper use of equipment by those concerned :- The following safety equipment shall invariably be provided.

- i) Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles.
- ii) Those engaged in white washing and mixing or stacking of cement bags or any material which is injurious to the eyes, shall be provided with protective goggles.
- iii) Those engaged in welding works shall be provided with welder's protective eye-shields.
- iv) Stone breaker shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.
- v) When workers are employed in sewers and manholes, which are in active use, the Contractors shall ensure that the manhole covers are opened and ventilated at-least for an hour before the workers are allowed to get into the manholes, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to the public. In addition, the Contractor shall ensure that the following safety measure are adhered to:
  - a) Entry for workers into the line shall not be allowed except under supervision of the engineer of B AND R or any other higher officer.
  - b) At least 5 to 6 manholes upstream and downstream should be kept open for at least 2 to 3 hours before any man is allowed to enter into the manhole for working inside.
  - c) Before entry presence of Toxic gases should be tested by inserting wet lead acetate paper which changes colour in the presence of such gases and given indication of their presence.
  - d) Presence of Oxygen should be verified by lowering a detector lamp into the manhole. In case, no Oxygen is found inside the sewer line, workers should be sent only with Oxygen kit.
  - e) Safety belt with rope should be provided to the workers. While working inside the manholes such rope should be handled by two men standing outside to enable him to be pulled out during emergency.
  - f) The area should be barricaded or cordoned of by suitable means to avoid mishaps of any kind. Power warning signs should be displayed for the safety of the public whenever cleaning works are undertaken during night or day.
  - g) No smoking or open flames shall be allowed near the blocked manhole being cleaned.
  - h) The malba obtained on account of cleaning of blocked manholes and sewer lines should be immediately removed to avoid accidents on account of slippery nature of the malba.
  - i) Workers should not be allowed to work inside the manhole continuously. He should be given rest intermittently. The Engineer -in-Charge may decide the time up to which a worker may be allowed to work continuously inside the manhole.
  - j) Gas masks with Oxygen Cylinder should be kept at site for use in emergency.
- K) Air-blowers should be used for flow of fresh air through the manholes. Whenever called for portable air blowers are recommended for ventilating the manholes. The Motors for these shall be vapour proof and of totally enclosed type. Non sparking gas engines also could be used but they should be placed at least 2 metres away from the opening and on the leeward side protected from wind so that they will not be a source of friction on any inflammable gas that might be present.
- L) The workers engaged for cleaning the manholes/sewers should be properly trained before allowing to work in the

manhole.

- m) The workers shall be provided with Gumboots or non sparking shoes bump helmets and gloves non sparking tools safety lights and gas masks and portable air blowers (when necessary). They must be supplied with barrier cream for anointing the limbs before working inside the sewer lines.
  - n) Workmen descending a manhole shall try each ladder stop or rung carefully before putting his full weight on it to guard against insecure fastening due to corrosion of the rung fixed to manhole well.
  - o) If a man has received a physical injury, he should be brought out of the sewer immediately and adequate medical aid should be provided to him.
  - p) The extent to which these precautions are to be taken depend on individual situation but the decision of the Engineer -in-Charge regarding the steps to be taken in this regard is an individual case will be final.
- iv) The Contractor shall not employ men and women below the age of 18 years on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, the following precaution should be taken:
- a) No paint containing lead or lead products shall be used except in the form of paste or readymade paint.
  - b) Suitable face masks should be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint is dry rubbed and scraped.
  - c) Overalls shall be supplied by the Contractors to the workmen and adequate facilities shall be provided to enable the working painters to wash during and on the cessation of work.
9. An additional clause (viii) (i) of Central Public Works Employer Safety Code (iv) the Contractor shall not employ women and men below the age of 18 on the work of painting with product contained lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, the following principles must be observed for such use:
- i) While lead, sulphate of lead or product containing these pigment, shall not be used in painting operation except in the form of pastes or paint ready for use.
  - ii) Measures shall be taken, wherever required in order to prevent danger arising from the application of a paint in the form of spray.
  - iii) Measures shall be taken, wherever practicable, to prevent danger arising out of from dust caused by dry rubbing down and scraping.
  - iv) Adequate facilities shall be provided to enable working painters to wash during and on cessation of work.
  - v) Overall shall be worn by working painters during the whole of working period.
  - vi) Suitable arrangement shall be made to prevent clothing put off during working hours being spoiled by painting materials.
  - vii) Cases of lead poisoning and suspected lead poisoning shall be notified and shall be subsequently verified by medical man appointed by competent authority of Employer.
  - viii) Employer may require, when necessary medical examination of workers.
  - ix) Instructions with regard to special hygienic precautions to be taken in the painting trade shall be distributed to working painters.
10. When the work is done near nay place where there is risk of drowning, all necessaryequipments should be



provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision, should be made for prompt first aid treatment of all injuries likely to be obtained during the course of the work.

11. Use of hoisting machines and tackle including their attachments, anchorage and supports shall conform to the following standards or conditions:
  - i) a) These shall be of good mechanical construction, sound materials and adequate strength and free from patent defects and shall be kept repaired and in good working order.
  - b) Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from patent defects.
  - ii) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years should be in charge of any hoisting machine including any scaffolding which or give signals to operator.
  - iii) In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or as means of suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load. In case of a hoisting machine having a variable safe working load and the condition under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.
  - iv) In case of Employer's machines, the safe working load shall be notified by the Electrical Engineer-in-Charge. As regards Contractor's machines the Contractor shall notify the safe working load of the machine to the Engineer-in-Charge whenever he brings any machinery to site of work and get it verified by the Electrical Engineer concerned.
12. Motors, gearing transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safeguards. Hoisting appliances should be provided with such means as will reduce to the minimum the risk of accidental descent of the load. Adequate precautions should be taken to reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary should be provided. The worker should not wear any rings, watches and carry keys or other materials which are good conductors of electricity.
13. All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near places of work.
14. These safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent place at work spot. The person responsible for compliance of the safety code shall be named therein by the Contractor.
15. To ensure effective enforcement of the rules and regulations relating to safety precautions the arrangements made by the Contractor shall be open to inspection by the Labour Officer or Engineer-in-Charge of the Employer or their representatives.
16. Notwithstanding the above clauses from (1) to (15) there is nothing in these to exempt the Contractor from the operations of any other Act or Rule in force in the Republic of India.

## ***Model Rules for the Protection of Health and Sanitary Arrangements for Workers Employed by B AND R or its Contractors***

### **1. APPLICATION**

These rules shall apply to all buildings and construction works in charge of the Employer in which twenty or more workers are ordinarily employed or are proposed to be employed in any day during the period during which the contract work is in progress.

### **2. DEFINITION**

Work place means a place where twenty or more workers are ordinarily employed in connection with construction work on any day during the period during which the contract work is in progress.

### **3. FIRST-AID FACILITIES**

- i) At every work place there shall be provided and maintained, so as to be easily accessible during working hours, first-aid boxes at the rate of not less than one box for 150 contract labour or part thereof ordinarily employed.
- ii) The first-aid box shall be distinctly marked with a red cross on white back ground and shall contain the following equipment:
  - a) For work places in which the number of contract labour employed does not exceed 50.

Each first-aid box shall contain the following equipments :

1. 6 small sterilized dressings.
  2. 3 medium size sterilized dressings.
  3. 3 large size sterilized dressings.
  4. 3 large sterilized burn dressings.
  5. 1 (30 ml.) bottle containing a two percent alcoholic solution of iodine.
  6. 1 (30ml.) bottle containing salvolatile having the does and mode of administration indicated on the label.
  7. 1 snakebite lancet.
  8. 1 (30 gms.) bottle of potassium permanganate crystals.
  9. 1 pair scissors.
  10. 1 copy of the first-aid leaflet issued by the Director General, Factory Advice Service and Labour Institutes, Government of India.
  11. 1 bottle containing 100 tablets (each of 5 gms.) of aspirin.
  12. Ointment for burns.
  13. A bottle of suitable surgical antiseptic solution.
- b) For work places in which the number of contract labour exceed 50 Each first-aid box shall contain the following equipments:

1. 12 small sterilized dressings.
2. 6 small size sterilized dressings.
3. 6 large size sterilized dressings.
4. 6 large size sterilized burn dressings.
5. 6(15 gms.) packets sterilized cotton wool.
6. 1 (60 ml.) bottle containing a two percent alcoholic solution iodine.
7. 1 (60 ml.) bottle containing salvolatile having the does and mode of administration indicated on the label.
8. 1 roll of adhesive plaster.
9. 1 snake bite lancet.
10. 1 (30 gms.) bottle of potassium permanganate crystals.
11. 1 pair scissors.
12. 1 copy of the first-aid leaflet issued by the Director General Factory Advice Service and Labour Institutes/ Government of India.
13. A bottle containing 100 tablets (each of 5 gms.) of aspirin.
14. Ointment for burns.
15. 12 small sterilized dressings.

A bottle of suitable surgical antiseptic solution.

- iii) Adequate arrangements shall be made for immediate recouplement of the equipment when necessary.
- iv) Nothing except the prescribed contents shall be kept in the First-aid box.
- v) The first-aid box shall be kept in charge of a responsible person who shall always be readily available during the working hours of the work place.
- vi) A person in charge of the First-aid box shall be a person trained in First-aid treatment, in the work places where the number of contract labour employed is 150 or more.
- vii) In work places where the number of contract labour employed is 500 or more and hospital facilities are not available within easy distance from the works. First-aid posts shall be established and run by a trained compounder. The compounder shall be on duty and shall be available at all hours when the workers are at work.
- viii) Where work places are situated in places which are not towns or cities, a suitable motor transport shall be kept readily available to carry injured person or person suddenly taken ill to the nearest hospital.

#### 4. **DRINKING WATER**

- i) In every work place, there shall be provided and maintained at suitable places, easily accessible to labour, a sufficient supply of cold water fit for drinking.
- ii) Where drinking water is obtained from an Intermittent public water supply, each work place shall be provided with storage where such drinking water shall be stored.

- iii) Every water supply or storage shall be at a distance of not less than 50 feet from any latrine drain or other source of pollution. Where water has to be drawn from an existing well which is within such proximity of latrine, drain or any other source of pollution, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with a trap door which shall be dust and waterproof.
- iv) A reliable pump shall be fitted to each covered well, the trap door shall be kept locked and opened only for cleaning or inspection which shall be done at least once a month.

## 5. WASHING FACILITIES

- i) In every work place adequate and suitable facilities for washing shall be provided and maintained for the use of contract labour employed therein.
- ii) Separate and adequate cleaning facilities shall be provided for the use of male and female workers.
- iii) Such facilities shall be conveniently accessible and shall be kept in clean and hygienic condition.

## 6. LATRINES AND URINALS

- i) Latrines shall be provided in every work place on the following scale namely :
  - a) Where female are employed there shall be at least one latrine for every 25 females.
  - b) Where males are employed, there shall be at least one latrine for every 25 males.

Provided that where the number of males or females exceeds 100, it shall be sufficient if there is one latrine for 25 males or females as the case may be upto the first 100, and one for every 50 thereafter.
- ii) Every latrine shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings.
- ii) Construction of latrines : The inside walls shall be constructed of masonry or some suitable heat-resisting nonabsorbent materials and shall be cement washed inside and outside at least once a year, Latrines shall not be of a standard lower than borehole system.
- iv) a) Where workers of both sexes are employed, there shall be displayed outside each block of latrine and urinal, a notice in the language understood by the majority of the workers "For Men only" or "For Women Only" as the case may be.
  - b) The notice shall also bear the figure of a man or of a woman, as the case may be.
- v) There shall be at least one urinal for male workers upto 50 and one for female workers upto fifty employed at a time, provided that where the number of male or female workmen, as the case may be exceeds 500, it shall be sufficient if there is one urinal for every 50 males or females upto the first 500 and one for every 100 or part thereafter.
- vi) a) The latrines and urinals shall be adequately lighted and shall be maintained in a clean and sanitary condition at all times. b) Latrines and urinals other than those connected with a flush sewage system shall comply with the requirements of the Public Health Authorities.
- vii) Water shall be provided by means of tap or otherwise so as to be conveniently accessible in or near the latrines and urinals.
- viii) Disposal of excreta : Unless otherwise arranged for by the local sanitary authority, arrangements for proper disposal of excreta by incineration at the work place shall be made by means of a suitable incinerator. Alternately excreta may be disposed of by putting a layer of night soil at the bottom of a pucca tank prepared for the purpose and covering it with a 15 cm. Layer of waste or refuse and then covering it with a layer of earth for a fortnight (when it will turn to manure).

- ix) The Contractor shall at his own expense, carry out all instructions issued to him by the Engineer-in-Charge to effect proper disposal of night soil and other conservancy work in respect of the Contractor's workmen or employees on the site. The Contractor shall be responsible for payment of any charges which may be levied by Municipal or Cantonment Authority for execution of such on his behalf.

## 7. PROVISION OF SHELTER DURING REST

At every place there shall be provided, free of cost, four suitable sheds, two for meals and the other two for rest separately for the use of men and women labour. The height of each shelter shall not be less than 3 metres (10 ft.) from the floor level to the lowest part of the roof. These shall be kept clean and the space provided shall be on the basis of 0.6 sqm (6 sqft.) per head.

Provided that the Engineer-in-Charge may permit subject to his satisfaction, a portion of the building under construction or other alternative accommodation to be used for the purpose.

## 8. CRECHES

- i) At every work place, at which 20 or more women worker are ordinarily employed, there shall be provided two rooms of reasonable dimensions for the use of their children under the age of six years. One room shall be used as a play room for the children and the other as their bedroom. The rooms shall be constructed with specifications as per clause 19H (ii) a, b & c.
- ii) The rooms shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provision of sweepers to keep the places clean.
- iii) The Contractor shall supply adequate number of toys and games in the play room and sufficient number of cots and beddings in the bed room.
- iv) The Contractor shall provide one ayaa to look after the children in the crèche when the number of women workers does not exceed 50 and two when the number of women workers exceeds 50.
- v) The use of the rooms earmarked as crèches shall be restricted to children, their attendants and mothers of the children.

## 9. CANTEENS

- i) In every work place where the work regarding the employment of contract labouris likely to continue for six months and where in contract labours numbering one hundred or more are ordinarily employed, an adequate canteen shall be provided by the Contractor for the use of such contract labour.
- ii) The canteen shall be maintained by the Contractor in an efficient manner.
- iii) The canteen shall consist of at least a dining hall, kitchen, storeroom, pantry and washing places separately for workers and utensils.
- iv) The canteen shall be sufficiently lighted at all times when any person has access to it.
- v) The floor shall be made of smooth and impervious materials and inside walls shall be lime-washed or colour washed at least once in each year.

Provided that the inside walls of the kitchen shall be line-washed every four months.

- vi) The premises of the canteen shall be maintained in a clean and sanitary condition.
- vii) Waste water shall be carried away in suitable covered drains and shall not be allowed to accumulate so as to cause a nuisance.

- viii) Suitable arrangements shall be made for the collection and disposal of garbage.
- ix) The dining hall shall accommodate at a time 30 percent of the contract labour working at a time.
- x) The floor area of the dining hall, excluding the area occupied by the service counter and any furniture except tables and chairs shall not be less than one square meter (10 sft.) per diner to be accommodated as prescribed in sub-Rule 9.
- xi) a) A portion of the dining hall and service counter shall be partitioned off and reserved for women workers in proportion to their number.
- b) Washing places for women shall be separate and screened to secure privacy.
- xii) Sufficient tables stools, chair or benches shall be available for the number of diners to be accommodated as prescribed in sub-Rule 9.
- xiii) a) 1. There shall be provided and maintained sufficient utensils crockery, furniture and any other equipments necessary for the efficient running of the canteen.
- 2. The furniture utensils and other equipment shall be maintained in a clean and hygienic condition.
- b) 1. Suitable clean clothes for the employees serving in the canteen shall be provided and maintained.
- 2. A service counter, if provided, shall have top of smooth and impervious material.
- 3. Suitable facilities including an adequate supply of hot water shall be provided for the cleaning of utensils and equipments.
- xiv) The food stuffs and other items to be served in the canteen shall be in conformity with the normal habits of the contract labour.
- xv) The charges for food stuffs, beverages and any other items served in the canteen shall be based on 'No profit, No loss' and shall be conspicuously displayed in the canteen.
- xvi) In arriving at the price of foodstuffs, and other article served in the canteen, the following items shall not be taken into consideration as expenditure namely:
  - a) The rent of land and building.
  - b) The depreciation and maintenance charges for the building and equipments provided for the canteen.
  - c) The cost of purchase, repairs and replacement of equipments including furniture, crockery, cutlery and utensils.
  - d) The water charges and other charges incurred for lighting and ventilation.
  - e) The interest and amounts spent on the provision and maintenance of equipments provided for the canteen.
- xvii) The accounts pertaining to the canteen shall be audited once every 12 months by registered accountants and auditors.

10. **ANTI-MALARIAL PRECAUTIONS**

The Contractor shall at his own expense, conform to all anti-malarial instructions given to him by the Engineer-in-Charge including the filling up of any borrow pits which may have been dug by him.

11. The above rules shall be incorporated in the contracts and in notices inviting tenders and shall form an integral part of the contracts.

12. **AMENDMENTS**

B AND R may, from time to time, add to or amend these rules and issue directions – it may consider necessary for the purpose of removing any difficulty which may arise in the administration thereof.

# Employer's Labour Regulations

## 1.0 SHORT TITLE

These regulations may be called the B AND R's Labour Regulations.

## 2.0 DEFINITIONS:

- i) **Workman** means any person employed by the Contractor directly or indirectly through a sub-Contractor with or without the knowledge of B AND R to do any skilled, semiskilled or unskilled manual, supervisory, technical or clerical work for hire or reward, whether the terms of employment are expressed or implied but does not include any person:
  - a) Who is employed mainly in a managerial or administrative capacity: or.
  - b) Who, being employed in a supervisory capacity drawn wages exceeding five hundred rupees per mensem or exercises either by the nature of the duties attached to the office or by reason of powers vested in him, functions mainly of managerial nature : or.
  - c) Who is an out worker, that is to say, person to whom any article or materials are given out by or on behalf of the employer to be made up cleaned, washed, altered, ornamental finished, repaired adopted or otherwise processed for sale for the purpose of the trade or business of the employer and the process is to be carried out either in the home of the out worker or in some other premises, not being premises under the control and management of the employer.

No person below the age of 18 years shall be employed to act as a workman.

- ii) **Fair Wages** means wages whether for time or piece work fixed and notified under the provisions of the Minimum Wages Act from time to time.
- iii) **Contractors** shall include every person who undertakes to produce a given result other than a mere supply of goods or articles of manufacture through contract labour or who supplies contract labour for any work and includes a sub-contractor.
- iv) **Wages** shall have the same meaning as defined in the Payment of Wages Act.

## 3.0 i) Normally working hours of an adult employee should not exceed 9 hours aday.

The working day shall be so arranged that inclusive of interval for rest, if any, it shall not spread over more than 12 hours on any day.

- ii) When an adult worker is made to work for more than 9 hours on any day or formore than 48 hours in any weed, he shall be paid over time for the extra hours put in by him at double the ordinary rate of wages.
- iii) a) Every worker shall be given a weekly holiday normally on a Sunday, in accordance with the provisions of the Minimum Wages (Central) Rules 1960 as amended from time to time irrespective of whether such worker is governed by the Minimum Wages Act or not.
- b) Where the minimum wages prescribed by the Government under the Minimum Wages Act are not inclusive of the Wages for the weekly day of rest, the worker shall be entitled to rest day wages at the rate applicable to the next preceding day, provided he has worked under the same Contractor for a continuous period of not less than 6 days.
- c) Where a Contractor is permitted by the Engineer-in-Charge to allow a worker to work on a normal weekly holiday, he shall grant a substituted holiday to him for the whole day on one of the five days immediately before



or after the normal weekly holiday and pay wages to such worker for the work performed on the normal weekly holiday at overtime rate.

#### 4.0 **DISPLAY OF NOTICE REGARDING WAGES ETC.**

The Contractor shall before he commences his work on contract, display and correctly maintain and continue to display and correctly maintain in a clear and legible condition in conspicuous places on the work, notices in English and in the local Indian languages spoken by the majority of the workers giving the minimum rates of wages fixed under Minimum Wages Act, the actual wages being paid, the hours of work for which such wages are earned, wages periods, dates of payments of wages and other relevant information as per Appendix 'III'.

#### 5.0 **PAYMENT OF WAGES**

- i) The Contractor shall fix wage periods in respect of which wages shall be payable.
- ii) No wage period shall exceed one month.
- iii) The wages of every person employed as contract labour in an establishment or by a Contractor where less than one thousand such persons are employed shall be paid before the expiry of seventh day and in other cases before the expiry of tenth day after the last day of the wage period in respect of which the wages are payable.
- iv) Where the employment of any worker is terminated by or on behalf of the Contractor the wages earned by him shall be paid before the expiry of the second working day from the date on which his employment is terminated.
- v) All payment of wages shall be made on a working day at the work premises and during the working time and on a date notified in advance and in case the work is completed before the expiry of the wage period, final payment shall be made within 48 hours of the last working day.
- vi) Wages due to every worker shall be paid to him direct or to other person authorized by him in this behalf.
- vii) All wages shall be paid in current coin or currency or in both.
- viii) Wages shall be paid without any deductions of any kind except those specified by the Central Government by general or special order in this behalf or permissible under the Payment of Wages Act 1956.
- ix) A notice showing the wages period and the place and time of disbursement of wages shall be displayed at the place of work and a copy sent by the Contractor to the Engineer-in-Charge under acknowledgement.
- x) It shall be the duty of the Contractor to ensure the disbursement of wages in the presence of the Engineer or any other authorized representative of the Engineer-in-Charge of B AND R who will be required to be present at the place and time of disbursement of wages by the Contractor to workmen.
- xi) The Contractor shall obtain from the authorized representative of the Engineer-in-Charge as the case may be a certificate under his signature at the end of the entries in the "Register of Wages" or the "wage-cum-Muster Roll" as the case may be in the following form:

"Certified that the amount shown in column No. \_\_\_\_\_ has been paid to the workman concerned in my presence on \_\_\_\_\_ at \_\_\_\_\_.

#### 6.0 **FINES AND DEDUCTIONS WHICH MAY BE MADE FROM WAGES**

- i) The wages of a worker shall be paid to him without any deduction of any kind except the following:
  - a) Fines
  - b) Deductions for absence from duty i.e. from the place or the places where by the terms of his employment he is required to work. The amount of deduction shall be in proportion to the period for which he was absent.

- c) Deduction for damage to or loss of goods expressly entrusted to the employed person for custody, or for loss of money or any other deduction which he is required to account, where such damage or loss is directly attributable to his neglect or default.
- d) Deduction for recovery of advances or for adjustment of overpayment of wages, advances granted shall be entered in a register.
- e) Any other deduction which the Central Government may from time to time allow.
- ii) No fines should be imposed on any worker save in respect of such acts and omissions on his part as have been approved of by the Chief Labour Commissioner.

**Note :** An approved list of Acts and Omissions for which fines can be imposed is enclosed at Appendix-I.

- iii) No fine shall be imposed on a worker and no deduction for damage or loss shall be made from his wages until the worker has been given an opportunity of showing cause against such fines or deductions.
- iv) The total amount of fine which may be imposed in any one wage period on a worker shall not exceed an amount equal to three paise in a rupee of the total wages, payable to him in respect of that wage period.
- v) No fine imposed on any worker shall be recovered from him by installment, or after the expiry of sixty days from the date on which it was imposed.
- vi) Every fine shall be deemed to have been imposed on the day of the act or omission in respect of which it was imposed.

## 7.0 LABOUR RECORDS

- i) The Contractor shall maintain a **Register of persons employed** on work on contract in Form XIII of the CL (R&A) Central Rules 1971 (Appendix IV).
- ii) The Contractor shall maintain a **Muster Roll** register in respect of all workmen employed by him on the work under Contract in Form XVI of the CL (R&A) Rules 1971 (Appendix V).
- iii) The Contractor shall maintain a **Wage Register** in respect of all workmen employed by him on the work under contract in Form XVII of the CL (R&A) Rules 1971 (Appendix VI).
- iv) **Register of accident** – The Contractor shall maintain a register of accidents in such form as may be convenient at the work place but the same shall include the following particulars:

Full particulars of the labourers who met with accident

Rate of Wages

- a) Sex
- b) Age
- c) Nature of accident and cause of accident
- d) Time and date of accident
- e) Date and time when admitted in Hospital
- f) Date of discharge from the Hospital
- g) Period of treatment and result of treatment

- h) Percentage of loss of earning capacity and disability as assessed by Medical Officer
  - i) Claim required to be paid under Workmen's Compensation Act
  - j)) Date of payment of compensation
  - k) Amount paid with details of the person to whom the same was paid
  - l) Authority by whom the compensation was assessed
  - m) Remarks.
- v) The Contractor shall maintain a **Register of Fines** in the Form XII of the CL (R&A) rules 1971 (Appendix-XI).
- The Contractor shall display in a good condition and in a conspicuous place of work the approved list of acts and omissions for which fines can be imposed (Appendix-X).
- vi) The Contractor shall maintain a **Register of deductions for damage or loss** in Form XX of the CL (F&A) rules 1971 (Appendix-XII).
  - vii) The Contractor shall maintain a **Register of Advances** in Form XXIII of the CL (R&A) Rules 1971 (Appendix-XIII).
  - viii) The Contractor shall maintain a **Register of Overtime** in Form XXIII of the CL (R&A) rules 1971 (Appendix-XIV).

#### 8.0 **ATTENDANCE CARD-CUM-WAGE SLIP**

- i) The Contractor shall issue an **Attendance card-cum-wage slip** to each workman employed by him in the specimen format (Appendix-VII).
- ii) The card shall be valid for each wage period.
- iii) The Contractor shall mark the attendance of each workman on the card twice each day, once at the commencement of the day and again after the rest interval, before he actually starts work.
- iv) The card shall remain in possession of the worker during the wage period under reference.
- v) The Contractor shall complete the wage slip portion on the reverse of the card at least a day prior to the disbursement of wages in respect of the wage period under reference.
- vi) The Contractor shall obtain the signature or thumb impression of the worker on the wage slip at the time of disbursement of wages and retain the card with himself.

#### 9.0 **EMPLOYMENT CARD**

The Contractor shall issue an **Employment Card** in Form XIV of the CL (R&A) Central Rules 1971 to each worker within three days of the employment of the worker (Appendix-VIII).

#### 10.0 **SERVICE CERTIFICATE**

On termination of employment for any reason whatsoever the Contractor shall issue to the workman whose services have been terminated, a Service certificate in Form XV of the CL (R&A) Central Rules 1971 (Appendix-IX).

#### 11.0 **PRESERVATION OF LABOUR RECORDS EMPLOYMENT CARD**

All records required to be maintained under Regulations Nos. 6&7 shall be preserved in original for a period of three years from the date of last entries made in them and shall be made available for inspection by the Engineer-in-Charge or Labour Officer or any other officers authorized by the Ministry of Urban Development in this behalf.

#### 12.0 **POWER OF LABOUR OFFICER TO MAKE INVESTIGATIONS OR ENQUIRY**

The labour Officer or any person authorized by Central Government on their behalf shall have power to make enquires with a view to ascertaining and enforcing due and proper observance of Fair Wage Clauses and the Provisions of these Regulations. He shall investigate into any complaint regarding the default made by the Contractor or Sub-Contractor in regard to such provision.

#### 13.0 **REPORT OF LABOUR OFFICER**

The Labour Officer or other persons authorized as aforesaid shall submit a report of result of his investigation or enquiry to the Engineer-in-charge of B AND R indicating the extent, if any, to which the default has been committed with a note that necessary deductions from the Contractor's bill be made and the wages and other dues be paid to the labourers concerned. In case an appeal is made by the Contractor under Clause 13 of these regulations, actual payment to labourers will be made by the Engineer-in-charge of B AND R after obtaining the approval from competent authority of B AND R on such appeal.

- i) The Engineer-in-charge of B AND R shall arrange payments to the labour concerned within 45 days from the receipt of the report from the Labour Officer or the competent authority of B AND R as the case may be.

#### 14.0 **APPEAL AGAINST THE DECISION OF LABOUR OFFICER**

Any person aggrieved by the decision and recommendations of the Labour Officer or other person so authorized may appeal against such decision to the General Manager of B AND R concerned within 30 days from the date of decision, forwarding simultaneously a copy of this appeal to the Engineer-in-charge of B AND R concerned but subject to such appeal, the decision of the officer shall be final and binding upon the Contractor.

#### 15.0 **PROHIBITION REGARDING REPRESENTATION THROUGH LAWYER**

- i) A workman shall be entitled to be represented in any investigation or enquiry under these regulations by:
  - a) An officer of a registered trade union of which he is a member
  - b) An officer of a federation of trade unions to which the trade union referred to in clause (a) is affiliated.
  - c) Where the employer is not a member of any registered trade union, by an officer of a registered trade union, connected with the industry in which the worker is employed or by any other workman employed in the industry in which the worker is employed.
- ii) An employer shall be entitled to be represented in any investigation or enquiry under these regulations by:
  - a) An officer of an association of employers of which he is a member.
  - b) An officer of a federation of associations of employers to which association referred to in clause (a) is affiliated.
  - c) Where the employers is not a member of any association of employers, by an officer of association of employer connected with the industry in which the employer is engaged or by any other employer, engaged in the industry in which the employer is engaged.
- iii) No party shall be entitled to be represented by a legal practitioner in any investigation or enquiry under these regulations.

16.0 **INSPECTION OF BOOKS AND SLIPS**

The Contractor shall allow inspection of all the prescribed labour records to any of this workers or to his agent at a convenient time and place after due notice is received to the Labour Officer or any other person, authorized by B AND R on his behalf.

17.0 **SUBMISSION OF RETURNS**

The Contractor shall submit periodical returns as may be specified from time to time.

18.0 **AMENDMENTS**

B AND R may from time to time add to or amend the regulations and on any question as to the application/ Interpretation or effect of those regulations the decision of the Engineer-in-charge of B AND R concerned shall be final.

REGISTER OF MATERNITY BENEFITS

Name and address of the Contractor

Name and location of the work

Name of the employee	Father's/ husband's name	Nature of employment	Period of actual employment	Date on which notice of confinement given
1	2	3	4	5

Date on which maternity leave commenced and ended				
Date of Delivery/ Miscarriage	In case of delivery		In case of miscarriage	
	Commenced	Ended	Commenced	Ended
6	7	8	9	10

Leave pay paid to the employee				
In case of delivery		In case of miscarriage		Remarks
Rate of leave pay	Amount paid	Rate of leave pay	Amount paid	
11	12	13	14	15

**SPECIMEN FORM OF THE REGISTER, REGARDING MATERNITY BENEFIT ADMISSIBLE TO  
THE CONTRACTOR'S LABOUR**

**Name and address of the Contractor** :

**Name and location of the work** :

1. Name of the woman and her husband's name
2. Designation
3. Date of appointment
4. Date with months and years in which she is employed
5. Date of discharge/ dismissal, if any
6. Date of production of certificates in respect of pregnancy
7. Date on which the woman informs about the expected delivery
8. Date of delivery/ miscarriage/ death
9. Date of production of certificate in respect of delivery/ miscarriage
10. Date with the amount of maternity/ death benefit paid in advance of expected delivery
11. Date with amount of subsequent payment of maternity benefit
12. Name of the person nominated by the woman to receive the payment of the maternity benefit after her death.
13. If the woman dies, the date of her death, the name of the person to whom maternity benefit amount was paid, the month thereof and the date of payment.
14. Signature of the Contractor authenticating entries in the register.
15. Remarks column for the use of Inspecting Officer.

**Labour Board**

Name and work : \_\_\_\_\_

Address of Contractor

Name and address of Employer : \_\_\_\_\_

Name of Employer's Labour Officer : \_\_\_\_\_

Address of Employer's Labour Officer : \_\_\_\_\_

Name of Labour Enforcement Officer : \_\_\_\_\_

Address of Labour Enforcement Officer : \_\_\_\_\_

Sl. No.	Category	Minimum Wage fixed	Actual Wage paid	Number present	Remarks

Weekly holiday : \_\_\_\_\_

Date of payment of wages : \_\_\_\_\_

Working hours : \_\_\_\_\_

Rest interval : \_\_\_\_\_



## Muster Roll

Name and address of Contractor \_\_\_\_\_

Name and address of establishment under which contract is carried on \_\_\_\_\_

Nature and location of work \_\_\_\_\_

Name and address of Employer \_\_\_\_\_ For the Month of fortnight \_\_\_\_\_

S.No.	Name of Workman	Sex	Father's/ Husband's name	Dates					Remarks
1	2	3	4	5					6
				1	2	3	4	5	

**Register of wages**

Name and address of Contractor \_\_\_\_\_

Name and address of establishment under which contract is carried on \_\_\_\_\_

Nature and location of work \_\_\_\_\_

Name and address of Employer \_\_\_\_\_ Wages Period : Monthly/ Fortnightly

**Amount of wages earned**

Sl. No.	Name of Workman	Serial No. in the register of workman	Designation nature of work done	No. of days worked	Units of work done	Daily rate of wages/ piece rate	Basic wages	Dearness allowances	Overtime	Other cash payments (Indicate nature)	Total	Deductions if any, (indicate nature)	Net amount paid	Signature or thumb impression of the workman	Initial of Contractor or his representative
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Wage Card No. \_\_\_\_\_

## Wage Card

Name and address of Contractor \_\_\_\_\_ Date of Issue \_\_\_\_\_

Name and location of work \_\_\_\_\_ Designation \_\_\_\_\_

Name of workman \_\_\_\_\_ Month / Fortnight \_\_\_\_\_

Rate of Wages \_\_\_\_\_

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31		
<b>Morning</b>																																	Rate
<b>Evening</b>																																	Amount
<b>Initial</b>																																	

Received from \_\_\_\_\_ the sum of Rs. \_\_\_\_\_ on account of my wages

The Wage Card is valid for one month from the date of issue

Signature

## Wages Slip

Name and address of Contractor : \_\_\_\_\_

Name and Father's/ Husband's name of workman: \_\_\_\_\_

Nature and location of work : \_\_\_\_\_

For the Week/ Fortnight/ Month ending : \_\_\_\_\_

1. No. of days worked : \_\_\_\_\_

2. No. of units worked in case of piece rate workers: \_\_\_\_\_

3. Rate of daily wages/ piece rate : \_\_\_\_\_

4. Amount of overtime wages : \_\_\_\_\_

5. Gross wages payable: \_\_\_\_\_

6. Deduction, if any : \_\_\_\_\_

7. Net amount of wages paid : \_\_\_\_\_

**Initials of the Contractor or his representative**

## Employment Card

Name and address of Contractor \_\_\_\_\_

Name and address of establishment in/under which contract is carried on \_\_\_\_\_

Name of work and location of work \_\_\_\_\_

Name and address of Employer \_\_\_\_\_

Name of the workman \_\_\_\_\_

Sl.No. in the register of workman employed \_\_\_\_\_

Name of employment/ designation \_\_\_\_\_

Wage rate (with particulars of unit in case of piece work ) \_\_\_\_\_

Wage period \_\_\_\_\_

Tenure of employment \_\_\_\_\_

Remarks \_\_\_\_\_

**Signature of Contractor**

### Service Certificate

Name and address of Contractor \_\_\_\_\_

Name and location of work \_\_\_\_\_

Name and address of workman \_\_\_\_\_

Age or date of birth \_\_\_\_\_

Identification marks \_\_\_\_\_

Father's/Husband's name \_\_\_\_\_

Name and address of establishment in under which contract is carried on \_\_\_\_\_

Name and address of Employer \_\_\_\_\_

S.No.	Total Period for which employed		Nature of Work Done	Rae of wages (with particulars of unit in case of piece work)	Remarks
	From	To			
1		2	3	4	5

Signature

**LIST OF ACTS AND OMISSIONS FOR WHICH FINES CAN BE IMPOSED**

**In accordance with Labour Regulations of Contractor's of B AND R to be displayed prominently at the site of work both in English and local Language.**

1. Willful insubordination or disobediences, whether along or in combination with other.
2. Theft fraud or dishonesty in connection with the Contractors beside a business or property of CPWD.
3. Taking or giving bribes or any illegal gratifications.
4. Habitual late attendance.
5. Drunkenness lighting, riotous or disorderly or indifferent behavior.
6. Habitual negligence.
7. Smoking near or around the area where combustible or other materials are locked.
8. Habitual indiscipline.
9. Causing damage to work in the progress or to property of the CPWD or of the Contractor.
10. Sleeping on duty.
11. Malingering or slowing down work.
12. Giving of false information regarding name, age father's name, etc.
13. Habitual loss of wage cards supplied by the employers.
14. Unauthorized use of employer's property of manufacturing or making of unauthorized particles at the work place.
15. Bad workmanship in construction and maintenance by skilled workers which is not approved by the Employer and for which the Contractors are compelled to undertake rectifications.
16. Making false complaints and/or misleading statements.
17. Engaging on trade within the premises of the establishments.
18. Any unauthorized divulgence of business affairs of the employees.
19. Collection or canvassing for the collection of any money within the premises of an establishment unless authorized by the employer.
20. Holding meeting inside the premises without previous section of the employers.
21. Threatening or intimidating any workman or employer during the working hours within the premises.

### Register of Fines

Name and address of Contractor \_\_\_\_\_

Name and address of establishment in under which contract is carried on \_\_\_\_\_

Nature and location of work \_\_\_\_\_

Name and address of Employer \_\_\_\_\_

S.No.	Name of Workman	Father's/ Husband's name	Designation/ nature of employment	Act/ Omission for which fine imposed	Date of Offence	Whether workman showed cause against fine	Name of person in whose presence employee's explanation was heard	Wage period and wages payable	Amount of fine imposed	Date of which fine realized	Remarks
1	2	3	4	5	6	7	8	9	10	11	12



## Register of Deduction for Damage or Loss

Name and address of Contractor \_\_\_\_\_

Name and address of establishment in under which contract is carried on \_\_\_\_\_

Nature and location of work \_\_\_\_\_

Name and address of Employer \_\_\_\_\_

S.No.	Name of Workman	Father's/ Husband's name	Designation/ nature of employment	Particulars of damage or loss	Date of damage or loss	Whether workman showed cause against deduction	Name of person in whose presence employee's explanation was heard	Amount of deduction imposed	No. of instalments	Date of recovery		Remarks
										First installment	Last installment	
1	2	3	4	5	6	7	8	9	10	11	12	13

### Register of Advances

Name and address of Contractor \_\_\_\_\_

Name and address of establishment in under which contract is carried on \_\_\_\_\_

Nature and location of work \_\_\_\_\_

Name and address of Employer \_\_\_\_\_

S.No.	Name of Workman	Father's/ Husband's name	Designation/ nature of employment	Wage period and wages payable	Date and amount of advance given	Purpose(s) for which advance made	Number of installments by which advance to be repaid	Date of amount of each installment repaid	Date on which last installment was repaid	Remarks
1	2	3	4	5	6	7	8	9	10	11

### Register of Overtime

Name and address of Contractor \_\_\_\_\_

Name and address of establishment in under which contract is carried on \_\_\_\_\_

Nature and location of work \_\_\_\_\_

Name and address of Employer \_\_\_\_\_

S.No.	Name of Workman	Father's/ Husband's name	Sex	Designation/ nature of employment	Date on which Overtime worked	Total overtime worked or production in case of piece rated	Normal rate of wages	Overtime rate of wages	Overtime earnings	Rate on which overtime wages paid	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

## PROFORMA OF SCHEDULES: A TO F

**SCHEDULE 'A'** : Financial Bid (in Percentage Rate): to be uploaded in CPP Portal for Techno-Commercially Recommended Bidder for ON-LINE Bidding.

### **SCHEDULE 'B'**

Schedule of materials to be issued to the Contractor : NIL

### **SCHEDULE 'C'**

Tools and plants to be hired to the Contractor : NIL

### **SCHEDULE 'D'**

Extra schedule for specific requirements / documents for the work, if any : NIL

### **SCHEDULE 'E'**

Reference to General Conditions of Contract : General Conditions of Contract (GCC) -2020 as amended / modified upto the last date of submission of Bid as well as mentioned in this e-NIT Tender.

**Name of Work:** Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.

Assessed Value of work : **As per Table - 1**

- i) Cost of Tender Document : **As per Table - 1**
- iii) Performance Bank Guarantee : (i) 5% of Contract Amount during execution period  
(ii) 2% of Contract Amount for CMC period
- iv) Security Deposit / Retention money : 5% of Contract Amount
- v) Time of Completion : 10 (Ten) months to be reckoned from the date of issue of Letter of Intent or handing over of the site whichever is later.

- vi) Compensation for delay : **Delay in Commissioning:** 2% of the Contract Price per month of delay, subject to maximum upto 10% of the Contract Price Even if Extension of Time (EoT) is allowed by SMPK or its authorized representative.
- Delay in CMC:** Penalty is at the rate of INR 6.78/- per unit generation loss.
- vii) Defect Liability Period : Defect Liability Period / Warranty period shall be for 1 (One) Year from date of successful completion applicable and issuance of completion certificate. CMC is included in this tender as the item rate includes 05 years Comprehensive Maintenance post 1 year warranty.
- viii) Mobilization Advance : **APPLICABLE**
- ix) Price Escalation : **NOT APPLICABLE**
- x) Secured Advance : **NOT APPLICABLE**
- xi) Scope of Work : **Annexure-D of Tender**

## SCHEDULE – F

### GENERAL RULES & DIRECTIONS:

Officer inviting Tender: General Manager(Commercial), B AND R / Kolkata

#### Definition :

- 2(v) Engineer-in-Charge : Head (SBU-Electrical), Kolkata, B AND R
- 2(viii) Accepting Authority : Chairman cum Managing Director (CMD), B AND R
- 2(x) Percentage on cost of materials and labour to cover all overheads and profits : 15%
- 2(xi) Standard Schedule of Rates :
- Civil work : Delhi Schedule of Rates (Latest Rev.) with amendments up to the date of submission of bid.
- Electrical & Mechanical works : Delhi Schedule of Rate (Latest Rev.) (E&M) with amendments up to the date of submission of bid.
- Horticulture work : Horticulture & Landscaping Schedule (Latest) of Rate with amendments up to the date of submission of bid.
- 2(xii) Employer : **Syama Prasad Mukherjee Port (SMPK)** having their registered office at Kolkakta represented through : **Bridge And Roof Co. (India) Ltd.** (herein before / herein after referred to as B AND R) having their registered Office at Kankaria Centre (4<sup>th</sup>& 5<sup>th</sup> Floor), 2/1 Russel Street, Kolkata-700071.
- 9(ii) Contract Form : Tender document

#### Clause 1

- i) Time allowed for submission of Performance Guarantee from the date of issue of letter of acceptance/letter of intent, in days : 30 days, may be extended upto 90 days subject to submission of request by Contractor stating reason for delay in procuring the Performance Guarantee to the satisfaction of the Engineer-in-Charge.

#### Clause 2

- Authority for levy compensation Under clause 2 : Concerned General Manager of B AND R's Project

#### Clause 2A

- (i) Whether Clause 2A shall be applicable : Not Applicable

#### Clause 5

- (i) Number of days from the date of issue of "Letter of Intent (LOI)" for reckoning date of start : 15 (Fifteen) days from the date of "Letter of Intent (LOI)"
- (ii) Time allowed for execution of Work : 10 (Ten) months to be reckoned from the date of issue of Letter of Intent or handing over of the site whichever is later.

Mile stone(s) as per table given below:

Table of Mile Stone(s)

Sl. No.	Description of Mile Stone	Time allowed for the work (from date of start)
1.	Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.	10 (Ten) months to be reckoned from the date of issue of Letter of Intent or handing over of the site whichever is later.

- **Micro planning (Milestone) shall be made with successful bidder at the time of mobilization / start of the work. These shall be formed part of the Contract after approval of the Accepting Authority (SMPK / B AND R)**
- **Withheld amount (if any) shall be released if and when subsequent milestone is achieved within respective time as mutually agreed in Milestone. However, in case milestones are not achieved by Contractor for the work, the amount mentioned in Milestones (mutually agreed) shall be withheld / kept.**
- **Payment Schedule shall be mentioned in Price Bid. However for payment, Details Billing Break-up Schedule shall be made during the execution of the Contract based on accepted Billing Break-up Schedule duly approved by B AND R / SMPK. Billing Break-up Schedule shall be submitted by Contractor for approval of B AND R / SMPK prior to submission of RA Bill(s) / Final Bill.**

#### Authority to Decide

Authority to give fair and reasonable extension of time : Concerned General Manager of B AND R's Project  
for completion of work

#### Clause 5.2

Nature of Hindrance Register (either Physical or : Physical  
Electronic)

#### Clause 5.4

Schedule of Rate of Recovery for day in submission of : Rs. 10000/- for more than Rs. 5.00 Cr. (Contract  
the modified Programme in terms of delay days : Value)

#### Clause 6

**Clause Applicable : Applicable. Payment Break-up shall be finalized during execution of the Contract as stated above.**

#### Clause 7

Gross work to be done together with net payment / : 10% of Awarded Value  
:adjustment of advances for material collected, if any,  
since the last such payment for being eligible to  
interim payment

#### Clause 7A

Whether Clause 7A shall be applicable	: <b>No Running Account Bill shall be paid for the work till the applicable Labour Licences, Registration with GST, EPFO, ESIC and BOCW Welfare Board, whatever applicable is submitted by Contractor to EIC.</b>
<b>Clause 8A</b>	: In case Contractor fails to submit the Completion Plan as prescribed in Clause 8A, he shall be liable to pay a sum of Rs. 8.00 Lakhs or actual expenses incurred on this account
<b>Clause 10A</b>	
List of testing equipment to be provided by the contractor at Field Testing Laboratory	: <b>As per Form M</b>
<b>Clause 10B(i)</b>	
Secured Advance on Non-perishable Materials	: <b>Not-Applicable</b>
<b>Clause 10B(ii)</b>	
Whether Clause 10B(ii) shall be applicable	: <b>Applicable</b>
<b>Clause 10C</b>	
Component of labour expressed as percentage of value of work	: <b>Not Applicable</b>
<b>Clause 10CA</b>	
Materials covered under this clause	: <b>NOT APPLICABLE</b>
<b>Clause 10CC</b>	: <b>NOT APPLICABLE</b>
<b>Overall Ceiling on Escalation</b>	: <b>NOT APPLICABLE</b>
<b>Clause 11</b>	
Specifications to be followed for execution of work	a) : <b>As enclosed</b>
	b) For E & M Work
	* As Enclosed herewith
<b>Clause 12</b>	: <b>Applicable (Project and Original Work)</b>
<b>Clause 12.1</b>	: <b>Applicable</b>
<b>Clause 12.2</b>	: <b>Applicable</b>
<b>Clause 12.3</b>	Maximum Limit – 30%



<b>Clause 12.4</b>	Foundation – 100%	
<b>Clause 16</b>	Competent Authority for deciding reduced rates	: <b>Concerned General Manager of B AND R</b>
<b>Clause 17</b>	Defects Liability Period shall be 12 (Twelve) months from the date of completion & handing over or possession of Occupancy Certificate from Local Authority, whichever is later.	: <b>Applicable</b>
<b>Clause 18</b>	List of mandatory machinery, tools & plants to be deployed by the contractor at site	: <b>As per Annexure – I</b>
<b>Clause 19C</b>	As per the decision of Competent Authority (B AND R / SMPK).	
<b>Clause 19D &amp; 19K</b>	As per the decision of Engineer-in-Charge subject to approval of Competent Authority (B AND R / SMPK).	
<b>Clause 32</b>	Minimum Requirement of Technical Personnel required to be deployed by Contractor and their Recovery Rates	: <b>As per Annexure - II</b>

**DETAILS OF CONSTRUCTION PLANT & EQUIPMENT  
LIKELY TO BE USED IN CARRYING OUT THE WORK**

I/We hereby certify that the following tools and plants, machineries and vehicles are to be deployed to this Project.

<b>Sl. No.</b>	<b>Name of Equipments</b>	<b>Minimum Nos. to be deployed by the successful Bidder</b>
1.0	Tong tester	<b>As Required</b>
2.0	Ammeter/ Multimeter	<b>As Required</b>
3.0	Meggar	<b>As Required</b>
4.0	Line tester	<b>As Required</b>
5.0	Crimping Tool	<b>As Required</b>
6.0	DG Set of minimum Capacity 160 KVA	<b>As Required</b>
7.0	DG Set 25 KVA	<b>As Required</b>
8.0	Pumps for dewatering including high pressure line	<b>As Required</b>
9.0	Bar Cutting machine	<b>As Required</b>
10.0	Bar Bending Machine	<b>As Required</b>
11.0	Welding Machine (400 / 600 mps)	<b>As Required</b>

**Note:** Any other equipment that may be required to complete the work within the phase/full completion period shall be deployed by the contractor within their quoted rates and prices. Bidder to judge the capacity of equipments (wherever not mentioned) in order to complete the work within the specified completion period.

he bidder is requested to submit ownership proof of the aforesaid equipments. In case of absence of Ownership proof of any particular equipment/equipments valid lease document/agreement substantiating the aforesaid may be furnished prior to deployment of equipment at site / A Declaration in their Letter Head has to be submitted that all the equipments to be deployed for each location(s).

# TECHNICAL PERSONNEL

[Requirement of Principal Technical Representative(s) and recovery Rate]

Table-A

Sl. No.	Minimum Qualification Discipline of Technical Representative	Discipline	Designation (Principal Technical/ Technical representative)	Minimum Experience	Min. Number to be deployed	Rate at which recovery shall be made from the Contractor in the event of not fulfilling minimum number as mentioned	
						Figures	Words
1.	Graduate Engineer	Electrical	Project Manager	15 years	1	80,000/-	Eighty Thousand
2.	Graduate/Diploma Engineer	Electrical	Construction Engineer	8 - 10 years	2	60,000/-	Fifty Thousand

Apart from that one Electrical Engineer of following Qualification dedicated to B and R shall be provided by the Bidder who will directly report to Band R Representative. The salary of the Person shall be paid by the Bidder. In case the bidder shall not provide the same then Band R shall pay the same to the concerned engineer and deduct from RA bill of Bidder. B and R will select and nominate the candidate.

Table-B

Sl. No.	Minimum Qualification Discipline of Technical Representative	Discipline	Designation (Principal Technical/ Technical representative)	Minimum Experience	Min. Number to be deployed	Rate at which recovery shall be made from the Contractor in the event of not fulfilling minimum number as mentioned	
						Figures	Words
1.	Graduate Engineer	Electrical	Project Manager	10 years	1	80,000/-	Eighty Thousand

Bidder(s) has to be submitted CV's of Technical Personnel(s) as per minimum requirement as mentioned above.

Table-C

Sl. No.	Minimum Qualification Discipline of Technical Representative	Discipline	Designation (Principal Technical/ Technical representative)	Minimum Experience	Min. Number to be deployed	Rate at which recovery shall be made from the Contractor in the event of not fulfilling minimum number as mentioned	
						Figures	Words
1.	Graduate/Diploma Engineer	EE/IT/CS/CE/EIE	SCADA Operator	5 years experience in SCADA operation	1	60,000/-	Sixty Thousand
2.	Skilled Labour			5 years experience in maintenance of Solar Plant	As and when required		

The total Technical Manpower mentioned at Table -A & B should be available at work site within one month of issuance of LOI and for Table-C, the manpower should be available at site from the date of commission of solar plant.

# **SPECIAL CONDITIONS OF CONTRACTS (SCC)**

## SPECIAL CONDITIONS OF CONTRACTS (SCC)

These Special Conditions of Contracts shall be read in conjunction with other provisions including General Conditions of the Contract and are supplementary to & complementary with each other. However, in the event of any provision of General Conditions are repugnant to or at variance with any provision of Special Conditions, then unless a different intention appears between the two, the provision given in "Special Conditions" shall be deemed to over-ride that provision of General Conditions and shall to the extent of such repugnancy or variation prevail & govern the contract.

### Definition of Terms :

The various terms appearing in the Tender Document shall have the following meaning unless they are repugnant to the context otherwise.

- a) Company : Bridge And Roof Co.(India) Ltd. having its registered office at "Kankaria Centre", 2/1, Russel Street, (5<sup>th</sup> Floor), Kolkata – 700071, inviting this Tender.
- b) Client : **Shyama Prasad Mukhejee Port, Kolkata** represented by Executing Agency Bridge And Roof Co. (I) Ltd. (hereinbefore / hereinafter referred to as B AND R) having their registered Office at Kankaria Centre,2/1 Russel Street, Kolkata-700071.
- c) Tenderer/Bidder : The firm/party who shall tender quotation to the Company.
- d) Contractor/Sub-Contractor/ Successful Bidder : The Tenderer whose quoted offer will be accepted, either in full or in part, by the Company.
- e) Work(s) : Jobs that are to be executed by the Contractor as awarded to him by the Company.
- f) LOI / Work-Order/Contract : The formal letter / notification issued to the Contractor awarding the work(s) in full or in part by the Company together with the applicable terms & conditions etc. as are finally & mutually agreed to between the Company and the Contractor.
- g) Site/Worksite : The premises where the work will be executed by the Contractor and shall include the lands, buildings, structures etc. erected thereupon.
- h) Engineer-in-Charge : The Officer/Engineer nominated & authorized by the Company for the time being for the purpose of operating the Contract or any work covered there under.
- i) Accepting Authority : Chairman Cum Managing Director / Director (Project Management) of the Company.

### 1.0 a) **Scope of work:**

The work consist of "**Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal**" and includes furnishing all materials, labour, tools and equipment and management necessary for the incidental to the construction and completion of the work. All work, during its progress and upon completion, shall conform to the lines, elevations and grades as shown on the drawings furnished by the Employer. Should any detail essential for efficient completion of the work be omitted from the drawings and specifications it shall be the responsibility of the contractor to inform the Employer and to furnish and install such detail with Employer's concurrence, so that upon completion of the proposed work the same will be acceptable and ready for use.

Responsibility for Supervision and execution of the proposed works by deployment of adequate qualified and experienced Engineers and supporting staff at site of works from the starting of work till completion of the Project to the satisfaction of the owner/ B AND R.

Ensuring that the construction is being carried out in accordance with the approved working design, drawing and specifications.

Ensuring quality control of the work including materials and workmanship, measurement of work executed and progressive payments based on physical realization / completion of work, as per approved CPWD Works Manual (Latest Rev.) procedure and schedule of payments.

Employer may in their absolute discretion issue further drawings and/or written instructions, details, directions and explanations, which are, hereafter collectively referred to as "The Employer's instructions" in regard to:

- i) The variation or modification of the design quality or quantity of works or the addition or omission or substitution of any work.
- ii) Any discrepancy in the drawings or between the schedule of quantities and/or drawings and/or specification.
- iii) The removal from the site of any defective material brought thereon by the contractor and the substitution of any other material thereof.
- iv) The demolition removal and/or re-execution of any work executed by the contractor/s.
- v) The dismissal from the work of any persons employed thereupon.
- vi) The opening up for inspection of any work covered up.
- vii) The rectification and making good of any defects under clauses hereinafter mentioned and those arising during the maintenance period (retention period).

The contractor shall forthwith comply with and duly execute any work comprised in such Employer's instructions, provided always that verbal instructions, directions and explanations given to the contractor's or his representative upon the works by the Employer shall if involving a variation be confirmed in writing to the contractor/s within seven days. No works, for which rates are not specifically mentioned in the priced schedule or quantities, shall be taken up without written permission of the Employer. Rates of items not mentioned in the priced schedule of quantities shall be fixed by the Employer as provided in clause "variation".

The contractor shall set up a field laboratory with necessary equipments for day to day testing of materials like grading of coarse and fine aggregates, silt content and bulkage of sand crushing strength of concrete etc. Such laboratory shall be set up at site during mobilization period so that the field laboratory is available from the date of commencement of work.

Regarding all factory made products for which ISI marked products are available, only products bearing ISI marking shall be used in the work. Other products should be supplied as per the brand name mentioned in the Technical Specifications and Special Conditions of Contract.

- 1.0 b) Unless otherwise provided in the schedule of quantities the rates tendered by the Contractor shall be all-inclusive and shall apply to all heights, levels, depths, leads, lifts etc.
- 2.0 The rates for all items of work, unless clearly specified otherwise, shall include the cost of all labour, materials, and other inputs involved in the execution of the items.
- 3.0 The Architectural, structural and other services drawings for the work shall at all time be properly correlated before executing any work and no claim whatsoever shall be entertained in this respect.
  - i) The Contractor shall submit shop drawings of internal electrical works for Approval of Engineer-in-charge. The Contractor shall also submit bar bending schedule for approval of Engineer-in-charge before Execution.
  - ii) The Contractor, through his engineer, shall ensure quality construction in a planned and time bound manner. Any sub-standard Material /work beyond set out tolerance limits shall be summarily rejected by the Engineer-in-Charge.
- 4.0 The Contractor shall have to make approaches, to the site, if so required and keep them in good condition for transportation of labour and materials as well as inspection of works by the Engineer-in-charge. Nothing extra shall be paid on this account.

- 6.0 The work shall be carried out in such manner so as not to interfere or affect or disturb other works, being executed by other agencies, if any. He shall arrange his work with that of the other in an acceptable and coordinated manner and shall perform it, in proper sequence to the complete satisfaction of the Engineer-in-Charge. In case any damage to any existing road is done by the contractor the same will be brought to him to original position and the cost of such work shall be included in their quoted rates. Barricading of the construction site shall be done by the contractor at their own cost. Any damage done by the Contractor to any existing work shall be made good by him at his own cost. Otherwise the same shall be got done at his risk and cost.
- 7.0 The Contractor shall leave such recesses, holes, openings etc. as may be required for the electrical and other related works. (for which inserts, sleeves, brackets, conduits, base plates, clamps etc. shall be provided by the Contractor without any extra cost to the Employer unless otherwise specifically mentioned) and the Contractor shall fix the same at the time of casting of concrete, stone work and brick works if required, and nothing extra shall be payable on this account unless otherwise mentioned in the item/contract.
- 8.0 The Contractor shall make his own arrangements for obtaining electric connections, if required, and make necessary payments directly to the Employer concerned. The Employer will however make all reasonable recommendations to the authority concerned in this regard.
- Construction Power will be provided by Contractor. No extra shall be made in this account.
- 9.0 The Contractor shall be responsible to arrange at his own cost all necessary tools and plants required for execution of this work. Tools, plant and machinery required shall be brought to the site to maintain the progress as per schedule of work and also as and when required by the Engineer-in-Charge and same shall not be removed without the consent of the Engineer-in-Charge. A list of minimum Plant & Equipment to be mobilized for the work **in Annexure-I** for the guidance of Contractor. Contractor may be required to mobilize any further equipment as per the requirement of work.
- 10.0 No foreign exchange shall be made available by the Employer for the purpose of procurement of equipment, plants, machinery, materials of any kind or any other items required to be carried out in execution of work.
- 11.0 The Contractor or his authorized representative should always be available at the site of work to take instructions from Engineer in charge, and ensure proper execution of work.
- 12.0 No work shall commence in the absence of Contractor's engineers and they shall certify in writing about the correctness of layout alignment of structure and shall ensure stability of all structural such as shuttering, scaffolding and other related items.
- 13.0 All work and materials brought and left upon the ground by the Contractor or by his orders for the purpose of forming part of the works, are to be considered to be the property of the Employer and the same are not to be removed or taken away by the Contractor or any other person without consent in writing of the Engineer-in-charge but the Employer is not to be in any way responsible for any loss or damage which may happen to or in respect of any such work or materials either by the same being lost or damaged by weather or otherwise.
- 15.0 The Contractor shall execute the different items simultaneously, as far as possible, so that minimum breakage and repairs are involved.
- 17.0 The Contractor shall be responsible for the protection of internal electrical fittings and other fittings and fixtures against pilferage's and breakage during the period of installation and thereafter until the building is handed over.
- 18.0 The Contractor shall give a performance test of the entire installation(s) as per standard specifications before the work is finally accepted and nothing extra whatsoever shall be payable to the Contractor for the test. The covering of pipes shall only be done after getting clearance from Engineer-in-Charge in writing.
- 19.0 Contractor may be required to execute the work under foul condition and nothing extra for executing the work in foul condition is payable.
- 20.0 The Contractor shall take all necessary precautions to prevent any nuisance or inconvenience to the Employers, tenants of adjacent properties and to the public in general and to prevent any damage to such properties and any pollution of environment and waterways. Utmost care shall be taken to keep the noise level to the barest minimum

so that no disturbance as far as possible is caused to the occupants/users of adjoining buildings.

Adequate preventive / precautionary measures as per norms to be taken by successful bidder towards their plant & equipment as-well-as workmen and successful bidder shall be solely responsible for any negligence on this account.

Successful bidder to ensure that no unauthorized person should enter the construction site during the entire period of execution. During phase completion/handling over, suitable barricading to be provided to completely separate out construction area from the usable area. Water to be sprinkled on regular interval of working hours to ensure least pollution on account of dust and dirt.

- 21.0 No payment will be made to the Contractor for damage caused by rains, or other natural calamity or other unforeseen reasons during the execution of the works and no such claim on this account will be entertained by Employer.
- 22.0 The empty containers 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.
- 23.0 Existing drains, pipes, cables, overhead wires, sewer lines, water lines and similar services encountered in the course of the execution of the work shall be protected against the damage by the Contractor. The Contractor shall not store materials or otherwise occupy any part of the site in a manner likely to hinder the operation of such services.
- 24.0 Contractor shall give the Engineer-in-charge on the 4<sup>th</sup> day of every month, a progress report of work done in previous month vis-a-vis target and programme for current month of the work. The progress of work shall be reviewed periodically by the Engineer-in charge with the Contractor and shortfalls, if any, sorted out. The Contractor shall thereupon take such action as may be necessary to bring back his work to schedule without additional cost to the Employer.
- 25.0 All materials which are specified to be tested at the manufacturer's works shall satisfactorily pass the tests in presence of the authorized representative of Engineer-in-charge before being used in the work. In case all requisite testing facilities are not available at the manufacturer's premises, such testing shall be conducted at laboratory approved by the Engineer-in-charge at Contractor's cost.
- 26.0 The work shall be executed and measured as per metric dimensions given in the Schedule of Quantities, drawings etc. (FPS units wherever indicated are for guidance only).
- 27.0 The Contractor shall carefully survey the site and identify the trees which are coming within the alignment of the building and also the trees which are required to be cut which may be falling within the space required for forming slopes/ benching, etc. for excavation of the basements and submit these details to the Engineer-in-Charge.
- 28.0 All associated activities required for obtaining necessary clearances, permissions, approvals, all licenses etc. as required from all concerned authorities in respect of Civil, and electrical works after installation and commissioning shall be the responsibility of the Contractor, the cost for which shall be deemed to be included in the rates for various items of work of Schedule of Quantities. However, actual statutory fee paid to the concerned authorities for obtaining approvals, if any, shall be reimbursed by the Employer on production of proof of payment made by the Contractor.
- 29.0 The rate shall be inclusive of working under water and adverse conditions and including pumping out or bailing out water, unless otherwise specified in the nomenclature. This will include water encountered from any source such as rains, floods, sub-soil water table or any cause whatsoever. Sub soil water table shall be maintained at least 50 cm below the P.C.C. level during laying of P.C.C., water proofing treatment, laying of raft and beams including filling of earth/sand under the floor. The water table shall not be allowed to rise above base of raft level until completion of outer retaining walls including waterproofing of vertical surface of walls and back filling along the walls up to formation level and till adequate load is imposed from structure to resist uplift pressure. However, the Contractor should inspect the site and make his own assessment about sub-soil water level likely to be encountered at the time of execution and quote his rates accordingly. Nothing extra on this account whatsoever shall be paid to him. The sequence of construction shall be got approved by the Engineer-in-charge.
- 30.0 Factory made materials shall be procured only from reputed & approved manufacturers or their authorized dealers. List of such approved manufactures is available with the Technical Specification and approved vendor/



Make list . For the items/materials not appearing in the list, the decision of Engineer-in-charge shall be final and binding.

- 31.0 Wherever work is specified to be done or material procured through specialized agencies, their names shall be got approved well in advance from Engineer-in-charge.

Failure to do so shall not justify delay in execution of work. It is suggested that immediately after award of work, Contractor should negotiate with concerned specialized agencies and send their names for approval to Engineer-in-charge. Any material procured without prior approval of Engineer-in-charge in writing is liable to be rejected. Engineer-in-charge reserve his right to get the materials tested in laboratories of his choice before final acceptance. Non- standard material shall not be accepted.

- 32.0 Before start of work, the Contractor keeping in view that space available is limited, shall furnish a construction yard layout, specifying area for construction, positioning of machinery, material yard, cement and other storage, steel fabrication yard, site laboratory, water tank, conveyers belt, etc. and seek formal approval of the Engineer-in-Charge. The Contractor shall not stack building material/ malba on others land or road or on the land owned by any other authority and he shall face penal action as per the rules, regulation and bye-laws of the said body or authority. The Engineer-in-Charge shall be at liberty to recover the amount due but not paid to the concerned authorities on the above account from any amount due to the Contractor including amount of the retention money or retention money in respect of this contract or any other contract.

- 33.0 **FACILITY:-**

**Office set**

Bidder to provide 01 (One) No. furnished Transit Camp/ Accommodation in the nearest locality of Location.

On expiry of completion of project, the Site Office shall be dismantled and site cleared unless the Employer directs otherwise. The furniture & others utilities will be returned to the Contractor at whatever condition they are. For providing the above mention facilities, Nothing extra will be paid to contractor. The above facilities should be provided by contractor upto completion of the project.

- 34.0(i) **WATER & ELECTRICITY :**

Bidder shall make his own arrangement for water and electrical power for construction and other purposes at his own cost and pay requisite electricity and water charges. Bidder shall also make standby arrangement for water and electricity to ensure uninterrupted supply. Necessary assistance for liaisoning with the concerned authority will be provided by B AND R/SMPK for obtaining water / electricity connection.

The contractor will have to make his own arrangement for water and power supply for execution and testing of all works. Electric connection for site office and area lighting may be provided by SMPK Authority at a single point from the nearby substation on chargeable basis. Contractor will make his own arrangements for availing this single point connection. Arrangement of Construction Water is within the scope of Contractor. Point for drinking water may be provided by SMPK Authority.

All incidental **expenditure including Environmental & Pollution Clearance Charges etc. if any** in respect of this contract shall be arranged & paid by the Contractor within their quoted rate and B AND R / SMPK will not entertain any claim whatsoever in respect of the same.

- 34.0(ii) The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, marking, flags, lights and flagman as necessary, at either end of the excavation/embankment and at such intermediate points, as directed by the Engineer-in-charge for the proper identification of construction area. He shall be responsible for all damages and accidents caused due to negligence on his part.

- 35.0 A detailed program in the form of precedence network diagram is to be submitted to the Engineer-in-Charge within 15 days of commencement of work. The program chart should include the following:

a) Descriptive note explaining sequence of various activities.

- b) Network (PERT/CPM).
- c) Program for procurement of materials by the Contractor.
- d) Program of mobilization of machinery/equipment.
- e) Labour deployment schedule.
- f) Cash flow statement.
- g) Handing over of work front to other agencies for taking up their work(s). However, the building shall be handed over progressively by these agencies for taking up finishing work. The Contractor has to plan in such a manner so that building shall be completed in all respects in stipulated time of completion.

The program chart will have to be updated fortnightly and submitted to the Engineer-in-Charge on fortnightly basis.

- 36.0 The submission for approval by the Engineer-in-Charge of detailed programs or the furnishing of such particulars shall not relieve the Contractor of any of his duties or responsibility under the contract. This is without prejudice to the right of the Engineer-in-Charge to take action against Contractor as per terms and condition of the agreement.
- 37.0 In order to adhere to the program, the work may have to be carried out in more than one shift and no claim on this account shall be entertained. Contractor will give advance notice in writing to Engineer-in-Charge for doing any work in odd hour.
- 38.0 Contractor shall be allowed 10 days for mobilization from the date of issue of letter of commencement for the work. During this period Contractor will mobilize plant & equipment including testing and commissioning and complete other preliminaries like construction of site office approval of quarry, mix design, trial mix etc. The mix design and testing of trial mixes shall be done in the laboratory of any IITs or National Test House or any other approved laboratory on payment of requisite fees by the Contractor, for the approval of Engineer-in-Charge:

No concreting shall be done until the mix-design is approved by the Engineer in charge. In case of change of source or characteristic properties of the ingredients used in the concrete mix-design during the work, a revised concrete mix-design conducted in laboratory established at site shall be submitted by the Contractor as per the direction of the Engineer-in-Charge. Nothing extra shall be paid on this account.

- 39.0 The Contractor shall take average 10 photographs per month of 4"X8" of the work as directed by the Engineer-in-Charge and supply two sets each month. Nothing extra shall be payable to the Contractor on this account.
- 40.0 The tenderer shall indicate the name of specialized agency (if not done departmentally) with whom they are likely to associate for internal electrical works and get the approval from Engineer-in-Charge before start of work.
- 41.0 Some restrictions may be imposed by the security staff of relevant ESIC on the working and for movement of labour, materials etc.
- i) The movement of trucks and vehicles shall be regulated in accordance with rules and regulations as approved by competent authority.
  - ii) The Contractor shall be bound to follow all such restrictions/instructions and nothing extra shall be payable on this account.
  - iii) No claim whatsoever will be entertained by the Employer on account of any, restrictions (including temporary suspension of work) imposed by the security agencies in execution of work.

#### 42.0 **INSURANCE**

Before commencing the execution of work, the Contractor shall, without in any way limiting his obligations and liabilities, insure at his own cost and expense against any damage or loss or injury, which may be caused to any person or property, at site of work. The Contractor shall obtain and submit to the B AND R, proper Contractor's All Risk Insurance Policy (CAR) for an amount 1.25 times the contract amount for this work, with Employer as the first beneficiary. The insurance shall be **obtained in joint names of Employer (SMPK) and the Contractor (who shall be second beneficiary)**. Also, he shall indemnify the Employer from any liability during the execution of the work. Further, he shall obtain and submit to the Employer, a third party insurance policy for maximum Rs.2.50

lakh for each accident, with the Employer as the first beneficiary. The insurance shall be obtained in joint names of Employer and the Contractor (who shall be second beneficiary). The Contractor shall, from time to time, provide documentary evidence as regards payment of premium for all the Insurance Policies for keeping them valid till the completion of the work. The Contractor shall ensure that similar Insurance Policies are also taken by his Sub-Contractors/ specialized agencies. The Contractor shall however be responsible, to the Employer, for any claim or loss resulting from the failure of his Sub -Contractors/ specialized agencies in obtaining such Insurance Policies. Without prejudice to any of its obligations and responsibilities specified above, the Contractor shall within 10 days from the date of letter of acceptance of the tender and thereafter at the end of each quarter submit a report to the Employer giving details of the Insurance Policies along with Certificate of these insurance policies being valid, along with documentary evidences as required by the Employer. No work shall be commenced by the Contractor unless he obtains the Insurance Policies as mentioned above. Also, no payment shall be made to the Contractor on expiry of insurance policies unless renewed by the Contractor. Nothing extra shall be payable on this account. No claim of hindrance (or any other claim) shall be entertained from the Contractor on these accounts).

43 **Mobilization Advance:**

**NOT APPLICABLE**

44 **Secured Advance**

**NOT APPLICABLE**

The contractor shall construct suitable go-down at the site of Work for safe storing the materials against any possible damages due to sun, rain, dampness, fire, theft etc. at his own cost as per instruction of Engineer-in-Charge. Contractor shall also employ necessary watch & ward establishment for the purpose at his costs and risks.

Contractor shall raise periodic R/A Bills .Payment of such R/A bills are to be released within 30 (Thirty) days from the date of receipt of the bills by **B AND R**.

Payments due to the Contractor shall be released in the form of RTGS/NEFT in favour of the Contractor payable at Kolkata. Bank charges, if any, to be on Contractor's account and the Contractor shall submit the following details to the company.

- i) Name of the company.
- ii) Name of Bank.
- iii) Name of Bank Branch.
- iv) City.
- v) Account Number.
- vi) Account Type.
- vii) IFSC Code of the Bank Branch.
- viii) MICR Code of the Bank Branch.
- a) Income Tax will be deducted from the Contractor's all bills by cash at source as per latest Income Tax Act and Rules framed there under.

50.0 The Contractor shall mobilize within 15 days from the date of issue of Letter of Intent / Instruction by Engineering-in-charge and strictly and scrupulously adhere to the Schedule/Programme of the works and shall earnestly and diligently endeavour to complete the works under the scope of this contract in all respect within **10 (Ten) months** from the date of our instruction to start the work.

In case the work could not be completed within the above schedule date due to reasons attributable to the Contractor, the Contractor shall pay to the Company as compensation for delay an amount equal to 1.0% (One percent) per month of delay to be computed on per day basis subject to a maximum of 10% (Ten percent) of Tender Value of work or of the Tender Value of the Sectional Part of work as mentioned in Schedule - F.

- 51.0 The Company shall have the right to take possession of or use of any completed or partially completed work or part of the works. Such possession or use shall not be deemed to be an acceptance of any work completed in accordance with the Contract.
- 52.0 The rates/price quoted by the Contractor shall remain firm and shall not attract any escalation due to labour wages and/or materials price in pursuant to this contract.
- 53.0 The Contractor shall follow and adhere to safe construction practice and guard against hazardous and unsafe working conditions and shall, within the quoted rates, comply with the Owner's safety rules, Code and Practice etc. as prevalent at site, of work. All safety device instrument and accessories etc. and precautionary measures shall be arranged and provided by the Contractor at his own cost.
- 54.0 Completion Certificate will be issued to the Contractor within a reasonable time from the date of overall completion of works, in all respect after the same would be passed and approved by the Owner. No certificate shall be given nor shall the works be deemed to have been executed until all scaffoldings, surplus materials and rubbish are cleaned off the site completely, not until the work shall have been measured by the Engineers.
- 55.0 The Contractor shall guarantee the works done by him for **a period of 12 (Twelve) months** from the date of handing over of completed work to SMPK Authority. Any damage or defects that may arise during the same Guarantee Period (Defect Liability Period) or be remained undiscovered at the time of issue of completion certificate ate and are attributable to the contractor's reasons connected anyway with the materials supplied by the Contractor or in the workmanship shall be rectified or replaced by the Contractor at his own cost and risks within and specified time to be notified by the Engineer-in-Charge.
- 56.0 **Make of Materials:**  
The materials required to be supplied by the Contractor under this contract shall be procured only from CPWD/ Owner/Consultant approved vendors. Where the make of materials are not indicated in the tender document, Contractor shall furnish the details of makes and shall obtain prior approval of Vendors/Sub-vendors from Engineer-in-Charge before placing order.
- 56.1 Empanelled Vendor for Solar Power Plant Component :  
As per Approved Vendor list Enclosed
- 56.2 Approved Third Party Inspection agency(TPI) :  
a) M/s. IR Class Systems and Solutions Pvt. Ltd.  
b) M/s. Baxcounsel Inspection Bureau Pvt. Ltd.  
c) M/s. Bureau Veritas (BV)  
d) M/s. Certification Engineers International Limited (CEIL)  
e) M/s. Det Norske Veritas (DNV)  
f) M/s. Lloyd's Register of Shipping  
g) M/s. SGS India Pvt. Ltd.  
h) M/s. Tata Projects Limited  
i) M/s. TUV India Pvt. Ltd.  
j) M/s. TUV South Asia Pvt. Ltd.
- The Third Party inspection shall be carried out by one of the TPIA mentioned above. The charges what so ever for carrying out TPI shall be fully borne by the Bidder .
- 57.0 Notwithstanding anything contained in the Contract it should be clearly noted that no extra claim lodged/to be lodged by the Contractor shall be entertained by the Company in pursuant to this Contract. Nevertheless, if the contractor insists and raises any extra claim bills, the Company shall pursue with the Owner in good faith, settlement of rates for Extra Item and Claims, if raised by the Contractor on the Company and the decision taken by the Owner and the Company shall be binding upon and acceptable to the Contractor corresponding to and relevant with his part of the work. It should also be clearly understood that the pursuing of the Contractor's claim on the Company in good faith with the Owner shall not mean under any circumstances, Company's acceptance of the rates of extra items and claims raised by the Contractor on the Company and at no point of time, Contractor's plea that irrespective of the decision taken by the Owner, the rates of extra items and claims

shall have to be paid to the Contractor based on his claim stating that the Contract is between the Company and the Contractor having no relationship with the Owner, shall contractually hold good because the Company have pursued Contractor's bills with the client in good faith only without going through the merit of the same.

For extra items rates are to be desired from analysis of costs an inputs and direct market rate documents are to be provided by the contractor. The rates finally accepted by client / owner shall be binding on the contracting but B AND R shall retain 50% (fifty percent) of the component of over head and profit finally settled with client/owner & remaining part shall be passed on to the contractor for his portion of works.

58.0 Contractor shall arrange for Site Office, store, material storage yard, fabrication yard etc. and for labour hutments including land / area at their own cost and such cost should be included in their quoted rates. However the same may be provided to the Contractor, if available on chargeable basis (if required) by SMPK Authority at a nearby location.

58.1 Acceptance of Materials: B&R will accept all materials from successful tenderer on behalf of SMPK and on consultation of SMPK.

59.0 **PAYMENT SCHEDULE:**

#### **For Solar PV Work / Electrical Work**

##### **A.1. Supply of material:( Total Supply Value)**

- i) Progressively upon receipt and acceptance of required material at site:70% of supply value.
- ii) Progressively upon installation at site:20% of supply value.
- iii) On Completion of Commissioning and final acceptance of Client : 10%of supply value.

##### **A.2. Installation:(Total Installation Value)**

- i. On Transportation and Installation in Position: 30% of installation value.
- ii. After Initial Alignment:30% of installation value.
- iii. After final alignment and making ready for commissioning: 30% of installation value.
- iv. After completion of all works in all respect and acceptance by Engineer In Charge :10% of installation value.

##### **B. Civil Work**

- i. 10% after completion of Foundation and Plinth work.
- ii. 25 % after completion of RCC Frame Structure
- iii. 20 % after completion of Brick masonry work including plastering.
- iv. 20 % payment after fencing work including water treatment work.
- v. 20 % payment after completion of other work including supply of furniture/ Electrical / false flooring/False ceiling/ Sanitary work where ever applicable.
- vi. 5% payment after final completion and commissioning of total work.

Order for Sl. No. A.1., A.2. &B shall be placed to successful agency by B AND R.

**C. Comprehensive Maintenance Contract Payment:** Payment shall be made in 20 half yearly towards Comprehensive Maintenance Contract value against submitted invoice on (a) Routine Maintenance report certified by representatives of SMPK. Payment shall be made by SMPK Authority to Agency. In this regard, a tripartite agreement shall be drawn between the Solar Contractor, SMPK Authority and B AND R.

The Contractor shall become entitled to payment only after B AND R has received the corresponding payment(s) / funds from the client/Owner (SMPK Authority) for the work done by the Contractor. The Contractor should submit monthly R/A Bill substantiating all the all requisite documents within 1<sup>st</sup> week of every month for the work done during the last month. This bill will be checked and certified by B AND R and subsequent certification by TPQA (Third Party Quality Assurance) and accordingly send this certified bill alongwith the proportionate bill of Agency Charges of B AND R to Client (SMPK) on immediate basis. The Client will transfer the fund for the monthly R/A bill of the Contractor alongwith proportionate Agency Fee of B AND R after necessary checking, review and compliances/ clarifications (if required) from bidder. **All the payments of R/A bills to Contractor are subject to the approval of Client and availability of requisite fund from them. Please note that**

**minimum value of any R/A bill should not be less than 10% of the awarded value.** After completion of work and handing over the project to the Client, the final bill of the Contractor alongwith all requisite documents will be submitted to the B AND R and after necessary checking, review and finalization this certified bill will be furnished to the Client and subsequently the Client will arrange the fund for transferring to the Bank account of the B AND R within next 60 days. **The payment of Final Bill to Contractor is subject to the approval of Client and availability of requisite fund from them.**

Contractor shall raise monthly R/A Bills substantiating all the requisite documents within 1st week of every month for the work done during the last month. This bill shall be checked and certified by B AND R. After necessary checking, review and finalization, this certified bill shall be furnished to SMPK Authority and the Payment will be released within **60 days from the date of certified bill by B AND R, subject to availability of fund from Owner i.e. SMPK Authority.**

## 60.0 TAXES AND DUTIES

The contractor shall be exclusively responsible for payment of all Taxes & duties (Except Goods and Services Tax) that may be levied from time to time according to the Laws & Regulation now in force & also hereafter to be imposed, increased or modified from time to time. Nothing will be payable extra by the company in respect of any duties/Taxes to be imposed on procurement of materials for execution of works contract.

### **GOODS AND SERVICES TAX (GST):**

Without prejudice to stipulation in General Conditions of Contract, the quoted price shall be exclusive of Goods and Services Tax. The GST as legally leviable & payable by the bidder under the provisions of applicable law/act shall be paid extra by B AND R as per Bidder's GST Tax Invoice. Bidder shall quote their rates after considering the input tax credit on their input materials and services.

In this works, as transfer of property of goods is involved in connection with immovable property, GST under supply of services is applicable. The bidder shall get registered with the GST authorities and the registration certificate shall be submitted along the bid documents (techno commercial). Bid without GST number shall be cancelled.

The GST (i.e. SGST, CGST or IGST) amount shall be shown separately in invoice and also submit proper Tax Invoice as per section 31 of CGST Act, and Rule 46 of CGST Rules, 2017 to get Input Tax Credit by B AND R. Declaration as per format given in Annexure-I to be submitted alongwith bid Documents.

Bidder shall raise their tax invoice in regular interval as per contract condition and uploaded their supply invoice in GSTN Portal through GSTR-1 return within 11<sup>th</sup> and GSTR-3B within 20<sup>th</sup> of next month & Mismatch in return of B AND R due to any reason attributable to bidder, the same shall be recovered from Bidder's bill.

In case, B AND R's Input Tax Credit (ITC) is rejected on account of wrong levy of tax i.e. payment of Integrated Tax in place of Central Tax+ State/Union Territory Tax or vice versa, the contractor is liable to make good the loss suffered by B AND R by issuance of suitable credit note to B AND R. In case, contractor does not issue credit note to B AND R, B AND R would be constrained to recover the amount including interest payable along with Statutory levy, if any, payable on such recovery.

B AND R shall reimburse GST levied as per invoice issued by the Contractor as prescribed under section 46 of the CGST Rules 2017 and respective states Act and Rules.

To enable B AND R to avail ITC, the contractor/supplier shall furnish/submit any and all certificates, documents and declarations as are required by B AND R to avail of the ITC with respect to GST reimbursed by B AND R on supply of Goods/services to B AND R.

The HSN/SAC Code under which the goods/service will fall should be clearly mentioned along with the Rate at the time of submission of invoice for releasing payment.

In case, B AND R is not able to take Input Tax Credit due to any noncompliance/default/negligence of the seller, the same shall be recovered from the pending bills/dues (including any security available with B AND R).

Supplier shall be responsible to indemnify B AND R for any loss, direct or implied, accrued to B AND R on account of supplier's failure to discharge his statutory liabilities like paying taxes on time, filling appropriate returns within the prescribed time etc.

Any benefit by way of reduction in rate of tax or increase in input tax credit arising due to introduction of GST shall be passed on to B AND R through reduction in supply value by way of commensurate reduction in Bill value. The Contractor shall ensure that all the required documents as per the GST regulations are furnished to B AND R with their invoices failing which B AND R shall not make any reimbursement of such GST."

Note:

Goods & Services Tax (GST) as applicable shall be payable extra. The vendor will have to raise invoice for the applicable GST amount as per approved format for claiming the GST paid. Payment of GST is subject to reflection of the party's invoice in GSTR 2A /anx-2 (GST new return) of B AND R.

**All Suppliers / Contractors should comply the GST regulation as per Rule.**

**GST-TDS @ 2% (Two Percent) will be deducted from basic Invoice Value (i.e. value before GST) under GST Law w.e.f. 01.10.2018 as per Govt. Notification No. 50/2018 – Central Tax dated 13.09.2018 for Taxable Services. TDS @ 1% each for CGST & SGST or 2% for IGST will be applicable except the exemption provision as stipulated in GST Law. Tax deducted at source will be deposited to the Govt. and TDS Certificate will be issued to Contractor as per the rules.**

61.0 **Labour Cess**

Payment of labour cess is within the scope of the contractor and shall be included in their quoted rates.

62.0 **Other Taxes & Levies**

Any other taxes and duties viz. Entry Tax, Octroi, Seignorage, Licenses, Deposits, Royalty, Stamp Duty, other charges/levies, etc. prevailing/applicable on the date of opening of technical bids and any variation thereof during the tenure of the contract are in the scope of Contractor. In case B AND R is forced to pay any such taxes, B AND R shall have the right to recover the same from the bidder either from running bills or otherwise as deemed fit.

63.0 **New Levies/Taxes**

In case Government imposes any new levy /tax after award of the work during the Contractual tenure of the contract, B AND R shall reimburse the same at actuals on submission of documentary proof of payment subject to the satisfaction of B AND R that such new levy/tax is applicable to this contract.

64.0 **SCAFFOLDING**

Double steel scaffolding having two sets of vertical supports shall be provided for external wall finish, cladding etc. Cup lock Form work system shall only be used for internal support system. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding platform shall be fixed and proper approach/ walkways shall be provided for necessary checking of work.

Special attention has been given to the ease of construction, carrying out parallel activities and the overall OI arrangement for the ease of its maintenance.

65.0 Contractor shall arrange for drinking water for his office and labour hutment at their own cost and such cost should be included in their quoted rates.

66.0 **METHODOLOGY OF EXECUTION**

- a. The work shall be executed as per CPWD / Enclosed specification / Relevant IEEE / BIS specifications and all mandatory tests on materials etc. shall be carried out as per accepted procedure. Proper records of the test result shall be maintained. While executing the construction works, the general conditions of contract for CPWD works will be taken as guidelines.
- b. During the execution of work, work if B AND R/SMPK/Third Party found any defect/variation during inspection, the contractor will have to rectify the same at their own cost, at no extra cost.
- c. The contractor will submit PERT/CPM chart in line with stipulated time frame agreed by B AND R
- d. The contractor has to provide the necessary guarantees relating to workmanship, quality assurance and timely completion of work.

**Construction methodology/Form work system:** The work shall be executed based on any one Construction

methodology and it shall be submitted before start of work

67.0 **COST CONTROL**

In case of variation of any item contractor has to obtain the approval for variation from B AND R/SMPK. The cost of the project may be set off against the cost of recoverable items after obtaining the approval of Competent Authority on the demolition of the existing structure.

68.0 **RECORDS**

- a. **CPM and Bar Charts:** Preparation of CPM and Bar Charts, monitoring and modifications as approved by the B AND R/SMPK shall be made by contractor. This should be given to the B AND R prior to commencement of work and thereafter it shall be updated/ rescheduled, if required, every month.
- b. All site documents as applicable during execution of the work shall be maintained by contractor and will be kept updated at all times. The B AND R/SMPK, authorized representative will have the right to peruse them and raise observations, if any, stage passing and **material testing will be paid special attention.**

The Contractor shall maintain strict secrecy and confidentiality and shall not divulge any information relating to assignment to any third party.

69.0 **INSPECTION OF WORK BY CHIEF TECHNICAL EXAMINER CELL, CVC.**

The contractor shall be responsible for the consequential effects arising out of the inspection of the project by the Chief Technical Examiner Cell, Central Vigilance Commission during the progress or any time after the construction of project and shall take appropriate action for rectification of defective work at his own the risk and cost . Rectification of defective work / replacement of sub standard as pointed out by Chief Technical Cell, Central Vigilance Commission/SMPK/B AND R or his authorized representative shall be carried out by contractor at their own cost. *B AND R/SMPK authority shall not pay any extra amount for such type of liabilities.* The contractor shall be responsible for the consequential effects arising out of the inspection of the project by the Chief Technical Examiner Cell, Central Vigilance Commission during the progress or any time after the construction of project and shall take appropriate action for rectification of defective work at his own the risk and cost . Rectification of defective work / replacement of sub standard as pointed out by Chief Technical Cell, Central Vigilance Commission /SMPK/B AND R or his authorized representative shall be carried out by contractor at their own cost. *B AND R/SMPK authority shall not pay any extra amount for such type of liabilities.*

70.0 **Defect Liability Period (DLP):-**

This period shall be **one year (12 months)** from the date of completion & handing over or possession of Occupancy Certificate from Local Authority, whichever is later. During this period **the** contractor shall get the defects rectified without any cost to B AND R/SMPK. For the item Solar Power Plant the contractor shall give O& M Of for 10(Ten) years. Similarly for other items like electrical/mechanical equipments which have guarantee/warranty period beyond one year wherever applicable as per manufacturer recommendations shall also be given by the contractor.

**Possession of Occupancy Certificate by Owner from Local Authority: Bidder will be responsible for possession of Occupancy Certificate by Owner from Local Authority and regarding this.**

72. Escalation/ Price variation clause is not applicable for this Tender.
73. Secured Advance clause is not applicable for this Tender.
74. Any Item of work to be executed, if not covered in the BOQ will be treated as Extra Item of work. The analysis of Extra Item of work will be on the basis of analysis based on market rates (Analysis preferably as per the guidelines of DAR 2019) to be done and accordingly approval of the same to be obtained from B AND R Engineer in Charge/ SMPK Authority.
75. Until and unless specifically noted in the item descriptions, otherwise all the basic materials and components should strictly conform to the approved vendor/make list. But, approval must be obtained by bidder from Engineer-in Charge for any material prior to procurement and incorporation to the work. In this regard the decision of EIC is final.



76. Any payment (R/A bill, Final bill or any other payment) will be paid to the Contractor after the due process of checking, modification & rectification as required, submission of all requisite documents by Contractor and subject to the availability of payment / fund against the same from SMPK Authority.
77. If any materials or components are not covered or deviated from the approved vendor/make list, prior approval/sanction from Engineer in Charge must be obtained by the contractor before procurement and incorporation to the work. All the material shall be procured from
78. Procurement schedule of E&M equipments & machineries must be submitted by the bidder within one month of the commencement of the work and accordingly approval of this Procurement Schedule must be obtained by the bidder from Engineer in Charge, B AND R.
79. Manufacturers Test Certificate of all the basic materials/components must be furnished to the PMC/Client wherever required.
80. Field Test/Laboratory Test must be carried out wherever required as per IS provisions and CPWD specifications.
10. Concrete Pour Cards must be filled up by the Contractor in approved format regularly prior to 24(twenty four) hours in advance for necessary checking and sanction by PMC/Client.
81. In case no separate specification (in BOQ item description or otherwise) is provided the work shall be carried out as per specifications enclosed with latest amendments and as per BIS standards. In case of any discrepancy in the specifications/ code, or if the specifications of any of the items are not available, the decision of the Engineer-in-Charge or his authorized representative shall be final and binding and work shall be executed in the manner as may be prescribed by him without allowing any extra cost payable to the Contractor.
82. The technical specifications shall be read in conjunction with the various other documents forming the contract, namely Invitation for Bids & Instructions to Tenderers, General Conditions of Contract, Special Conditions of Contract, nomenclature of items and other related documents, together with any corrigendum/addendum issued thereto.
84. All material and execution of works shall be subjected to an approved quality assurance plan. The contractor has to submit a quality manual/quality assurance plan within 15 (fifteen) days of issuance of LOI and this quality assurance plan shall be approved by the Engineer-in Charge. In this QAP the details of testing, checking, quality monitoring & ensuring systems with frequency of testing and the stages for inspection by the Engineer-in-charge (B AND R) or his representative shall be mentioned elaborately. Notwithstanding any previous approvals the engineer-in-charge shall reserve the right for surprise/ unannounced inspections as well as additions/ alterations to the QAP of the pending works/ supplies of material giving reasonable notice to the contractor.  
  
A Third Party Quality Assurance (TPQA) Team ( One of the Bidders as mentioned in TPIA list mentioned else where in NIT document ) will visit the site on regular basis and will monitor all the quality related aspects and necessary documentations. In case of any observation by TPQA the bidder will have take immediate action regarding compliances. TPQA certifications of all the intermittent R/A bills and Final bill furnished by the bidder during execution period are mandatory for acceptance of the same by B AND R and SMPK.
85. The contractor shall arrange for testing of samples of materials from an approved testing laboratory, as instructed by Engineer-in-Charge. The cost and charges for samples of materials and delivering the same to the testing laboratory including all incidentals in connection with the same as directed by the Engineer-in-charge and the testing charges thereof shall be borne by the contractor and shall be deemed to be included in the rates and prices quoted. The results of the tests carried out shall be binding on the contractor who shall comply with any rectification measures that the Engineer-in-charge may deem fit and order to be executed by the contractor as a result of testing.
86. Contractor shall arrange for final demarcation of the periphery of land in presence of local RI/Tahsildar prior to the commencement of work. Representative of B AND R will be present during such demarcation and co-operate in this matter.

- 87 The contractor will have to make his own arrangement of land for site office, store, cement godown, batching plant, built up storage accommodation for T&P, fabrication yard, maintenance yard, material stock yard, labour colony etc. at his own cost. However, if the suitable vacant space for the above is available/considered feasible within the work premises, same may be provided by B AND R/ Local District Authority on written appeal by the contractor.
- 88 The contractor will have to make his own arrangement for water and power supply for execution and testing of all works.
- 89 Any damage done to the other installations during the execution of work shall be made good by the contractor free of cost. In the event of his failure to do so within a reasonable time the same shall be got rectified by B AND R through another agency at the risk and cost of the contractor.
- 90 The contractor or his authorized representative will have to sign site order book to acknowledge the instruction issued by Engineer-in-Charge or his authorized representative for all matters relating to the execution of work. The instructions noted in the site order book shall have to be complied within reasonable time as decided by the Engineer-in-Charge
- 91 Apart from Electrical Engineers, Electrical supervisors/ Electricians with proper, requisite, valid electrical supervisory license will be engaged for all electrical works.
- 92 The Engineer-in-Charge reserves the right to test the material at manufacturer's place, site of work, any independent Laboratory/ Test House. If at any stage during the execution of work, the Engineer-in-Charge is not satisfied with the quality of materials brought/ used at the site of work, he shall be at liberty to reject all such materials. The rejected materials shall have to be removed from the site of work immediately. The decision of the Engineer-in-Charge regarding makes of the materials selected shall be final and binding on the contractor.
- 93 The contractor shall stand guarantee/ warranty during defects liability period from the date of completion of work or after taking over the installations by the department whichever is later, against any manufacturing defect in material, unsatisfactory performance / working and / or breakdown, workmanship.
- The material/ equipment/ installation so found defective shall be replaced/ repaired free of cost to the satisfaction of the Engineer-in-Charge. The delay in rectification/replacement shall not be accepted. B AND R reserves the right to get it done at the risk and cost of the contractor. The decision of the Engineer-in-Charge, shall be final & binding to the contractor.
- The contractor must carry out routine inspection/ testing once in every three months during the defects liability period and attend to the defects taking place during this period. Sufficient number of trained and experienced staff shall be made available to meet any exigency/ emergency at site of work during the defects liability period.
- 94 Care shall be taken by the contractor to avoid damage to the adjoining existing installations/ buildings during execution of his part of the work. Any dismantling, if required, should be done in consultation with the engineer-in-charge. The contractor shall be responsible for repairing all damages and restoring the same to their original finish at his own cost. The contractor shall also remove at his cost all unwanted and waste materials arising out of his work from the site.
- 95 Liasoning with Local Authority for clearance of hindrances:  
This is to be clearly noted by the bidder that in case of cutting and removal of trees, shifting of over head electric lines or shifting of any other existing utilities the bidder will have to take necessary initiatives for liasoning with local bodies/ State Govt. Departments for shifting/ removal of the same. It is the responsibility of the bidder to obtain a hindrance free work site during execution of work.
- 96 Existing Utilities:  
Notwithstanding anything to the contrary contained herein, the Contractor shall ensure that the respective entities owning the existing roads, right of way, level crossings, structures, or utilities on, under or above the Site are enabled by it to keep them in continuous satisfactory use, if necessary, by providing suitable temporary diversions with the authority of the controlling body of that road, right of way or utility. No extra cost will be

provided by B AND R in this regard.

97 **Shifting of Obstructing Utilities:**

The Contractor shall, in accordance with Applicable Laws and with assistance of the Engineer-In-Charge, cause shifting of any utility (including electric lines, telephone lines, OFC cables and other public utilities) to an appropriate location or alignment, if such utility or obstruction adversely affects the execution of Works or Maintenance of the Project Location in accordance with this Agreement. The actual cost of such shifting, as approved and communicated by the entity owning the utility as per the rates of the entity owning the utility, shall be paid by the Contractor without any extra claim. However, this expenditure incurred by contractor may be reimbursed by the Engineer-in-Charge to the contractor subject to approval of the same by SMPK Authority.

98 The Contractor shall prepare and submit as-built drawings by way of making modifications/ changes carried out with respect to the approved drawings issued prior to the execution of respective elements.

99 Deviation, Extra Items and Pricing: All final decisions / finalizations are subject to the approval of our Client / Owner i.e. SMPK Authority, Govt. of India.

100 Deviation, Deviated Quantities, Pricing: All final decisions / finalizations are subject to the approval of our Client / Owner i.e. SMPK Authority, Govt. of India.

101 In all the aforesaid clauses Engineer-in-charge means B AND R's Site in charge.

102 For all sorts of Technical Audits (by Central/State/SMPK/B AND R team) the bidder shall be held totally responsible.

103 In case of Statutory Clearances to be obtained for the premises from Local Authority, the bidder will have to make all the necessary liaisoning and follow ups with local bodies / authorities.

104. Bidders are advised to visit the site before tendering to become fully aware of the site conditions which may affect their quoting.

**Bidder has to submit "Declaration confirming Knowledge about Site Conditions" as per Form-L alongwith the offer.**

105. **Penalty / Compensation for Delay:**

106. **Delay in Commissioning:** 2% of the Contract Price per month of delay, subject to maximum upto 10% of the Contract Price even if Extension of Time (EoT) is allowed by SMPK or its authorized representative.

**Delay in CMC:** Penalty is at the rate of INR 6.78/- per unit generation loss.

107. **Workman Compensation Policy :**

The Bidder shall get all the works / buildings insured till expiry of maintenance period from a Govt. approved insurance agency. The Bidder shall submit copies of valid Contractor All Risk (CAR) & Workman Compensation (WC) Policy to B AND R / SMPK as and when required by B AND R / SMPK and prevailing statutory laws before start of work, failing which, B AND R / SMPK shall obtain these policies and recover amount from RA Bills from the Contractor. In case delay / extension in work, the Contractor shall get the policies extended time to time at his own cost.

108. **Quantity Variation :**

Plus (+) or Minus (-) 20%.

Note: Release of payment to the contractor beyond their W.O / P.O. value will be given them after approval of Competent Authority for which amended Order is required.

109. **Payment Terms :**

**For Solar PV Work / Electrical Work**

**A.1. Supply of material:( Total Supply Value)**

- i) Progressively upon receipt and acceptance of required material at site: 70% of supply value.
- ii) Progressively upon installation at site: 20% of supply value.
- iii) On Completion of Commissioning and final acceptance of Client : 10%of supply value.

**A.2. Installation: (Total Installation Value)**

- i. On Transportation and Installation in Position: 30% of installation value.
- ii. After Initial Alignment: 30% of installation value.
- iii. After final alignment and making ready for commissioning: 30% of installation value.
- iv. After completion of all works in all respect and acceptance by Engineer In Charge :10% of installation value.

**B. Civil Work**

- vii. 10% after completion of Foundation and Plinth work.
- viii. 25 % after completion of RCC Frame Structure
- ix. 20 % after completion of Brick masonry work including plastering.
- x. 20 % payment after fencing work including water treatment work.
- xi. 20 % payment after completion of other work including supply of furniture/ Electrical / false flooring/False ceiling/ Sanitary work where ever applicable.
- xii. 5% payment after final completion and commissioning of total work.

Order for Sl. No. A.1., A.2. &B shall be placed to successful agency by B AND R.

**D. Comprehensive Maintenance Contract Payment:** Payment shall be made in 20 half yearly towards Comprehensive Maintenance Contract value against submitted invoice on (a) Routine Maintenance report certified by representatives of SMPK. Payment shall be made by SMPK Authority to Agency. In this regard, a tripartite agreement shall be drawn between the Solar Contractor, SMPK Authority and B AND R.

110. **Scope of supply by B&R**

(a) Client's Technical Specifications, (b) Terms & Conditions& (c) Copy of detail project report.

111. **Scope of supply by Contractor:**

Construction Power, Construction Water, Design, Supply, Installation, Testing, Commissioning with Comprehensive Maintenance Contract (CMC for 10 Years) post 1 year warranty including Solar PV modules, Module mounting structure, Inverter, Junction Box, Cables, connectors, Lightning protection system, earthing& surge protection system, PV monitoring system ( Scada ), weather monitoring system etc. along with system integration and helpline, Service centre, Operation and maintenance manual, all Equipments, Machineries, Tools & Tackles, Accessories, Consumables, ancillary materials all types of Labour, Supervisor, Safety Belt, Safety Helmet, Safety Shoes and any other personnel protective equipments and all other materials/ equipments required to complete the job. All taxes are inclusive/cess including BOCW in scope of contractor excluding GST. Components to be purchased from SMPK empanelled manufacturers only.

Transportation & accommodation for contractor's staff & labours, Labour License, Construction of site office, site store, ESIC, PF, Labour Welfare Cess, (BOCW welfare Cess), gate pass formalities, etc. as required to complete the job in all respect.

112. **Termination of the Contract :-**

On such termination surplus material lying at site and T&P, if any, will not be taken over by the Client. In the event, Agreement between SMPK and B AND R is terminated, then the agreement between Contractor and B AND R will automatically stand terminated and that he should take away T&P and surplus materials from the site of work sfter the joint measurements are taken of the same.

## SPECIAL CONDITIONS (ELECTRICAL WORKS)

The conditions and directions listed in this Section shall be considered as an extension to and not as a limitation of the obligations of the Contractor.

The specifications generally applicable to this work shall be as per C.P.W.D. Specifications 2013 with upto date correction slip for electrical works (part I) internal, CPWD specifications 1994 (part II) with upto date correction slip for external, except as otherwise specified in the description of items given in the Schedule of Quantities or in the attached Technical Specifications. These specifications will override the C.P.W.D. specifications. The requirements of these specifications will be fulfilled by the Contractor within the tendered rates and without any extra charge. The item rates quoted will be deemed to have taken these specifications into account.

1. The electrical work will be carried out in accordance with the General Specifications 2013 for electrical works in (part I) with upto date correction slip for internal, CPWD specifications 2013) and the specification enclosed with upto date correction slip for external, except as otherwise specified in the description of items given in the Schedule of Quantities or in the attached Technical Specifications while complying in all respects with the requirements of the latest Indian Electricity Rules in force at the time of execution.
2. The electrical work shall be carried out simultaneously with the civil and interior works and will be continued till it is completed satisfactorily along with the completion of essential portions of building work.
3. If any minor alterations are found necessary, the Contractor shall do the same within tendered rates.
4. The work shall be carried out in the best workmanlike manner and any defect in the work or changes in the design pointed out before execution shall be carried out by the Contractor within the tendered rates.
5. The Contractor shall employ adequate labour to complete the work within the stipulated time and make his own arrangements for housing labour and storage of materials etc. A full time Electrical Engineer as per general conditions of contract shall be employed by the Contractor who will remain at site of work to receive orders or any other instructions from the Engineer-in charge.
6. The Contractor shall obtain for himself, on his own responsibility and at his own expense, all the information which may be necessary for the purpose of tendering and for entering into a contract, and must inspect the site, examine and study the specifications, drawings and the design of the electrical installations, the building plans etc. If the drawings are supplied to the Contractor for tender purposes, the same must be returned in good condition with the tender. The Contractor shall also make local and independent inquiries, if required.
7. All tender rates will include the cost of materials, erection, connections, labour, supervision, tools, plant, transport, all taxes, duties, contingencies, breakage, wastage, sundries and scaffolding, i.e. they should be for an item complete in all respects.
8. The Contractor, while executing the work, shall conform to the provision of Government Acts relating to the work and to the regulations and Bye laws of the local authorities, and of the company to whose system of supply the installation is proposed to be connected. The Contractor shall give all notices, required by the Acts, Regulations or Bye -Laws. He will also undertake to provide test certificates and drawings as required and will make necessary arrangements to procure the electricity supply. The Contractor shall also obtain all approvals for the items of work done under this contract from the appropriate authorities. All inspection fees or submission fees paid by the Contractor will be reimbursed by the Employer against valid official receipts. Contractor shall possess a valid electrical Contractor's license issued by the inspectorate of the local government.
9. Samples of materials and fabrication drawings will be submitted by the Contractor according to the schedule/ specification. Contractor shall take prior approval for the list of makes proposed to be used. Any deviation from the schedule/ specifications must have the written consent of the Engineer-in-charge. No approval given by the Engineer-in-charge to any samples or drawings submitted by the Contractor shall in any way exonerate the Contractor from his liability to carry out the work in accordance with the terms of contract.

10. Contractor shall at each relevant stage of the project estimate the quantity of materials required to execute the works as detailed in the drawings and Specifications as per various items of work and procure accordingly.

11. **DRAWINGS**

Shop Drawings:

One soft copy and one hard copy of the Single Line Drawings (power distribution schematics), floor plan layouts and site plan shall be given to Contractor. The Contractor will submit four sets of shop drawings for conduit layouts for all floors and any fabricated items which must contain details of general arrangement drawings with dimensions, clearances, loading details, foundation details, number of conduits and locations of junction boxes, cable box details, etc. with required copies. The Drawing / SLD is indicative and final drawing / SLD shall be submitted by the bidder to achieved the solar power palnt capacity of 2.30 MWp for approval. The DB schedule, fixture schedule and cable schedule shall be prepared accordingly and got approved engineer in charge. These drawings and other literature shall be submitted in advance for approval of engineer-in-charge.

Contractor shall work out actual quantity of various item required at site based on approved drawing take procurement action accordingly.

Completion Drawings:

The Contractor shall submit one complete set of original tracings and further two copies of final existing layout drawings to the Architect /Engineer in-charge after completion of the work. No completion certificate will be issued until the completion drawings are submitted. The drawings will be prepared and submitted by the Contractor without extra charge.

12. **PROGRESS AND TIME OF COMPLETION**

The associate for internal electrical works shall work in close coordination with Contractor and other Contractors as per the time schedule set with the Contractor.

13. **COMPLETION TESTS**

On completion of installations the following tests shall be carried out:-

Insulation Resistance Test

– between phase-to-phase, phase-to-neutral and phase-to-earth

Polarity Test of Switch

Earth Continuity Test

Earth electrode resistance

Other test of PV module and other accessories as per IS and approved ITP/QAP

14. **MAINTAINANCE DURING DEFECTS LIABILITY PERIOD**

The completed installation inclusive of total solar power plant, wiring, light fittings and fans (where supplied by the Contractor) shall not be finally taken over till acceptance certificate is issued to the Contractor. Thereafter the Defects Liability Period shall commence during which the Contractor shall be liable for:

The replacement of any defects that may develop in goods of his own manufacture or supplied by him.

The rectification of all the defects arising out of defective workmanship of the Contractor.

Until the installation is finally taken over, the Contractor shall have the right of entry to the premises, at his own risk and expense, for maintaining the installation in proper order. To facilitate maintenance after the handing-over, the Contractor should clearly indicate the detailed distribution diagram on every Panel , Distribution Board and Sub-Distribution Board.

## 15. POSITION OF LIGHTING, DISTRIBUTION BOARDS AND SWITCHGEARS

The recommended positions of the lighting points, control switches, distribution boards and switchgears as shown on the layout drawings will be generally adhered to.

Should there be any discrepancy or incomplete description, ambiguity or omission in the drawings and other documents, whether original or supplementary, forming the contract, completion or maintenance of the installation, the Contractor shall immediately, on discovering the same, bring it to the attention of the Engineer-in-charge.

Prior to the installation of lighting, fan and plug points and telephone, TV, data on other outlets the distribution boards, switches etc., final positions shall be ascertained by the Contractor with the Engineer -in-charge.

The dimensions and other details of the electrical drawings shall be compared with the civil drawings at site before execution of the work.

## 16. PAINTING AND MARKING

All exposed steel work not actually embedded in the building construction (viz. conduits, junction boxes) will be painted with one coat of primer and two coats of synthetic Enamel Paint in shades decided by the Engineer in Charge. The paint will match the existing shades of walls unless otherwise instructed. This work will be done by the Contractor without extra charges.

All Panels, MDBs, SDBs and final DBs etc. shall be properly painted, labelled and numbered as detailed in the Technical Specifications.

## 17. SCOPE OF WORK

The general character and scope of work to be carried out under this contract is illustrated in the Schedule of Quantities and drawings( provided with price bid to shortlisted bidder). Contractor shall carry out and complete the said work under this contract in every respect and to the satisfaction of the Engineer-in-charge. In general the scope of work shall cover supply, installation, testing and commissioning of all electrical works of the project including the following main items/ systems:

### **Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant**

Internal electrification through concealed MS/PVC Conduit and provide light points, fan points, socket outlets etc. including supplying, installation, testing and commissioning of light fixtures, fans, socket outlets, switch boards etc.

Providing MCB Distribution Boards and MV Panels (Sub-Distribution Boards) including submain wiring/cabbling.

Conduiting and wiring for telephone points having Telephone Distribution Boards (Tag Blocks), telephone outlets etc. complete with telephone cabling from tag blocks to telephone outlets.

Submains, cables and cable tray work.

Lightning protection system consisting of lightning down conductors, finial, horizontal and vertical strips, test joints, earth electrodes etc.

Hume/RCC for cable entry.

Earthing and lightning protection of electrical installation complete in all respect.

Testing and commissioning of all electrical installations.

Obtaining all approvals/NOC/certificate from Local Electricity Supply Authority (State Electricity Boards) and any other

statutory authorities for the complete scope.

Any other works required for completion of electrical works.

## 18. REGULATIONS AND STANDARDS

The installation shall conform in all respects to Indian Standard Code of Practice for Electrical Wiring Installations IS:732-1989. It shall also be in conformity with Indian Electricity Rules and Regulations, National Electric Code, National Building Code, CPWD specifications for Electrical works Part-I to V and requirements of the Local Electric Supply Authority. In general, all materials, equipment and workmanship shall conform to the Indian Standards, specifications and Code. Some of the applicable codes/standards are under:

- |   |                       |
|---|-----------------------|
| a) Guide for marking of insulated conductors.   | IS 5578               |
| b) Guide for uniform system of marking and identification of conductor and apparatus terminals.   | IS 11353              |
| c) Low voltage switchgear and control –gear assemblies  | IS 8623 Part – 1 to 3 |
| d) Degrees of protection provided by enclosures for low voltage switchgear and control-gear.  | IS 2147               |
| e) Enclosed distribution boards and cut-outs for voltage not exceeding 1000V AC and 1200V DC  | IS 2675               |
| f) Code of practice for selection, installation and maintenance of switchgear and control gear.   | IS 10118 Part 1-4     |
| g) Low –voltage fuses for voltages not exceeding 1000V AC or 1500V DC   | IS 13703 Part 1&2     |
| h) PVC insulated (heavy duty) electric cables   | IS 1554               |
| i) PVC insulated cables for working voltages upto and including 1100V   | IS 694                |
| j) Conduit for electrical installations.  | IS 9537               |
| k) Accessories for rigid steel conduits for electrical wiring.  | IS 3837               |
| l) Boxes for the enclosure of electrical accessories.   | IS 5133               |
| m) General and safety requirements for luminaries.  | IS 1913               |
| n) Code of practice for earthing.   | IS 3043               |
| o) Electrical accessories-circuit breakers for over current protection for household and similar installations.   | IS 8828               |
| p) Low voltage switchgear and control gear.   | IS 13947 Part 1-5     |
| q) Residual current operated circuit breakers.  | IS 12640              |
| r) Current transformers.  | IS 2705               |
| s) Voltage Transformers.  | IS 3156               |
| t) Direct acting indicating analogue electrical measuring instruments and their accessories   | IS 1248 Part – 1 to 9 |
| u) Control Switches (switching device for control and auxiliary circuits including contactor relays) for voltages upto and including 1000V ac and 1200V dc. | IS 6875 Part – 1 to 3 |

## 19. CODES OF PRACTICE



The electrical installation work shall be carried out in accordance with India Standard Code of Practice for Electrical Wiring Installation IS:732-1989 and IS: 2274-1963. It shall also be in conformity with the current Indian Electricity Rules and Regulations of the Local Electricity Supply Authority and Fire Insurance Regulations, so far as these become applicable to the installation. Electrical work in general shall be carried out as following CPWD Specifications with upto date amendment.

CPWD Specifications for Electrical Works Part – I (Internal) – Latest Rev. with upto date correction slip  
CPWD Specifications for Electrical Works Part – II (External) – Latest Rev. with upto date correction slip

Wherever this specification calls for a higher standard of material and or workmanship than those required by any of the above mentions regulations and specifications then the specification here under shall take precedence over the said regulations and standards. In case of discrepancy/ambiguity in the specifications the specifications given herewith will prevail. The Specification enclosed with the NIT for solar PV plant work along with Substation work shall be read in conjunction with the CPWD specification.

**BRIDGE AND ROOFCO. (INDIA) LIMITED**  
**ADDITIONAL CONDITIONS OF CONTRACT (ACC)**

1. If the Contractor shall desire an extension of the time for completion of the work under relevant conditions of the contract, no application for such extension will be entertained if it is not received in sufficient time to allow the Engineer-in-Charge to consider it and the Contractor will be responsible for the consequences arising out of his negligence in this respect.
2. The Contractor will have to leave ducts in walls and floors to run conduit or cables, where necessary, and he will not be entitled to any extra payment on this account.
3. Contractors in the course of their work should understand that all materials (e.g. store and other materials) obtained in the work of dismantling, excavation, etc., will be considered as property of B AND R/SMPK Authority and will be disposed of to the advantage of B AND R/SMPK Authority.
4. No Compensation for any damage done by rain or traffic during the execution of the work will be made.
5. The Contractor should quote through rate inclusive of cost of materials and carriage to place of working.
6. In the event of emergency the Contractor will be required to pay his labour every day and if this is not done, Government shall make the requisite payment as would have been paid by the Contractor and recover the cost from the Contractors.
7. Inconvenience of the public.
  - a) The Contractor(s) shall not deposit material on any item which will seriously inconvenience the public. The Engineer-in-Charge may require the contract(s) to remove any materials, which are considered by him to be a danger or inconvenience to the public or cause them to be removed at the Contractor's cost.
  - b) The Contractor undertakes to have the site clean, free from all surplus materials, rubbish etc. upto the satisfaction of the Engineer-in-Charge. All surplus materials, rubbish, etc. will have to be removed to the places fixed by the Engineer-in-Charge and nothing extra will be paid for the same.
  - c) The Contractor shall not allow any rubbish or debris to remain on the premises during or after repairs, but shall remove the same and keep the place neat and tidy during the progress of the work. The Engineer-in-Charge may get the site or premises cleared of debris, etc., and recover the cost from the bill of the Contractor if the latter shows slackness in observing this clause.
  - d) Materials brought at site shall not be stacked at random. The Contractor shall stack all these materials as directed by the Engineer-in-Charge.
8. The Contractor will have to make his own arrangements for the carriage of materials.
9. For all items of contract works requiring unskilled labour the Contractors shall be bound to employ unskilled local labour. The expression "local" shall mean and deem to mean the Anchal, the Block, the Thana or the District of the State of Jharkhand where the work will be executed. In cases of non-availability of such unskilled local labour and of other difficulties experienced by the Contractor in recruiting such local labour, the Contractor may, with the prior permission in writing of the Engineer-in-Charge of the work, recruit and employ unskilled labour from neighbouring areas of that District. In case the work is in the border area of two districts and there is dearth of adequate number of labour from the district where the work will be executed, labour may be recruited by the Contractor from contiguous areas of the other contiguous district. In case local labour will not be available even from the districts as mentioned and when the exigency or progress of work so demands, the Contractor may, with the prior permission in writing of the said Engineer-in-Charge engage labour from the other districts of the State of Jharkhand and in case the same be not available then the Contractor may, with the prior permission of the said Engineer-in-Charge, employ imported labour of other states.

In case where the Contractor fails to secure unskilled local labour or to engage imported labour, the Contractor shall employ labour locally recruited by company or labour imported by company at the rate to be decided by the Engineer-In-Charge of the works concerned whose decision as to the circumstances in which employment of such labour is of mutual advantage to company and the Contractor, will be final and binding on the parties.

10. Ready Mix Concrete as per approved design mix shall be arranged by the Contractor either from own Batching Plant to be installed outside the campus or from approved RMC Plant. For procurement of RMC from RMC Plants, the Contractor shall within 15 days of award of work seek approval towards the RMC plant from which they intend to procure RMC, by submitting the name of the company of the RMC plant along with their (RMC Plant company) credentials / list of Clients. EIC after inspecting the proposed plant may accord necessary approval if the plant found satisfactory or may reject the plant if found unsatisfactory. Contractor shall the propose a new plant name & seek approval. After obtaining the approval from EIC, Contractor shall draw MOU with the approved RMC company & submit the copy of the MOU to EIC before commencement of the job.

EIC reserve the right to exercise control over the quality as well as the quantity of the ingredients, water, & admixture etc. to be used for production of RMC, declaring the materials fit or unfit, checking the calibration of the plant etc. Batching Plant to be used shall be fully computerized & contractor shall submit every batch report of the RMC to EIC at the time of submission of each Bill.

11. The Contractor shall arrange to carry out all mandatory tests on construction materials as prescribed in CPWD Specifications and BIS Code of Practice and maintain all such records of mandatory tests conducted to ensure the quality of work. The Contractor shall produce copy of test report regularly to B AND R / SMPK during inspection of works and otherwise also.
12. The Contractor shall carry out the work of water proofing treatment through specialized firm, who shall submit the 10 years guarantee bond against as per given format leakages / dampness on a Rs. 100/- stamp paper to B AND R. The guarantee shall include rectification of works within the guarantee period of 10 years free of cost if leakage / dampness is reported by the Client. Guarantee bond shall be tripartite agreement form.
13. The Contractor shall not assign or transfer or part with any of the rights, duties or obligations under the agreement, wholly or partly to any other agency without the prior written consent of B AND R / SMPK.
14. All defects notice during the currency of the contract and, also during the defect liability period of 12 months after completion of the work except those pertaining to leakage / dampness shall be got completely and satisfactorily rectified by the Contractor immediately after notifying the defects without any extra payment for the same. In case the defects are such as cannot be rectified or the Contractor fails to rectify these satisfactorily and completely, the Engineer-in-Charge reserves his right to accept the work at reduced rates (provided defects are non-structural) or to get the rectification work done at the risk and cost of Contractor. The decision of the Engineer-in-Charge, in this regard, shall be final and binding on the Contractor.
15. The land shall be made available to Contractor for Construction, free from all encumbrances, Any cost towards clearance of land and change in land use shall be borne by Client, as per actual. The Contractor shall, forthwith take possession of the site from the Engineer-in-Charge and keep it free from all encroachments till completion and handing over the work.
16. The Contractor shall ensure that associated developments works and bulk services are simultaneously Carried out so as to make the buildings functional immediately on completion. Any building even if it is physically ready for occupation, shall be deemed to be completed only from the date of services like water supply, sewerage and electricity are made available for it, by the Contractor.
17. The Contractor shall comply with the Fair Wage Clause and CPWD Contractor's Labour Regulations as mentioned in CPWD Manual.

**FORM OF PERFORMANCE BANK GUARANTEE (PBG) IN LIEU OF SECURITY DEPOSIT**  
**(To be executed on Non-Judicial Stamp Paper of Appropriate Value)**

1. In consideration of the Employer (hereinafter called "The Employer") having offered to accept the terms and conditions of the proposed agreement between and \_\_\_\_\_ (hereinafter called "the said Contractor(s)") for the work \_\_\_\_\_ (hereinafter called "the said agreement") having agreed to production of a irrevocable Bank Guarantee for Rs. \_\_\_\_\_ (Rupees \_\_\_\_\_ only) as a security/guarantee from the Contractor(s) for compliance of his obligations in accordance with the terms and condition in the said agreement.

We, \_\_\_\_\_ (hereinafter referred as "the Bank") hereby undertake to  
(indicate the name of the Bank)  
pay to the Employer an amount not exceeding Rs. \_\_\_\_\_ (Rupees \_\_\_\_\_ only) on demand by the Employer.

2. We, \_\_\_\_\_ do hereby undertake to pay the amounts due and  
(indicate the name of the Bank)  
payable under this guarantee without any demure, merely on a demand from the Employer stating that the amount claimed is required to meet the recoveries due or likely to be due from the said Contractor(s). 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 Rs. \_\_\_\_\_ (Rupees \_\_\_\_\_ only).

3. We, the said bank further undertake to pay the Employer unconditionally any money so demanded notwithstanding any dispute or disputes raised by the Contractor(s) in any suit or proceeding pending before any court or Tribunal or Arbitration or before any other authority relating thereto, our liability under this present being absolute and unequivocal.

The payment under this Guarantee so made by us under this bond shall be a valid discharge of our liability for payment there under and the Contractor(s) shall have no claim against us for making such payment.

4. We, \_\_\_\_\_ further agree that the guarantee herein contained shall  
(indicate the name of the Bank)  
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 the dues of the Employer under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged or till Engineer -in-Charge on behalf of the Employer certified that the terms and conditions of the said agreement have been fully and properly carried out by the said Contractor(s) and accordingly discharges this guarantee.

5. We, \_\_\_\_\_ further agree with the Employer that the Employer shall  
(indicate the name of the Bank)  
have the fullest liberty without our consent and without affecting in any manner our obligation hereunder to vary any of the terms and conditions of the said agreement or to extend time of performance by the said Contractor(s) 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 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(s) or for any forbearance, act of omission on the part of the Employer or any indulgence by the Employer to the said Contractor(s) 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.

This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

6. It shall not be necessary for the Company to proceed against the contractor before proceeding against the Guarantor bank and the Guarantee herein contained shall be enforceable against them notwithstanding any security, which the Company

may have obtained or obtain from the contractor shall at the time when proceedings are taken against the guarantor hereunder be outstanding or unrealized.

7. The guarantor hereby declare that it has power to execute this guarantee and the executants has shall powers to do so on its behalf under the proper authority granted to him/them by the guarantor.

8. We, \_\_\_\_\_lastly undertake not to revoke this guarantee except with the  
(indicate the name of the Bank)  
previous consent of the Employer in writing.

9. This guarantee shall be valid upto \_\_\_\_\_ unless extended on demand by the Employer. Notwithstanding anything mentioned above, our liability against this guarantee is restricted to Rs. \_\_\_\_\_ (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).

**INFORMATION REGARDING ELIGIBILITY  
LETTER OF TRANSMITTAL**

**[To be submitted in Bidder's Letter Head]**

From:

To

.....

Subject: Submission of bids for the work of .....

Sir,

Having examined the details given in press notice and bid document for the above work, I/we hereby submit the relevant information.

1. I/we hereby certify that all the statement made and information supplied in the enclosed **forms A to O**, Annexures and accompanying statement are true and correct.
2. I/we have furnished all information and details necessary for eligibility and have no further pertinent information to supply.
3. I/we submit the requisite certified solvency certificate and authorize the Executive Engineer .....to approach the Bank issuing the solvency certificate to confirm the correctness thereof. I/we also authorize Executive Engineer ..... to approach individuals, employers, firms and corporation to verify our competence and general reputation.
4. I/we submit the following certificates in support of our suitability, technical knowledge and capability for having successfully completed the following works:

Name of work	Certificate from

Enclosures:

**Seal of bidder**

**Date of submission:**

**Signature(s) of Bidder(s).**

**PROCESS COMPLIANCE FORM**

[Tenderers are required to print this on their Company's Letter head and sign, stamp before uploading]

To  
Bridge AndRoofCompany (India) Ltd,  
(A Govt. of India Enterprise),  
Kankaria Centre, 5th Floor,  
2/1, Russel Street, Kolkata: 700 071

**SUBJECT: ACCEPTANCE TO THE PROCESS RELATED TERMS AND CONDITIONS FOR ETENDERING**

Dear Sir,

This has reference to the Terms and conditions for e-Tendering mentioned in **Notice Inviting e-Tender (e-NIT) No. B AND R/HO/SMPK/61038/SOLAR-WORK/NIT/CW/01 DTD. 11.03.2024**

We hereby confirm the following:-

- a) The undersigned is authorized Representative of the Company.
- b) We have carefully gone through the e-NIT (**Notice Inviting e-Tender No. B AND R/HO/SMPK/61038/SOLAR-WORK/NIT/CW/01 DTD. 11.03.2024**) and the Rules governing the e-Tendering as mentioned in **Central Public Procurement Portal website <https://eprocure.gov.in>** as well as this documents.
- c) We will honor the Bid submitted by us during the e-Tendering
- d) We give undertaking that if any mistake occurs while submitting the bid from our end, we will honor the same.
- e) We are aware that if B AND R has to carry out e-Tender again due to our mistake, B AND R has the right to disqualify us for this tender.
- f) We confirm that B AND R shall not be liable & responsible in any manner whatsoever for my / our failure to access & submit offer on the e-Tendering site due to loss of internet connectively, electricity failure, virus attack, problems with the PC, digital signature certificate or any unforeseen circumstances etc.

With regards,

Signature with Company Seal

Name:

Company / Organisation:

Designation within Company / Organisation:

Email ID:

Tel. No.

Mobile No. :

## FINANCIAL INFORMATION

1. **Financial Analysis**-Details to be furnished duly supported by figures in Balance Sheet, Statement of Profit & Loss account alongwith notes to accounts for the last Five years duly certified by Chartered Accountant mentioning the Firm Registration Number issued by ICAI alongwith full address, as submitted by the applicant to the SMPK (Copies to be attached)

i. **Gross Annual Turnover on Construction works as per Balance Sheet**

Rs/Crores

FY→	2022-23	2021-22	2020-21	2019-20	2018-19
Gross Annual Turnover on construction works					

ii. **Profit / Loss**

Rs/Crores

FY→	2022-23	2021-22	2020-21	2019-20	2018-19
Total Assets					
Current Assets					
Total Liabilities					
Current Liabilities					
Profit before Tax					
Profit after Tax					
Net Worth					
Bank Solvency Amount as mentioned in the Bank Solvency Certificate as per <b>Form - B</b>					

**Note :**

- a. In case of Bidder with Foreign Origin (Outside India), the financial year shall be as applicable for the respective Countries i.e. 2018, 2019, 2020, 2021 & 2022.
- b. Net Worth shall mean the sum of subscribed and paid-up equity and reserves from which shall be deducted the sum of revaluation reserves, miscellaneous expenditure not written off and reserves not available for distribution to equity shareholders.

Signature of Chartered Accountant with Seal & FRN.

Signature of Bidder (s)



**FORM OF BANKERS' CERTIFICATE FROM A SCHEDULED BANK**

This is to certify that to the best of our knowledge and information that M/s./ Shri .....having marginally noted address, a customer of our bank are/is respectable and can be treated as good for any engagement upto a limit of Rs..... (Rupees.....).

This certificate is issued without any guarantee or responsibility on the bank or any of the officers.

(Signature)  
For the Bank

**NOTE**

- (1) Bankers Certificates should be on letter head of the Bank, self-attested and should have been issued within 90 days from original last date of bid submission.
- (2) In case of Partnership Firm, Certificate should include names of all Partners as recorded with the Bank.

**DETAILS OF ELIGIBLE SIMILAR NATURE OF WORKS COMPLETED DURING THE LAST SEVEN YEARS ENDING LAST DAY OF THE MONTH PREVIOUS TO THE ONE IN WHICH THE BIDS ARE INVITED**

S. No.	Name of Work/ Project & location	Owner of sponsoring Organization	Cost of Work In Lakh)	Date of Commencement As per contract	Stipulated Date of completion	Actual date of completion	Litigation/ Arbitration Pending/ in Progress with details*	Name & address/ Telephone No. of officer to whom reference may be made	Remarks

\* Indicate gross amount claimed and amount awarded by the Arbitrator.

Signature of Bidder(s)

## PROJECT UNDER EXECUTION OR AWARDED

S. No.	Name of Work/ Project & location	Owner of sponsoring Organization	Cost of Work In Lakh)	Date of Commencement As per contract	Stipulated Date of completion	Upto date Percentage Progress of work	Slow Progress, If any, & reasons thereof	Name & address/ Telephone No. of officer to whom reference may be made	Remarks

Certified that above lists of works is complete and no work has been left out and that the information given is correct to my knowledge and belief.

Signature of Applicant

## PERFORMANCE REPORT OF WORKS REFERRED TO IN FORMS C1 &amp; C2

1.	Name of work / Project & Location	
2.	Agreement No.	
3.	Executed Cost	
4.	Tendered Cost	
5.	Date of Start	
6.	Date of completion	
(i)	Stipulated date of completion	
(ii)	Actual date of completion	
7. (a)	Whether case of levy of compensation for delay has been decided or not	Yes / No
(b)	If decided, amount of compensation levied for delayed completion , if any	
8.	Performance Report	Outstanding / Very Good / Good /Poor
(1)	Quality of work	Outstanding / Very Good / Good /Poor
(2)	Financial soundness	Outstanding / Very Good / Good /Poor
(3)	Technical Proficiency	Outstanding / Very Good / Good /Poor
(4)	Resourcefulness	Outstanding / Very Good / Good /Poor
(5)	General behavior	Outstanding / Very Good / Good /Poor

Dated : \_\_\_\_\_

Executive Engineer or Equivalent

## STRUCTURE &amp; ORGANIZATION

1.	Name & Address of the applicant		
2.	Telephone No. / Telex / Fax No.		
3.	Legal status of the applicant (attach copies of original document defining the legal status)		
	a) An Individual b) A proprietary firm c) A firm in partnership d) A limited company or Corporation		
4.	Particulars of registration with various Government bodies ( <i>attach attested photocopy</i> )		
		Organization / Place of Registration	Registration No.
5.	Names and Titles of Directors & Officers with designation to be concerned with this work		
6.	Designation of individuals authorized to act for the organization.		
7.	Has the Bidder, or any constituent partner in case of partnership firm Limited Company / Joint Venture, ever been convicted by the Court of Law? If so, Give details?		
8.	In which field of Electrical Engineering / Solar Power plant engineering construction the applicant has specialization and interest?		
9.	Any other information considered necessary but not included above.		

**AFFIDAVIT  
(On Non Judicial Stamp Paper duly Notarized)**

1. I, the undersigned, do hereby certify that all the statements made in the required attachments are true and correct.
2. The undersigned also hereby certifies that our firm M/s \_\_\_\_\_ have neither abandoned any contract awarded to us nor such works have been rescinded, during the last five years prior to the date of this application.
3. The undersigned also hereby confirmed M/s \_\_\_\_\_ have not been blacklisted/debarred/penalized by any government agency or public sector undertaking or judicial authority/arbitration body.
4. The undersigned hereby authorize (s) and request (s) any bank, person, firm or corporation to furnish pertinent information deemed necessary and requested by the Department to verify this statement or regarding my (our) competence and general reputation.
5. The undersigned understands and agrees that further qualifying information may be requested, and agrees to furnish any such information at the request of the Client.
6. The undersigned undertake that I / We have not attested / modified the Tender attached in CPP e-Tender Portal / B AND R. If it is found during the tender stage or later that Tender is modified by us, the Client(s) / B AND R shall have the right to reject our bid.

**Signature of Applicant**

**AFFIDAVIT****(To be submitted in Bidders Letter Head only)**

I/We undertake and confirm that eligible similar work(s) has / have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of **B AND R**, then I / we shall be debarred for bidding in B AND R in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Earnest Money Deposit / Performance Guarantee.

We do hereby indemnify Client (i.e.SMPK) / B AND R, against all penal action that may be levied / effected by any Concerned Authority for default in any Labour Regulation / PF / ESI and other Statutory Requirement of the relevant Acts / Laws related to the work of the Contractor and will bear the Legal Changes, if any, and will pay the legal changes / dues directly to the Concerned Authority.

Date :

Place :

Signature (s) of Bidder (s)  
With Seal of Firm

**CERTIFICATE FOR ASSOCIATING ELECTRICAL AGENCY**

**WILLINGNESS CERTIFICATE**

I hereby give my willingness to work as electrical associate for this work.

I will execute the work as per specifications and conditions for the agreement and as per direction of the Engineer-in-Charge. Also I will employ full time technically qualified Supervisor / Engineer for the works as per requirement. I will attend inspection of officers of the department as and when required.

Date:

Place:

Signature of the Electrical Associate



**DETAILS OF TECHINCAL & ADMINISTRATIVE  
PERSONNEL TO BE EMPLOYED FOR THE WORK  
As per requirement mentioned in Annexure - II**

SI. No	Designation	Total Number	Number Available For this Work	Name	Qualification	Professional experience and details of work carried out	How these would be involved in this work	Remarks

Signature of Bidder

**DETAILS OF CONSTRUCTION PLANT AND EQUIPMENT LIKELY  
TO BE USED IN CARRYING OUT THE WORK  
As per requirement mentioned in Annexure - I**

SI.No.	Name of Equipment	Nos.	Capacity of Type	Age	Condition	Ownership Status		To be Purchased	Current Location	Remarks
						Presently owned	Leased			

**INFORMATION REGARDING CURRENT LITIGATION WITH CLIENT / B AND R,  
DEBARRING EXPELLING OF TENDERER OR ABANDONMENT OF WORK BY  
THE TENDERER**

**(To be typed and submitted in Bidder's Letter Head )**

- 01) a) Is the tenderer currently involved in any litigation relating to the works. Yes / No.  
b) If yes: - give details.
- 02) Has the tenderer or any of its constituent partners been debarred / expelled by any agency in India during the last 5 years. Yes / No.
- 03) a) Has the tenderer or any of its constituent partners failed to perform on any contract work in India during the last 5 years. Yes / No.  
b) If yes: - give details.

**Note:**

If any information in this schedule is found to be incorrect or concealed, qualification application will summarily be rejected.

**Date :**

**Signature of the Tenderer**

**DECLARATION CONFIRMING KNOWLEDGE ABOUT SITE CONDITIONS**

[ To be typed and submitted in the Letter Head of the Company / Firm of Bidder ]

To,  
(Write Name & Address of Officer of B AND R inviting the Tender)

Dear Sir,

**Sub. : Declaration confirming Knowledge about Site Conditions**

**Ref. : 1) NIT / Tender Specification No. : .....**  
**2) All other pertinent issues till date**

I/We, ..... Hereby declare and confirm that we have visited the Project Site as referred in B AND R Tender Specifications and acquired full knowledge and information about the Site conditions including Wage structure, Industrial Climate, the Law & Order and other conditions prevalent al and around the Site. We further confirm that the above information is true and correct and we shall not raise any claim of any nature due to lack of knowledge of Site Conditions.

I/We, hereby offer to carry out work as detailed in above mentioned Tender Specification, in accordance with Terms & Conditions thereof.

Yours faithfully,

(Signature, Date & Seal of Authorised  
Representation of the Bidder)

Date :  
Place :

**COMPLIANCE TO BID REQUIREMENT  
(To be submitted in Bidder's Letter Head)**

We hereby agree to fully comply with, abide by and accept without variation, deviation or reservation all technical, commercial and other conditions whatsoever of the e-NIT Documents and Addendum to the e-NIT Documents, if any, for subject work issued by Bridge And Roof Co. (India) Ltd.

We hereby further confirm that any terms and conditions if mentioned in our e-NIT offer shall not be recognized and shall be treated as null and void.

(Signature, Date & Seal of Authorized  
Representation of the Bidder)

Date:  
Place:

**INTEGRITY PACT****Between**

**M/s. BRIDGE AND ROOFCO. (INDIA) LTD.** (B AND R), a company registered under the Companies Act 1956 and having its registered office at **Kankaria Centre, 4<sup>th</sup>& 5<sup>th</sup> Floor, 2/1, Russel Street, Kolkata – 700071** hereinafter referred to as “The Principal”, which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

**and**

....., hereinafter referred to as “The Bidder/ Contractor” which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART

**Preamble**

The Principal intends to award, under laid-down organizational procedures, contract/s for ..... **(Name of Work). Tender Document No.** .....). The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint Independent External Monitor(s), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

**Section 1 – Commitments of the Principal**

- 1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:-
  - 1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.
  - 1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.
  - 1.1.3 The Principal will exclude from the process all known prejudiced persons.
- 1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

**Section 2 – Commitments of the Bidder(s)/ Contractor(s)**

- 2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.
  - 2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to

any third person any material, immaterial or any other benefit which he / she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

- 2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.
- 2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant IPC/ PC Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.
- 2.1.4 The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.
- 2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

### **Section 3 – Disqualification from tender process and exclusion from future contracts**

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidders(s)/ Contractor(s) from the tender process or take action as per the separate “Guidelines for Suspension of Business Dealings with Suppliers/ Contractors” framed by the Principal.

### **Section 4 – Compensation for Damages**

- 4.1 If the Principal has disqualified the Bidder(s) from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.
- 4.2 If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages equivalent to 10% of the contract value or the amount equivalent to Security Deposit/Performance Bank Guarantee, whichever is higher.

### **Section 5 – Previous Transgression**

- 5.1 The Bidder declares that no previous transgressions occurred in the last 3 years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.
- 5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

### **Section 6 – Equal treatment of all Bidders/ Contractors/ Sub-contractors**

- 6.1 The Bidder(s)/ Contractor(s) undertake(s) to obtain from all subcontractors a commitment consistent with this Integrity Pact and report Compliance to the Principal. This commitment shall be taken only from those sub-contractors whose contract value is more than 20% of Bidder's/ Contractor's contract value with the Principal. The Bidder(s) / Contractor(s) shall continue to remain responsible for any default by his Sub-contractor(s).
- 6.2 The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors.
- 6.3 The Principal will disqualify from the tender process all bidders who do not sign this pact or violate its provisions.

## **Section 7 – Criminal Charges against violating Bidders/ Contractors /Sub-contractors**

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

## **Section 8 –Independent External Monitor(s).**

- 8.1 The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.
- 8.2 The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, B AND R.
- 8.3 The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the Principal including that provided by the Bidder(s)/ Contractor(s). The Bidder(s)/ Contractor(s) will grant the monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation. The same is applicable to Sub-contractor(s). The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Sub-contractor(s) with confidentiality.
- 8.4 The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.
- 8.5 As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or take corrective action, or heal the situation, or to take other relevant action. The Monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.
- 8.6 The Monitor will submit a written report to the CMD, B AND R within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise, submit proposals for correcting problematic situations.
- 8.7 The CMD, B AND R shall decide the compensation to be paid to the Monitor and its terms and condition.
- 8.8 If the Monitor has reported to the CMD, B AND R, a substantiated suspicion of an offence under relevant IPC / PC Act, and the CMD, B AND R has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.
- 8.9 The number of Independent External Monitor(s) shall be decided by the CMD, B AND R.
- 8.10 The word 'Monitor' would include both singular and plural.

## **Section 9 – Pact Duration**

- 9.1 This Pact begins and shall be binding on and from the submission of bid(s) by bidder(s). It expires for the Contractor 12 months after the last payment under the respective contract and for all other Bidders 6 months after the contract has been awarded.
- 9.2 If any claim is made / lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified as above, unless it is discharged/ determined by the CMD, B AND R.



**Section 10 – Other Provisions**

- 10.1 This agreement is subject to Indian Laws and jurisdiction shall be registered office of the Principal, i.e. Kolkata.
- 10.2 Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.
- 10.3 If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.
- 10.4 Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.
- 10.5 Only those bidders/ contractors who have entered into this agreement with the Principal would be competent to participate in the bidding. In other words, entering into this agreement would be a preliminary qualification.

For & On behalf of the Principal  
(Office Seal)

For& On behalf of the Bidder/ Contractor  
(Office Seal)

Place -----

Date -----

Witness: \_\_\_\_\_  
(Name & Address)

Witness: \_\_\_\_\_  
(Name & Address)

**BANK GUARANTEE IN LIEU OF EARNEST MONEY DEPOSIT**

BG NO.: \_\_\_\_\_  
DATED : \_\_\_\_\_  
VALID UPTO : \_\_\_\_\_

To ,  
Bridge and Roof Co. (I) Limited,

Dear Sirs,

In consideration of Bridge and Roof Co. (I) Limited (hereinafter called " B AND R" which expression shall include its successors and assigns), having agreed inter-alia to consider the tender of (Name of the Tenderer) having its Head Office/Registered Office at ( \_\_\_\_\_ Address of Tenderer \_\_\_\_\_ ) (hereafter called the "Tenderer" which expression shall include its successors and assigns), for the work of \_\_\_\_\_ according to Tender No. \_\_\_\_\_ upon the Tenderer furnishing a Bank Guarantee with all undertaking from the Bank as hereinafter appearing in lieu of cash deposit of the Earnest Money. We \_\_\_\_\_ (Name of the Bank) a Bank constituted / Registered under the \_\_\_\_\_ Act ,having our head Office / Registered Office at \_\_\_\_\_ (hereinafter called the "Bank" which expression shall include Its successors and assigns), at the request of the Tenderer and with the intent to bind the Bank and its successors and assigns do hereby unconditionally and irrevocably undertake to pay the B AND R at Kolkata forthwith on first demand without protest or demur or proof or satisfaction or condition and without reference to the Tenderer, all sums payable by the Tenderer as and by way of Earnest Money to B AND R, up to an aggregate limit of Rs. \_\_\_\_\_ (Rupees \_\_\_\_\_) AND THE BANK DOTH HEREBY FURTHER AGREE AS FOLLOWS:

1. This Guarantee / Undertaking shall be a continuing guarantee and shall remain in full force and effect for all claims or demands made by the B AND R on the Bank until the B AND R discharges this Guarantee/Undertaking subject, however, that the B AND R shall have no claims under this Guarantee/Undertaking after the midnight of \_\_\_\_\_ 20\_\_\_\_ or any written extension(s) thereof. PROVIDED that if the aforesaid work tendered for or any part thereof shall be awarded to the Tenderer on or before the said date, whether on the basis of accompanying tender or any other basis, then the validity of this guarantee/undertaking shall stand automatically Extended for all claims and demands made by the B AND R for further three months.
2. The B AND R shall have the fullest liberty without reference to the Bank and without affecting in any way the liability of the Bank under this Guarantee/Undertaking at any time and/or from time to time to postpone and/or vary any of the powers, rights, and obligations exercisable by the B AND R against the Tenderer and either to enforce or to forbear from enforcing all or any of the terms and conditions of or governing the said Tender and/or any contract consequent upon any award of work or the said Earnest Money Deposit or the securities available to the B AND R or any of them and the Bank shall not be released from Its liability under these Presents and the liability of the Bank hereunder shall remain in Full force and effect notwithstanding any exercise by the B AND R of the liberty with reference to any of all the matters aforesaid or by reason or any other act, matter or thing whatsoever which under law relating to the sureties or otherwise which could, but for this provision have the effect of releasing the Bank from all or any of its obligations hereunder or any part thereof, and the Bank Specifically waives any and all contrary rights whatsoever.
3. It shall not be necessary for the B AND R to proceed against the Tenderer before proceeding against the Bank and the Guarantee/Undertaking herein contained shall be enforceable against the Bank as principal debtor notwithstanding the (existence of any other undertaking or security for any indebtedness of the Tenderer to the B AND R and notwithstanding that any such security shall at the time when claim is made against the Bank or proceedings taken against the Bank hereunder, be outstanding or unrealized.

Contd. – P/2

4. The amount stated by the B AND R in any demand, claim or notice made with reference to this guarantee shall as between the Bank and the B AND R for the purpose of these Presents is conclusive of the amount payable by the Bank to the B AND R hereunder.

5. The liability of the Bank to the B AND R under this Guarantee/Undertaking shall remain in full force and effect notwithstanding the existence of any difference or dispute between the Tenderer and the B AND R, the Tenderer and the Bank and/or the Bank and the B AND R or otherwise howsoever touching these Presents or the liability of the Tenderer to the B AND R, and notwithstanding the existence of any instructions or purported instructions by the Tenderer or any other person to the Bank not to pay or for any cause withhold or defer payment to the B AND R under these Presents, with the intent that notwithstanding the existing of such difference dispute or instructions, the Bank shall be and remain liable to make payment to the B AND R in terms thereof.

6. This Guarantee/Undertaking shall not be determined or affected by the liquidation or winding up or dissolution or change of constitution or insolvency of the Tenderer or any change in the legal constitution of the Bank or the B AND R.

7. Without prejudice to any other mode of service, a demand or claim or other communication may be transmitted by the B AND R to the Bank either by post or by fax, if transmitted by fax, the transmission shall be complete as soon as acknowledged by Bank.

8. Notwithstanding anything contained herein:

- i) The Bank's liability under this guarantee / undertaking shall not exceed (Amount in figures & words);
- ii) This guarantee / undertaking shall remain in force up to \_\_\_\_\_ and any extension(s)therefore; and
- iii) The Bank shall be released and discharged from all liability under this guarantee / undertaking unless a written claim or demand is issued to the Bank on or before \_\_\_\_\_ or the date of expiry of any extension(s) thereof if this guarantee / undertaking has been extended.

The Bank doth hereby declare that Shri \_\_\_\_\_ who is authorized to sign this Guarantee /

Undertaking on behalf of the Bank and to bind the Bank thereby.

This \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_\_

Yours faithfully,

Signature : \_\_\_\_\_

Name &Designation : \_\_\_\_\_

Name of the Branch : \_\_\_\_\_

**FORM OF BANK GUARANTEE IN LIEU OF RETENTION MONEY / SECURITY DEPOSIT**  
**(To be executed on Non-Judicial Stamp Paper of Rs. 100/-)**

Page No.: 1 of 2

BRIDGE AND ROOFCO. (INDIA).LTD.,  
Kankaria Centre, (5th Floor),  
2/1, Russel Street,  
Kolkata - 700 071.

Dear Sirs,

In consideration of BRIDGE AND ROOF CO.(INDIA).LTD. (hereinafter called "The Company" which expression shall include its successors and assign) having awarded certain work for and relative to.....  
..... (name of the project/work) to ..... (name & address of the contractor) (hereinafter called the "Contractor") upon certain terms & conditions inter-alia mentioned in the Company's Letter of Intent No./Work Order No..... dated..... (hereinafter called the Contract, which expression shall include any formal contract entered into between the Company and the Contractor and all amendments and/or modifications in the Contract) inclusive of the condition that the Company may accept a Bank Guarantee of a Scheduled Bank in India in lieu of Cash Deposit of the Security Deposit as provided for in Clause No..... of the Contract :

We, ..... a body registered/constituted under(name of the Bank) the ..... having registered and Head Office at.....(hereinafter called "the Bank") at the request of the Contractor and with the intent to bind the Bank and its successors and permitted assigns, do hereby unconditionally and irrevocably guarantee payment to the company of the unpaid balance of the Security Deposit upto an aggregate limit of Rs.....(Rupees..... Only) AND undertake to pay the Company on demand & without protest or demur the unpaid balance of said Security deposit subject to the aggregate limit aforesaid of Rs.....(Rupees.....only).

AND the Bank do hereby further agree as follows :

1. The Guarantee/undertaking herein contain shall remain in full force and effect during the period that would be taken for the performance of the said contract and the claim of the Company relative thereto satisfied and/or discharged and the Company accordingly discharge the Guarantee/undertaking subject, however, that the Company shall have no claim under this Guarantee/undertaking after .....2008, unless a notice of the claim under this Guarantee/undertaking has been served on the Bank before the expiry of the said date, in which event the same shall be enforceable against the Bank notwithstanding that the same is enforced after the expiry of the said date namely .....
2. The Company shall have the fullest liberty without reference to the Bank and without affecting in any way the liability of the Bank under this Guarantee/undertaking, at any time and/or from time to time to anywise vary the said Contract and/or any of the terms & conditions thereof or relative to the said Security Deposit or to extend time of performance of the said Contract in whole or part or to postpone for any time and/or from time to time any of the obligations of the Contractor and/or power exercisable by the Company against the Contractor & either to enforce or forbear from enforcing any of the terms and conditions of or governing the said Contract or the said Security Deposit or the Securities available to the Company or any of them and the Bank shall not be released from its liability under these presents & the liability of the Bank shall remain in full force and effect notwithstanding any exercise by the Company of the liberty with reference to any or all the matters aforesaid or by reason of time being given to the Contractor or any other forbearance, act or omission on the part of the Company or any indulgence by the Company to the Contractor or of any other act, matter or thing whatsoever which under the law relating to sureties would, but for this provision, have the effect of releasing the Bank from its liability hereunder or any part thereof.

3. It shall not be necessary for the Company to proceed against the Contractor before proceeding against the Bank and the Guarantee/undertaking herein contained shall be enforceable against the Bank notwithstanding the existence of any other security for any indebtedness of the Contractor to the Company (including relative to the said Security Deposit) and notwithstanding that any such security shall at the time when claim is made against the Bank or proceedings taken against the Bank hereunder, be outstanding or unrealised.
4. The amount stated by the Company in any demand, claim or notice as the unpaid balance of the said security deposit for the time being shall as between the Bank and the Company for the purpose of these presents be conclusive of the said balance.
5. The liability of the Bank to the Company under this Guarantee/undertaking shall remain in full force and effect notwithstanding the existence of any difference or dispute between the Contractor and the Company, the Contractor and the Bank/and or the Bank and the Company, or otherwise whatsoever touching or affecting these presents or the liability of the Contractor to the Company, and notwithstanding the existence of any instructions or purported instructions by the Contractor or any other person to the Bank not to pay or for any cause withhold or defer payment to the Company under these presents, with the intent that notwithstanding the existence of such difference, dispute or instruction, the Bank shall be and remain liable to make payment to the Company in terms hereof.
6. The Bank shall not revoke this Guarantee/undertaking during its Currency except with the previous consent of the company in writings and also agree that any change in the constitution of the Contractor or the Bank or the Company shall not discharge the Bank's liability hereunder.
7. Notwithstanding anything herein contained our liability under this guarantee is restricted to Rs..... and our guarantee shall remain in full force till ..... (date) unless a suit or action to enforce the claim under this guarantee .....(date) is filed against Bank within three month from the above date i.e., on or before ..... (date) all your rights under the said guarantee shall be forfeited and Bank shall be relieved and discharged from all liabilities thereunder.
8. The Bank doth hereby declare that Shri ..... (name of the person signing on behalf of the Bank) who is ..... (his designation) authorised to sign this Guarantee/undertaking on behalf of the Bank & to bind the Bank thereby.

Dated this .....day of .....200

Yours faithfully,  
For .....

Signature

Name & Designation

Name of the Branch

**Format for INPUT TAX CREDIT**  
**TO WHOMSOEVER IT MAY CONCERN**

Legal Name of Entity	:	
Trade Name of Entity	:	
Registered Office Address	:	
Pin	:	
GSTIN	:	

Please select the applicable response under column C in respect of details set out in column "B".

Case No.	Aggregate Turnover at PAN level (in any preceding financial year from FY 17-18 onwards)	Select the applicable case
(A)	(B)	(C)
1.	More than INR 50 Crores	
2.	Less than or equals to INR 50 Crores	
3.	Specific category excluded from compliance to e-invoicing, as notified.	

I/We, .....of .....(hereinafter called as "the Company") do hereby declare that the aggregate turnover of "the Company" computed as per Section 2(6) of Central Goods and Service Tax Act., 2017 exceed limit prescribed for generation of an unique Invoice Registered Number (IRN) and QR code as per the provisions of Central Goods and Service Tax Act., 2017 and rules there under ("GST Law"). Accordingly, we are covered under the ambit of GST e-invoicing provisions w.e.f. 1<sup>st</sup> October,2020 and therefore, the invoices, debit notes, credit notes or any other prescribed documents under e-invoicing issued/raised by us duly compliance with the notified e-invoicing provision.

Further, any invoice or document issued by the Company to Bridge and Roof Co. (India) Ltd. having GSTIN: 19AABCB3166E1ZW shall be properly and timely reported under respective return under GST by the Company in line with the notified provisions and the applicable tax collected form Bridge and Roof Co. (India) Ltd. shall be timely and correctly paid to respective Government by us.

We acknowledge that information furnished above are true to the best of our knowledge. In case any of the above information is found to be incorrect at a later date or due to failure on our part to comply with the relevant laws/regulations and if any GST liability, interest, penalties or any other amount becomes payable or input tax credit is denied to Bridge and Roof Co. (India) Ltd. having GSTIN: 19AABCB3166E1ZW, we shall indemnify for the same.

**For and on behalf of** .....

**(Signature of Authorized Signatory )**

Name : .....



# **BRIDGE AND ROOF CO. (INDIA) LIMITED**

**BIDDING DOCUMENT NO.  
B AND R/HO/SMPK/61038/SOLAR-WORK/NIT/CW/01**

FOR

**Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.**

Volume – II

## **Price Part**

**BRIDGE AND ROOF CO. (INDIA) LIMITED  
KANKARIA CENTRE (4<sup>TH</sup> & 5<sup>TH</sup> FLOOR)  
2/1, RUSSEL STREET,  
KOLKATA - 700071**

# **Technical Specifications**

**ALL MATERIALS REQUIRED FOR THE ENTIRE WORK, TO BE SUPPLIED BY THE CONTRACTOR SHALL  
BE IN CONFORMITY WITH THE CPWD SPECIFICATIONS  
(LATEST REVISION)**

**THE DETAILED TECHNICAL SPECIFICATIONS & MAKE LIST (FOR DSR & NON-DSR) WILL BE AS PER  
CPWD SPECIFICATION LATEST REVISION AND BIS CODE OF STANDARDS.**

**ENCLOSED**



**ANNEXURE-P**

**DRAWINGS**

**ENCLOSED**

**PREAMBLE TO SCHEDULE OF QUANTITIES & RATES**

[ Tenderers are required to print this on their Company's Letter head and sign, stamp before uploading ]

1. The Schedule of Rates/Price shall be read with all other sections of this Bidding Document.
2. The Contractor is deemed to have studied the drawings, specifications and details of works to be done within the Time Schedule and should have acquainted himself of the conditions prevailing a site.
3. No claim shall be entertained during currency of this Contract towards any items due to the above including where the Contractor has quoted low/ high rates.
4. Owner / Consultant / B AND R reserves the right to interpolate or extrapolate the rates for any new item of work not covered in Schedule of Quantities & Rates from the similar items already available in Schedule of Quantities & Rates. All the works shall be measured upon completion and paid for at the rate quoted and accepted in the "Schedule of Quantities & Rates ". In case any activity though specifically not covered in Schedule of Quantities & Rates descriptions but the same is covered under scope of work/ scope of supply/ specification/ drawings etc. no extra claim on this account shall be entertained, since Schedule of Quantities & Rates is to be read in conjunction with all other documents forming part of the Contract.
5. All items of work mentioned in the Schedule of Quantities & Rates shall be carried out as per the specifications, drawings and instructions of Owner / Consultant / B AND R and the rates are deemed to be inclusive of material, consumable, labour, supervision, tools & tackles and detailing of construction drawings, isometric wherever required as called for in the detail specification and conditions of the Contract.
6. Owner / Consultant / B AND R reserves the right to cancel/ delete/ curtail any item or group of work if necessary. Such a step shall not be construed as reason for changing the rates.
7. The Schedule of Quantities & Rates (SOQR) rates are deemed to be inclusive of all taxes & duties i.e. **Purchase Tax, Turn Over Tax, Excise Duty, Work Contract Tax, LabourCess or any other Tax, Royalty, all incidental expenditure including Environmental & Pollution Clearance Charges etcexcept Goods & Services Tax (GST).**
8. Bidder shall indicate "**above / below / at par (0%) in single percentage basis rounded upto two decimal places** in the "Prices" sheet. Bidder shall not change rate / amount indicated in "Schedule of Quantities & Rates".
9. Bidder shall furnish the details as requested below along with this Preamble to Schedule of Quantities & Rates, to be submitted along with their price offer:

Name of authorized person submitting the tender on behalf of the Bidder (s):

Designation of authorized person:

Name of firm / Contractor:

Address of firm / Contractor:

Date:

## HELP FOR THE TENDERER / BIDDER WITH DSC

Instructions / Guidelines for tenders for electronic submission of the tenders have been annexed for assigning the agencies to participate in e-Tendering.

Any agencies willing to take part in the process of e-Tendering will have to be enrolled & registered with the Government e-Procurement System; through logging on to <https://eprocure.gov.in/eprocure/app> the agency is to click on the link for e-Tendering site as given on the web portal.

Each Tenderer is required to obtain DSC (Enlisted Class- III ) for submission of online e-tendering from any Certifying Authorities (CAs) certified by the Controller of Certifying Authorities (CCA) on payment of requisite amount , details are available at the Web Site [www.cca.gov.in](http://www.cca.gov.in)

**THE TENDERERS / BIDDERS CAN APPROACH ANY ONE OF THE FIVE CAS FOR GETTING DIGITAL SIGNATURE CERTIFICATE. THE WEBSITE ADDRESSES ARE GIVEN BELOW.**

[www.safescrypt.com](http://www.safescrypt.com)

[www.idrbtca.org.in](http://www.idrbtca.org.in)

[www.tcs-ca.tcs.co.in](http://www.tcs-ca.tcs.co.in)

[www.ncodesolutions.com](http://www.ncodesolutions.com)

[www.e-Mudhra.com](http://www.e-Mudhra.com)

<http://hrinfracon.com> [Is LRA and alliance partner of (n)Code Solutions (a div. of GNFC) ]

[www.crgcorporate.co/](http://www.crgcorporate.co/) [authorized agent of eMudhra Consumer Services Ltd. ]

Bids shall be submitted online only at CPPP website: <https://eprocure.gov.in/eprocure/app> Manual bids shall not be accepted. Tenderer / Contractors are advised to follow the instructions provided in the 'Instructions to Tenderer' for the e-submission of the bids online through the Central Public Procurement Portal for e-Procurement at <https://eprocure.gov.in/eprocure/app> before proceeding with the tender.

**FOR FURTHER INFORMATION, REGARDING SUBMISSION OF TENDER PLEASE VISIT TO BIDDER MANUAL KID**

<https://eprocure.gov.in/eprocure/app?page=BiddersManualKit&service=page>

### **ASSISTANCE TO BIDDERS**

- 1) Any queries relating to the tender document like terms and conditions should be addressed to the Tender Inviting Authority for a tender or the relevant contact person indicated below.

**Please send mail to:**

a) (Mr. M. Tewari) : [commercial@bridgeroof.co.in](mailto:commercial@bridgeroof.co.in) | Extn 269 / 298

**B and R office: - (033) 2217-4469 to 4473, 2217-4053/4054/4056.**

- 2) Any queries relating to the process of online bid submission or queries relating to CPP Portal in general like **page not loading, java error, unable to upload document, DSC etc....** may be directed as

**Please send mail to:**

a.) (Mr. Kalyan Karar) [eprocurement@bridgeroof.co.in](mailto:eprocurement@bridgeroof.co.in)

Ph: (033) 2217-4469 to 4473, 2217-4053/4054/4056 | Extn: - 295.

b.) (Shri. Barun Kanti Das) [barunkanti.das@bridgeroof.co.in](mailto:barunkanti.das@bridgeroof.co.in)

Ph: (033) 2217-4469 to 4473, 2217-4053/4054/4056 | Extn: - 268.

**NOTE:** Requesting bidder, first send an e-mail wait for an hour or so. Before making phone call Company holidays on (2<sup>nd</sup> & 4<sup>th</sup> Sat).

**APPROVED MAKE/MANUFACTURERS**

<b>Sl. No.</b>	<b>Item Description</b>	<b>Make</b>
<b>A</b>	<b>PV Section</b>	
1	Solar PV module	MNRE Approved
2	Connectors MC4	Phoenix Contact/Multi Contact/ Amphenol/Bizlink/ Staubli
3	Male MC4	Phoenix Contact/Multi Contact/ Amphenol/Bizlink/ Staubli
4	Female MC4	Phoenix Contact/Multi Contact/ Amphenol/Bizlink/ Staubli
5	In-Line-Fuse	Phoenix Contact/Multi Contact/ Amphenol/Bizlink/ Staubli
6	Solar String Inverter with Remote Monitoring System	Servotech, Microtech, Sukam, UTL Solar, Livguard, Luminous, Goldi solar , Epro Global , Lanto India , Smarten, Hitachi, ABB,Delta, Siemens,Havells
<b>B</b>	<b>Structures</b>	
1	Module mounting Structure (Ballast type) along with cement blocks	MS Sheet: Tata/SAIL/Jindal/ Vizag Steel Plant Reputed fabricators having hot dip galvanizing facilities
2	Civil foundation for module mounting structure	TMT: Tata/JSW/SAIL/ Vizag Steel Equivalent Cement : Dalmia, Ultratech, ACC
3	Nuts & Bolt, Plain Washers, Serrated washer & Spring Washer	Reputed Make
<b>C</b>	<b>Monitoring System and Accessories</b>	
1	Pyranometer	Kipp and Zonen SMP3
2	Module Back Surface Temperature sensor	IMT Germany, Yokogawa, Honeywell, ABB, Emerson, General Instrument , AN Instrument
3	Ambient temperature sensor	IMT Germany, Yokogawa, Honeywell, ABB, Emerson, General Instrument , AN Instrument , GIC
4	Wind sensors	FT Technology, Testo, Sivara Syatems and solutions , Edutek Instrumentation
5	Remote Monitoring and data acquisition system	Siemens, Rockwell , ABB, Schneider, Allen Bradly , Honeywell automation, Emerson Process Management,Phoenix Contact
6	Online UPS	Luminous/Microtek/Exide/ Hirel/ Tata Libert/ ABB
<b>D</b>	<b>DC side - Cables &amp; Accessories</b>	
1	All DC Cables	Lapp/Leoni/Siechem/APAR/ Thermo/ Suyog/ Paramount cable/ KEI Industry
2	All Earthing Cables	Siechem/Polycab/KEI/Thermo/ Suyog/ Paramount cable
3	Lightning Protection System( ESE Type )	Trinity Touch, Dehn,Phoenix Contact, Aplicaciones Tecnológicas SA
	Surge Protection System	Dehn,Phoenix Contact, Aplicaciones Tecnológicas SA
3	Polyamide (PA6) Flexible corrugated Conduit	Teknik, Interflex, Flexicon
<b>E</b>	<b>AC side - Cables &amp; Accessories</b>	
1	All AC Cables	Universal/ Torrent/ Asian cable industry/KEI/ Polycab/ RPG/ Havells/ Gemscab/ Delton / Paramount/ Golster
2	AC Combiner Box	Samptel Energy Pvt. Limited, Ishan Corporation, Starlite , Sunrise Technology or any reputed make
3	LT panel	L & T, Schneider, ABB, Siemens, Elecmech, GE, Alstom, C&S Electric LTD, Control & Schematic Ltd,ElectroCon Solution
4	AC Electrical accessories (Consumables like Lugs, Trefoils and trefoil clamps, Glands, Ferrules, Cable Ties, uPVC tape, uPVC saddle, Cable clips, Trafoil Clamp, Cable sealing etc.)	Any Reputed Make
<b>F</b>	<b>Sub Station</b>	
1	Power Transformer	Bharat Bijli, Voltamps, Kirlosokar, Voltas, General Electric, Schneider, Indotech Transformers Ltd, Transformer and Rectifier ( P ) limited
2	HV Switchgear	Siemens, ABB, GE India Industrial Limited , Voltas, Jyoti, Alstom, Schneider, L &T , BHEL, Kruggs
3	MV Switchgear	Siemens, ABB, GE India Industrial Limited , Alstom , Schneider, L &T , Fuji, Hitachi
4	DE UPS	Luminous/Microtek/Exide/ Hirel/ Tata Libert/ ABB
<b>H</b>	<b>Module Cleaning System</b>	
1	Module Cleaning System Water CPVC Pipe Line System For Module Cleaning With Suitable Hp Water Pump& Booster Pump With Associated Accessories.	Prasham Green, Arrow International, Ewilt Technology LLP or any Reputed make

Sl. No.	Item Description	Make
<b>I</b>	<b>Civil Works</b>	
1	Cement (PPC/PSC)	Ultratech/Dalmia/ACC
2	Ms Steel/Reinforcement	TATA/SAIL/Vizag/Jindal
3	Vitrified Tiles	Jhonson/RAK/Somany/Nitco
4	Ceramic Tiles	Somany/Kajaria/Jhonson/Nitco
5	Cement Concrete Tiles	Ultra/Eurocon/Somany
6	Water Proofing Compound	Sika/Pidilite/Cico/Dr Fixit
7	Paints	Asian/Berger/Ici Dulux/Nerolac
8	Glass	Modifloat/Asahi/Saintgobain
9	Putty	Birla/JK
10	Aluminium Sections	Jindal/Indal/OEL/Hindalco
11	Ceiling	Armstrong/Calciumsilicate/Anutone
12	Adhesive	Fevicol/Pidilite/Chandra chemicals
13	Flush Door	Alishan/Greenply/Mayur/Century/Merino
14	Laminates	Greenlam/ Merino /Century
15	Block Board & Plywood	Alishan/Greenply /Mayur/Century/ Merino
16	Locks	Godrej/Dooret/Hafelle/Dorma
17	Hardwares	Earlbihari/Dorma/Hafelle/Dorma/ Godrej
18	Cement Concrete Pipes	Indian Hume Pipe/Mm Metal & Co
19	Door Closer	Dorma/Hafelle/Hardwyn/Doorset/ Godrej
20	Frp Door	Rajashree/Darwaja
21	Aluminium Window	Wintech/Fenesta/Okotech
22	Upvc Door/Window	Fenesta/Wintech/Okotech
23	Steel Section	TATA/Jindal/SAIL
24	ACP Cladding	Alstone/Aludecor/Alstrong
25	Paver Block	Tuffstone/Equivalent
26	Galvanium Sheet	G.E Plastics/TATA/Bhusan
<b>J</b>	<b>Water Supply &amp; Sanitation Works</b>	
1	Vitreous Sanitary Ware	Hindware/Parryware/Jaquar/Kohler/Cera
2	Vitreous Urinal Partition	Hindware/Parryware/Jaquar/Kohler
3	Bib Cock & Cp Fittings	Jaquar/Hindware/Parryware/Kohler/Cera
4	CPVC Pipes & Fittings	Ajaya/Astral/Ashribad/Supreme
5	GI Pipes	Tata/Jindal
6	CI Pipes	Kirlosker/Venus/Sushila
7	SWR Pipes	Hind/Orissa/Orind/Ashribad/ Supreme/Kishan



PROJECT TITLE :	2.30MWp ROOF MOUNTED, GRID CONNECTED SOLAR PV POWER PLANT AT SPMP KOLKATA
TITLE :	DETAIL PROJECT REPORT FOR SOLAR PV POWER PLANT
DOCUMENT NO. :	NITCON-SPMP-OTH-DOC-04_TECHNOLOGY SELECTION_Rev-00

**DETAIL PROJECT REPORT FOR  
2.30MWp GRID CONNECTED  
ROOF MOUNTED SOLAR PV POWER PLANT**

**PROJECT LOCATION:  
KIDDERPORE DOCK-II  
AT SYAMA PRASAD MOOKERJEE PORT, KOLKATA  
(MULTIPLE ROOF)**

00	28-03-2023	INITIAL SUBMISSION	RM	VM	IPS
Rev	Date	Description	Prepared	Reviewed	Approved

PROJECT TITLE :	2.25MWp ROOF MOUNTED, GRID CONNECTED SOLAR PV POWER PLANT AT SPMP KOLKATA
TITLE :	DETAIL PROJECT REPORT FOR SOLAR PV POWER PLANT
DOCUMENT NO. :	NITCON-SPMP-OTH-DOC-04_TECHNOLOGY SELECTION_Rev-00

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## 1. ABOUT SYAMA PRASAD MOOKERJEE PORT, KOLKATA (SPMP)

Port of Kolkata or Kolkata Port, officially known as Syama Prasad Mookerjee Port Trust (formerly Kolkata Port Trust), is the only riverine major port of India,[12] located in the city of Kolkata, West Bengal, around 203 kilometres from the sea. It is situated on the left bank of the Hooghly River It is the oldest operating port in India. Kolkata is a freshwater port with no variation in salinity. The port has two distinct dock systems — Kolkata Dock at Kolkata and a deep water dock at Haldia Dock Complex, Haldia.

## 2. TARGET BENEFICIARIES

In present times, the world has been adopting renewable power at a rapid rate. India is also emerging in the global arena as a leading generator of renewable energy. Rooftop solar panels utilize sunlight to convert it into electricity. India is situated at an ideal geographical location and receives ample tropical sunlight. There are almost 300 sunny days with clear skies each year in India. Thus, rooftop solar panels are ideal to be used here.

The main beneficiaries will be the **Syama Prasad Mookerjee Port, Kolkata**, which are using the unused roof space of the warehouse for generation of clean and green energy from PV solar power plant.

Industrial buildings / warehouse are characterized with the irrelatively better are as which facilitates ready deployment of photovoltaic(PV) systems on the roof top. However, increasing generation capacity also implies higher capital investment.

It is demonstrated that the solar PV system could prove to be viable since the diesel prices are increasing and PV systems prices are coming down.

Main stream applicability of Solar PV for diesel abatement and grid replacement in commercial establishments is driving companies to adopt Solar as available Technology and Investment.

### **Major benefits of the PV Solar system are below:**

A clean and green energy source.

Solar energy is pollution free and does not emit greenhouse gases.

Renewable clean energy available every day of the year.

Low Maintenance Costs

Suitable for Indian Climate



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### 3. PROPOSED PROJECT LOCATION

#### 3.1 PROJECT BRIEF

The proposed project for 2.25 MWp Solar power plant at 5 warehouse terrace will generate electricity from non-conventional sources, using mono-crystalline technology with blast type fixed tilt (15 degree) module mounting structure solution on Roof Top. This project envisages generation of safe and reliable electricity in an environment friendly way.

#### 3.2 PROJECT DETAIL

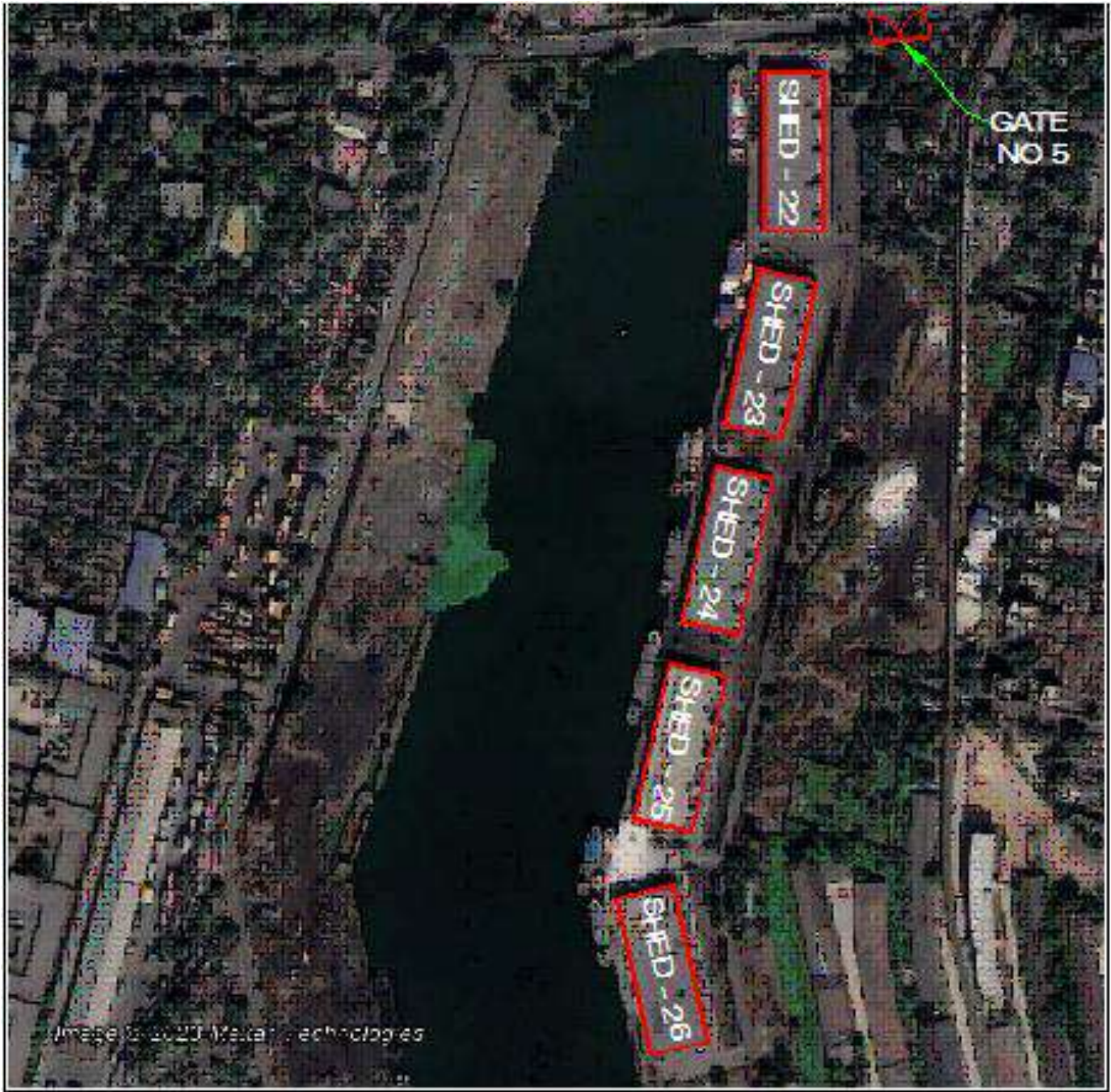
Plant Capacity	– 2.25MWp
Plant Type	– Grid Connected Solar PV Power Plant
Surface Type	– Rooftop (Flat Roof)
Type of Roof	
Shed 22 to 25	– Arch Roof mounted on structural member, with lime terracing on top & water proofing APP membrane applied over it
Shed 26	– Sheet metal deck slab mounted on structural member, with lime terracing on top & water proofing APP membrane applied over it
Height of Roof	– Ground Floor + First Floor (Approx 10.3 mtrs)
Site Location	– Kidderpore Dock-II, Syama Prasad Mookerjee Port, Kolkata
<b>Latitude &amp; Longitude</b>	<b>– 22°32'14.79"N &amp; 88°18'52.22"E</b>

Basic Wind Speed – **50 Meters per Second (180Km/h) As per IS 875 (Part-3) 2015**

The available cumulative roof area including all five shed (Shed no 22 to shed no 26) is 24,699 Sq Mtr (approx.) to implement 2.3 MW power plant. The distance from substation location to nearest shed that is Shed No 22 is nearly 21 Meters. The site has a decent irradiation level of 4.88 kWh/m<sup>2</sup>/day.

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### 3.3 PROJECT LOCATION :



Google Earth Image of Site

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### 3.4 BUILDING / ROOF DETAIL :

S.No.	Building Name	Latitude	Longitude	Azimuth Angle of Building W.R.T. South	Area of Roof (Sq. Mtrs)
1	Shed 22	22°32'14.99"N	88°18'52.15"E	0 ° (True South)	4751.25
2	Shed 23	22°32'9.98"N	88°18'51.64"E	12.5 ° (South-West)	4784.26
3	Shed 24	22°32'4.92"N	88°18'50.42"E	12.5 ° (South-West)	4758.59
4	Shed 25	22°32'0.04"N	88°18'49.16"E	12.5 ° (South-West)	4756.14
5	Shed 26	22°31'54.76"N	88°18'48.95"E	12.5 ° (South-East)	5648.60

### 3.5 SITE SNAP :



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**ACCESS FOR THE TERRACE**

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### ROOF SLAB FROM INSIDE



### SHED ROOF



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### SHED – 23 ROOF



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### MUMTY ON ROOF





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#### 4. DESIGN PHILOSOPHY

The main objective of the design philosophy is to construct the plant with in-built Quality and appropriate redundancy to achieve high availability and reliability with minimum maintenance efforts. Selection of the equipment and adoption of a plant layout to ensure ease of maintenance.

SPV power plant should be designed to operate satisfactorily in synchronization with the grid within permissible limits of high voltage and frequency fluctuation conditions. It is also extremely important to safeguard the system during major disturbances, internal and external surge conditions while ensuring safe operation of the plant.

The plant Data Acquisition and control system should be designed to ensure high availability and reliability of the plant to assist the operators in the safe and efficient operation of the plant with minimum effort.

Use of equipment and systems with proven design and performance that have high availability track records under similar service conditions.

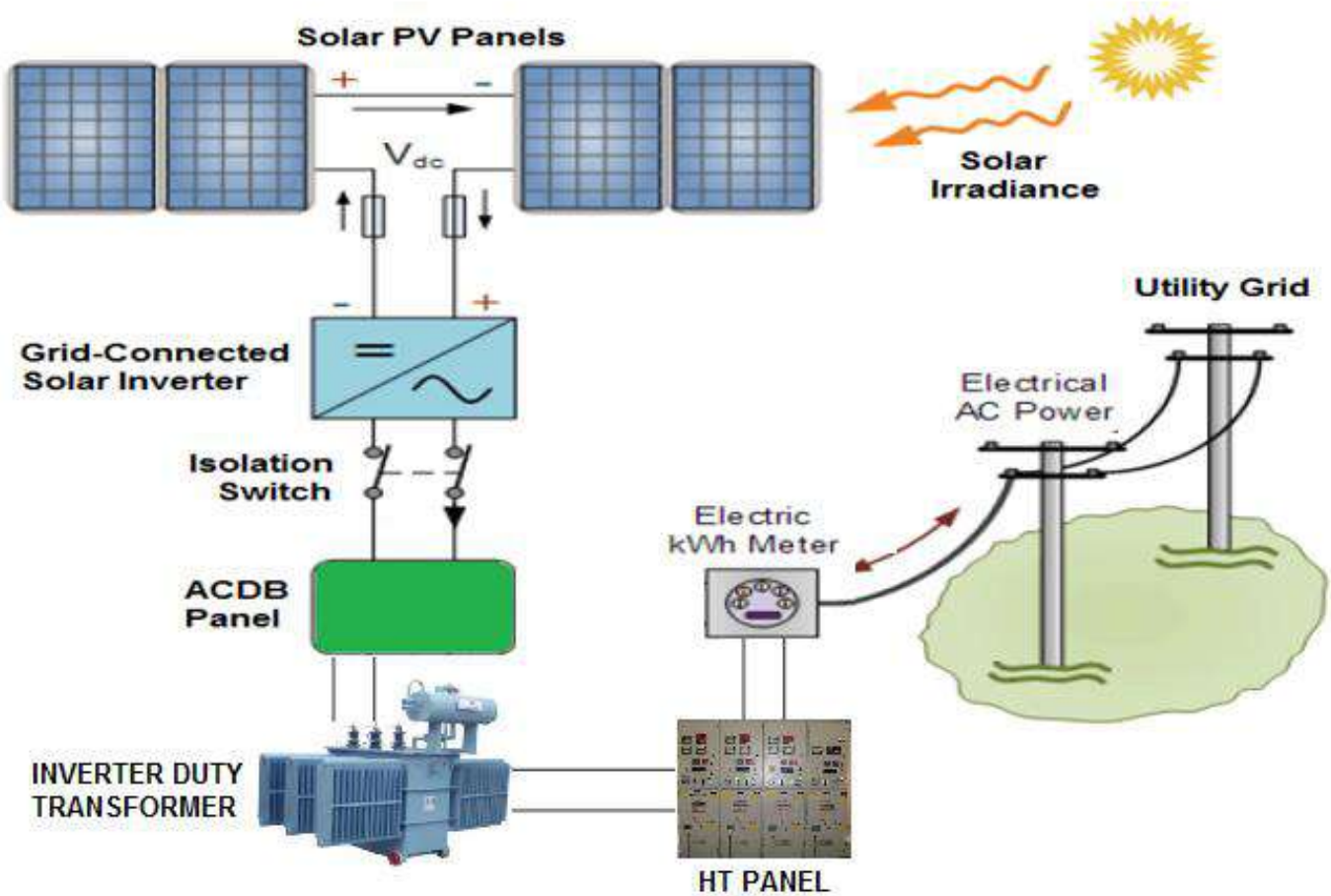
The solar PV panels typically produce DC electricity that is fed to a grid interactive inverter, which in turn converts the DC electricity into AC electricity at a required voltage level. To obtain higher system voltage, the output of the inverter is fed to step up transformer to increase the voltage level to the desired voltage level. After the transformer, the output power is routed through high voltage panels and other necessary protection and measurement equipment before terminating to the grid.

When evaluating a prospective site, we consider a variety of physical factors, including:

- Available Space on Roof
- Roof Height
- Safty of Water Proofing System on Roof / Roof safty
- Roof Orientation

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- Local wind speed
- Solar Irradiance
- Geotechnical/Structural Characteristics
- Interconnection Requirements
- Distance to Point Of Interconnection Voltage
- Local Permitting Authority
- Environmental Permitting Considerations



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## 5. TECHNOLOGY SELECTION

The main equipment of a rooftop solar PV system are following components listed below:

- Solar PV Modules
- Module Mounting Structure
- Inverter
- Junction Box / Combiner Box
- Cables
- Connectors
- Lightening Protection System
- Earthing and Surge Protections
- Power Evacuation Infrastructure
- Monitoring System
- Weather Monitoring System

### 5.1 Solar PV Modules

Photovoltaic comprises the technology to convert sunlight directly into electricity. The term "photo" means light and "voltaic," electricity. A photovoltaic (PV) cell, also known as "solar cell," is a semiconductor device that generates electricity when light falls on it.

Traditional solar cells are made from silicon. Thin-film solar cells are made from amorphous silicon or non-silicon materials such as cadmium telluride.

There are 4 major types of solar panels available on the market today

- a. **Monocrystalline solar panels**
- b. **Polycrystalline (or Multi-crystalline) solar panels**
- c. **Passivated Emitter and Rear Contact cells (PERC) solar panels**
- d. **Thin-film solar panels**

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### 5.1.1 Monocrystalline solar panels:

Mono-crystalline Silicon panels has a continuous crystal lattice structure with practically zero defects or impurities. The monocrystalline solar panels are also known as the single crystal panels. They are made from pure silicon crystal which is sliced into several wafers forming cells. These wafers are cut to an octagonal shaped wafer because of which they get their unique look and uniform colour. They can be easily identified by their black or dark blue colour, as they are made from pure silicon.

Within monocrystalline solar panels, there is a technology known as **Half Cut cells**. Here the square shaped cells are cut in half, so there are twice the number of cells. The top half of the panel has all cells connected in one series and the bottom half in another series. This allows the panel to continue power generation in the top half even if there is a shadow on the bottom half of the panel. Thus the overall power generation from half cut cells is higher in installations with partial shadow issues.

Feature of Monocrystalline Solar Panels :

- Mono-crystalline Silicon is superior to other types of silicon cells in terms of higher efficiencies – which are typically around 20-23%.
- The monocrystalline panels are more expensive as compared to other panels since the manufacturing process of single-crystal silicon cells is complex.
- Mono-Crystalline panels are mostly considered where the space is limited as in the case of rooftops.
- The lifespan of mono-crystalline cells is a minimum of 25 years and can go more
- The monocrystalline panels display higher heat resistance as compared to other panels
- Being high efficiency module, higher wattage can be obtained in less space.

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### 5.1.2 Polycrystalline (or Multi-crystalline) solar panels:

Multi-crystalline (or poly-crystal) silicon panels are made by using polycrystalline wafers. The polycrystalline solar panels are composed of multiple silicon crystals. They are made from silicon fragments that are melted and poured into square molds. Once these crystals are cooled, they are sliced into thin wafers and assembled together to form a polycrystalline solar panel. They are also known as “multi-crystalline” panels.

Feature of Polycrystalline (or Multi-crystalline) solar panels:

- Due to the less pure crystals, the efficiency of these cells reduces and the module efficiencies typically range in between 16-18%.
- The lifetime of these modules is also around 25 years or more.
- The polycrystalline panels can be identified by the square shape of the cells and shining blue hue with straight edges.
- These panels are more affordable than monocrystalline solar panels as the manufacturing process is simpler and less silicon is wasted during the whole process. These panels are cheaper option where the space is not a limitation.

### 5.1.3 Passivated Emitter and Rear Contact cells (PERC) solar panels

Also known as 'rear cells', PERC solar panels are manufactured using advanced technology. It is done by adding a layer on the back of solar cells. The traditional solar panels absorb sunlight only to some extent and some light passes straight through them. The additional layer in the PERC panels allows this unabsorbed sunlight to be absorbed again from the rear side of the panels, making it even more efficient.

Nowadays, PERC technology is typically combined with Monocrystalline cells to produce high efficiency Mono-PERC panels which have the highest power ratings among commercially available solar panels. The efficiency of these panels are 20 to 24%.

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Feature of Passivated Emitter and Rear Contact cells (PERC) solar panels:

- PERC solar panels are more efficient as compared to traditional solar panels as they absorb more sunlight.
- The PERC panels are more expensive as compared to any other panels
- The lifespan of mono-crystalline cells is a minimum of 25 years and can go more
- The advent of new cell architectures has allowed for higher efficiency levels in solar PV modules.

#### **5.1.4 Thin-film solar panels :**

Thin-film solar panels are manufactured using photovoltaic substances which include Amorphous silicon (a-Si), copper indium gallium selenide (CIGS) and cadmium telluride (CdTe). These substances are deposited onto a solid surface such as glass, metal or plastic making it lighter and easy to install. However the efficiency of these panels is low and is around 7%

Categories of Thin-film solar panels as following:

- Cadmium telluride (CdTe)
- Amorphous silicon (a-Si)
- Copper indium gallium selenide (CIGS)

Feature of Thin-film solar panels:

- Thin-film solar cells are comparatively lightweight and more flexible than traditional silicon panels, thus making them easy to install.
- They are less efficient compared to silicon crystalline panels.
- They are comparatively cheaper than the any other panels.
- These types of panels are most suitable for large ground mount and wide open space locations with very low land cost.

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### 5.1.5 Comparison of Different Types of PV Modules

S.No	Particulars	Monocrystallin -PERC	Monocrystalline	Polycrystalline	Thin- film
1	Efficiency	Highest (Approx. 18-24%)	High (Approx. 18-23%)	Medium (Approx. 13 to 18 %)	Lower (Around 7%)
2	Cost	Highest	High	Medium	Lower
3	Lifespan	More than 25 years	More than 25 years	25 years	25 years
4	Performance ( Degradation )	0.5 - 0.8 % per year	0.5 - 0.8 % per year	0.5 - 1 % per year	0.7 - 1.5% per year
5	Appearance	Black and rounded edges	Black/ Darker colour with octagonal shape	Blue colour with square edges	Deends on the variant

**Note: Monocrystalline PERC panels are advance feature of Monocrystalline technology and we recommend to use this Monocrystalline PERC technology. In drawing we may refer it as Monocrystalline panels.**

### 5.1.6 Solar PV Module Recommendation :

Each of the above technologies has their own particular strengths and limitations. Monocrystalline solar photovoltaic technology panels is recommended for the rooftop project of easy availability, cost effectiveness and technological stability. In monocrystalline panel the latest technology is Half cut cell having high efficiency and lesser effect of shadow if any. Most of the manufacturing units has shifted to MONO half cut cell and as per the market trend other technologies shall be obsoleted within in year or so. Seeking all the market trend in terms of production, availability and efficiency, we recommend **Monocrystalline - PERC Solar PV Module** for 2.25MW project.

## 5.2 Inverter Technologies

An inverter is one of the most important equipment in a solar energy system. An inverter is an electrical device which converts direct current (DC) electricity, which is what a solar panel generates, to alternating current (AC) electricity. It is also known as Power Conditioning Unit (PCU). A inverter consists of an electronic Inverter along with associated control, protection

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and data logging devices. Typically the utility scale inverters are unidirectional and supply the power to the grid in the form of AC power conforming to IEC 61727 or equivalent standard. The inverter has a feature that it automatically adjusts with the grid conditions such as the voltage & frequency levels to suit the Grid. The Inverter have provisions of automatically 'wake up' in the morning and begin to export power provided there is sufficient solar energy and the grid voltage and frequency is in range.

There are mainly two category of solar inverters are available on the market today.

- a. **Central Inverter**
- b. **String Inverter**

### **5.2.1 Central Inverter:**

A central inverter is generally adopted for ground mount MW scale plant. The central inverter takes input from number of arrays and operates at single MPP. Large arrays of solar panels are all connected to one combiner box and from there all the DC power is directed to the central inverter. Hence the inverter MPP (maximum power point) is governed by the arrays which are having partial shading, mismatch losses, modules with tolerances which may lead to reduce output. The main advantage of central inverters is the low cost as compared to string inverter and ability to produce much higher power (range in size from as big 4.5MW to as small as 500kw).

There are some drawbacks also as compared to string inverter as higher replacement cost and potential for a single point of failure even if a single panel is shaded or fails due to some other reason, it will affect the performance of the entire system. The protective environment is required to place the central inverter.

Central inverters typically do not have many MPPTs, mostly central inverters only have 1 or 2 MPPTs per inverter.

### **5.2.2 String Inverter:**

String inverter can handle comparatively less power than central inverter. String inverter is directly attached to each solar panel. The String inverter has MPPT (multi power point tracker) technology. The inverter has MPPT control algorithm in such a way that it adjusts itself with the voltage of SPV array to optimize solar power. This dramatically increased the efficiency of



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inverters. Inverter having more MPPTs and shorter strings will result in greater efficiency, and it will also give more flexibility for plant design using different module orientations, different elevations, different hours of sunlight and different shadow profiles without sacrificing production.

String inverters started having more and more MPPTs, which means more and more efficient power production, but also a relative increase in cost. Central inverters typically do not have many MPPTs, many central inverters only have 1 or 2 MPPTs per inverter, while string inverters can have as many as 10 to 12 MPPTs per inverter.

String inverters are less powerful and smaller than central inverters, but these characteristics are beneficial in a rooftop solar project. Their light weight and overall flexibility and modularity make them ideal for wall mounting within small commercial environments. The range of string inverters starts from 10 KW to 100kW in LV and 250kW in HV.

Most of rooftops are installed with string inverter. The maximum capacity of string inverter is 120kW in case of feeding voltage is 415V and 250kW in case of feeding voltage is 800V and above.

### 5.2.3 Inverter Recommendation :

As there are 5 nos sheds for installing solar PV system, which having different orientation with respect to true south. So, string inverters would be best suited for this rooftop solar pv power plant project.

Hence a **string inverter** is recommended for this rooftop project.

### 5.3 Module Mounting System:

Solar mounting structures are most important for the efficient working of a solar power system. PV modules must be mounted on a stable, durable structure that can support the modules and withstand wind, rain, hail, and corrosion over decades.

The designing of module mounting structure and its foundation or grouting arrangement mainly depends on two factors wind load and tilt angle.

The material of the structure is to be selected in such a way that it will work for at least 25 years with the local environmental conditions. Nut & bolts, supporting structures including Module Mounting Structures shall have to be adequately protected from atmosphere and weather prevailing in the area.

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Module mounting structures are mainly made of three types of materials. These are aluminum, galvanized iron (GI) sheets & MS sheet with hot dip galvanization.

### Structure Recommendation :

The module mounting structure for this project should be made of **mild steel sheet (CRCA sheet) and galvanizing HDGI (Hot Dip Galvanized) with minimum 85 microns coating.**

The fasteners should be of stainless steel - SS 304 Grade.

As the site location is near watersource, non other than HDGI structure shall be used to avoid any kind of rust and for long life.

## 6. RECOMMENDED COMPONENTS AND BOS (BALANCE OF SYSTEM)

### 6.1 Photovoltaic Solar Modules / Panels

We recommend **Monocrystallin-PERC** Solar Panel of minimum 540Wp and above wattage for this project. We have considered 540 Wp Solar PV Module in the present design.

The module should be PID resistant. The front glass used to make the crystalline silicon modules shall be toughened low iron glass with minimum thickness of 3.2 mm (2.5mm for glass-to-glass frameless & 2.0mm for glass to glass framed module). The glass used shall have transmittance of above 90% and with bending less than 0.3% to meet the specifications. The module frame shall be made of anodized Aluminium, which shall be electrically & chemically compatible with the structural material used for mounting the modules. It is required to have provision for earthing to connect it to the earthing grid. The anodization thickness shall not be less than 15 microns. PV Module shall have a RFID tag as per MNRE guidelines and must be able to withstand harsh environmental conditions.

#### Technical Requirements

<b>Cell type</b>	<b>: Mono-crystalline</b>
<b>Module Efficiency</b>	<b>: ≥19 % for Mono-crystalline</b>
<b>Rated power at STC</b>	<b>: No negative tolerance</b>
<b>Temperature co-efficient of power</b>	<b>: Not less than -0.4%/°C</b>

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## 6.2 Inverter

We recommended **String Inverter** for this rooftop project.

As Solar PV array produce direct current electricity, it is necessary to convert this direct current into alternating current and adjust the voltage levels to match the grid voltage. Conversion shall be achieved using an electronic Smart Inverter and the associated control and protection devices.

Maximum power point tracker (MPPT) shall be integrated in the inverter to maximize energy drawn from the Solar PV array. The MPPT voltage window shall be sufficient enough to accommodate the output voltage of the PV array at extreme temperatures prevailing at site.

Inverter shall consist of an electronic three phase inverter along with associated control, protection, filtering, measurement and data logging devices.

### Technical Requirements

<b>Type</b>	<b>:String</b>
<b>Rated AC power</b>	<b>: As per Design (In the present design, 125 kW and 25 kW are considered)</b>
<b>Switching devices</b>	<b>: Microprocessor / DSP (Digital Signal Processor)</b>
<b>Nominal AC output voltage and frequency</b>	<b>: 415V, 3 Phase, 50 Hz</b>
<b>Output frequency</b>	<b>: 50 Hz</b>
<b>Grid Frequency Synchronization range</b>	<b>: + 3 Hz or more</b>
<b>Ambient temperature considered</b>	<b>: -20o C to 50o C</b>
<b>Humidity</b>	<b>: 95 % Non-condensing</b>
<b>Protection of Enclosure</b>	<b>: IP-65 (Minimum) for outdoor.</b>
<b>Grid Frequency Tolerance range</b>	<b>: + 3 Hz or more</b>
<b>Grid Voltage tolerance</b>	<b>: - 20% &amp; + 15 %</b>
<b>No-load losses</b>	<b>: Less than 1% of rated power</b>
<b>Inverter efficiency(minimum)</b>	<b>: &gt;93%</b>
<b>Total Harmonic Distortion</b>	<b>: Less than 3%</b>

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### 6.3 Module mounting structure

The module mounting structure for this project should be made of mild steel sheet (CRCA sheet) and galvanizing HDGI (Hot Dip Galvanized) with minimum 85 microns coating with self blast type. Each structure should have angle of inclination 15 degree as we consider in present drawing as per the site conditions to take maximum irradiation.

The Mounting structure shall be so designed to withstand the basic wind speed of **180km/hour**. Suitable fastening arrangement such as grouting and clamping should be provided to secure the installation against the specific wind speed.

The mounting structure steel shall be as per latest IS 2062: 1992 and galvanization of the mounting structure shall be in compliance of latest IS 4759.

The fasteners used should be made up of stainless steel. The structures shall be designed to allow easy replacement of any module. The array structure shall be so designed that it will occupy minimum space without sacrificing the output from the SPV panels.

Installation of solar structure should not damage the roof in any way. The concrete foundation or blast shall be cast on site or pre-cast type. It will be ensure that the total load of the structure (when installed with PV modules) on the terrace shall be less than 60 kg/m<sup>2</sup>.

As per the design of the module mounting structure the total load of the structure on the roof (when installed with PV modules) on the shed shall be as follows.

S.No.	Building Name	Total Dead Load on Terrace (kg/Sq.Mtrs)	Remarks
1	Shed 22	64.23	Refer Drawing of MMS Layout with Marking Plan Annex. 3A, 3B, 3C, 3D & 3E
2	Shed 23	63.56	
3	Shed 24	62.69	
4	Shed 25	63.32	
5	Shed 26	63.6	

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## 6.4 Cables

### DC Cables:

Solar cable is the interconnection cable used in photovoltaic power generation. A solar cable interconnects solar panels and other electrical components of a photovoltaic system. Solar cables are designed to be UV resistant and weather resistant. It can be used within a large temperature range and are generally laid outside.

One common factor for most of the photovoltaic power systems is outdoor use, characterized by high temperatures and high UV radiation. Single-core cables with a maximum permissible DC voltage of 1.8 kV U<sub>max</sub>.

The phase to ground DC voltage rating must be U<sub>o</sub>1.5kVDC and a temperature range from -40 °C to +90 °C ambient, 120 °C on the conductor for 25 year service life against thermal ageing. Ambient temperature and conductor temperature is derived from the Arrhenius law for ageing of polymers-ageing of polymers doubles for every 10 °C rise. DC string cables must be class II double insulated to protect against short circuits and ground faults.

<b>DC CABLE (Modules to Inverter)</b>	
Size (cable from modules to T-connector)	<b>Single core 4.0 sq.mm Cu. Multi strand flexible solar grade cable</b>
Conductor Temperature Range	-40 °C to +120° C
Nominal Voltage	1000 V DC
Voltage	1.8KV DC
Type	<ul style="list-style-type: none"> <li>- Annealed Tinned Copper</li> <li>- Flexible type conductor</li> <li>- Class-5</li> </ul>
Properties	UV Resistant, Ozone & Flame Resistant Weather & Abrasion Resistant
Approval	TUV (2PFG 1169/08.2007) RoHS Conformity
Colour Codes	<ul style="list-style-type: none"> <li>- Positive :Red</li> <li>- Negative :Black</li> </ul>
Applicable standard	IEC60228

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### LT Cable :

1.1kV Grade, Cu. / Al Conductor XLPE cable will be used between outgoing from solar string inverter to combiner ACDB panel and between other feeder panel. These cables will be laid on conduit / cable tray / trench. The cable will confirm to relevant IS standards.

AC CABLE ( From Inverter to ACDB Panel)	
Size	4C x 35 sq.mm & 4C x 70 sq. mm Cu XLPE cable, PVC Insulated
Temperature Range	90 Deg. C Maximum
Conductor	Copper as per Class 2 of IS:8130/84.LatestRevision
Insulation	XLPEasperIS7098(Pt-1)/88,LatestRevision
Armouring	GI Flat Armouring
Outer Sheath	ExtrudedPVCTypeST2asperIS:5831/84
Nominal Voltage	1.1KV (1.5KV DC)
Applicable Standard	IS8130/84,IS7098PartI/88,IS5831/84,IS

AC CABLE ( Field ACDB Panel to Main Solar ACDB Panel)	
Temperature Range	90 Deg. C Maximum
Conductor	Aluminum as per Class 2 of IS:8130/84.LatestRevision
Insulation	XLPE as perIS7098(Pt-1)/88,LatestRevision
Armouring	Aluminum Flat Armouring
Outer Sheath	ExtrudedPVCTypeST2asperIS:5831/84
Nominal Voltage	0.6/1 (1.2)kV
AC Test Voltage	3.5kV/5Min.
Applicable Standard	IS8130/84,IS7098PartI/88,IS5831/84,IS3975/88 Latest with upto date amendments

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AC CABLE (From Inverter duty transformer to HT Panel)	
Size	3Cx 240 sq.mm Al., Armoured, Multistranded XLPE Insulated(Earthed)
Temperature Range	90 Deg. C Maximum
Conductor	H4GradeStrandedAluminum
Conductor Screening	Extruded Semi-conducting compound
Nominal Voltage	6.6 / 11kV Earthed Cable
Insulation	XLPEasperIS:7098/II/85shielded with extruded layer of semi-conducting cross-linked polyethylene with triple extrusionprocess
Insulation Screening	Extruded semi-conducting compound followed by layer of copper tapes
Inner Sheath	Extruded PVCST-2asperIS:5831
Outer Sheath	FRLSPVC Type ST-2 as per IS-5831
Conductor Shielding	Extruded layer of semi-conducting cross-linked polyethylene compound over the conductor
Armour	Galvanized flat steel strips as per IS:3975
Applicable Standard	IEC60332-3,IS:7098/II/85

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## 6.5 Connectors

PV connectors are single-contact electrical connectors commonly used for connecting solar panels. MC4 stands for the manufacturer Multi-Contact and a 4 for the 4mm (diameter) contact pin. MC4s allow strings of panels to be easily constructed by pushing the connectors from adjacent panels together by hand, but require a tool to disconnect them to ensure they do not accidentally disconnect when the cables are pulled. The MC4 and compatible products are universal in the solar market today, equipping almost all solar panels produced since about 2011. Originally rated for 600 V, most versions since are rated to 1000 V, which allows longer strings to be created.

Sl.No.	Description	Specification for MC4 Connectors
1.	Connector System	4 sq mm Cu DC Cable
2.	Rated Voltage	1000VDC (IEC)
3.	Rated Current	30Amps
4.	Test Voltage	6kV (50 Hz, 1 min)
5.	Ambient Temperature Range	-40 Deg. C to +90Deg. C
6.	Upper Limiting Temperature	105Deg. C
8.	Overvoltage Category/Pollution Degree	CATIII /2
9.	Contact resistance of Plug connectors	0.5m Ohms
10.	Safety Class	II
11.	Contact System	MC Multilam
12.	Type of termination	Crimping
13.	Contact Material	Copper, tin plated
14.	Insulation Material	PC/PA
15.	Locking System	Snap-in
16.	Flame Class	UL94-V0
17.	Cable Strain relief according to	EN50521:2008



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## 6.6 Earthing and Surge Protection

Each array structure of the PV plant yard will be fixed properly. In addition, the lightning arrestor/masts will be provided inside the array field, if necessary. Provision will be kept for shorting and grounding of the PV array at the time of maintenance work. All metal casing/shielding of the plant will be thoroughly grounded in accordance with MNRE standards. Earth Resistance will be tested and earthing will be done by calibrated earth tester. Each array structure of the PV yard should be grounded/ earthed properly as per IS: 3043-1987.

DC & AC Earthing should be separate.

Grounding/Earthing should be as per IS: 3043-1987 & IEEE 90.

DC & AC Earthing should be separate.

Total resistance should be <1.5 Ohm for Array Yard, and <1 Ohm for LA

## 6.7 Lightning Protection

ESE type lightning arrestors will be installed to cover the entire PV area on the roof from lightning protection. Protection will meet the safety rules as per International Standards NFC –C 17 102.



**Early Streamer Emission (ESE) Type Terminal**

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We are installing ESE type lightning arresters on each roof mumty to protect the entire PV field with following specification.

AIR TERMINAL PROTECTOR HEIGHT : 5 MTRS (MINIMUM)

LEVEL : III

QUANTITY : 1 NOS ON EACH ROOF

EARTHING FOR LA : TRIPOD EARTHING PIT

For ESE type lightning arrester, the required radius of protection for the roof will be as follows.

S.No.	Building Name	ESE Type LA with Radius of Protection	Remarks
1	Shed 22	97 MTRS.	Refer Drawing of LIGHTNING ARRESTER SYSTEM LAYOUT Annex. 5A, 5B, 5C, 5D & 5E
2	Shed 23	97 MTRS.	
3	Shed 24	97 MTRS.	
4	Shed 25	97 MTRS.	
5	Shed 26	75 MTRS.	

## 6.8 LT panels (ACDB Panel)

AC Distribution Panel Board (ACDB) shall control the AC power from string inverter, and should have necessary surge arrestors with suitable rating

All switches and the circuit breakers, connectors should conform to IEC 60947, Part I, II and III/ IS60947 Part I, II and III.

All cables shall be terminated onto a busbar by means of suitable MCB/MCCB.

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ACDB Panels shall be metal clad, totally enclosed, rigid, floor mounted, air - insulated, cubical type suitable for operation on three phase 415 volts, 50 Hz

Cable alley design needs to be compatible to allow easy access depending upon the number of AC Cables into the panel. Minimum width of cable alley shall be 300 mm. Location of bus bars should be such so as to avoid any overlapping/looping of cables in the panels.

Connections of cable with the bus bars should be properly tightened and check nuts must be provided to avoid any possibility of loosening of connections.

Bare/exposed portion of terminal/cables should be covered with appropriate sleeves instead of wrapping insulating tape.

<b>Type</b>	<b>: Outdoor</b>
<b>Nominal AC output voltage and frequency</b>	<b>: 415V <math>\pm</math> 10%,, 3 Phase, 3 Phase, 4 wire, Neutral Solidly Earthed</b>
<b>Output frequency</b>	<b>: 50 Hz</b>
<b>Grid Frequency Synchronization range</b>	<b>: + 3 Hz or more</b>
<b>Ambient temperature (Minimum)</b>	<b>: 45 degree Celsius</b>
<b>Humidity</b>	<b>: 90 % and dusty weather</b>
<b>Protection of Enclosure</b>	<b>: IP65 or better.</b>
<b>Light</b>	<b>: Tube Light (20W)</b>

All the 415 Volt AC devices / equipment like bus support insulators, circuit breakers, VTs etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under the following supply conditions .

<b>Variation in supply voltage</b>	<b>: +/- 10 %</b>
<b>Variation in supply frequency</b>	<b>: +/- 3 Hz</b>

## 6.9 Inverter Duty Transformer

Transformer will be 2.5MVA, 3 phase, 50Hz, 2 winding Inverter Duty transformer. Inverter output will be connected with transformer LV winding. This transformer shall step up inverter's voltage from 415V to 6.0 kV.

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### Technical Requirements

Type	: 3-ph, Inverter duty Transformer, Outdoor Type, Oil filled, Cu Wdg
Rated Power	: 2500 kVA
Rated Voltage (H.V Winding)	: 6.0 kV
Rated Voltage (L.V Winding)	: 0.415 kV
Frequency	: 50 Hz
Cooling	: ONAN
Winding connection	
H.V. Winding	: Delta
L.V. Winding	: Star
Impedance Voltage (%), at Nominal Tap	: 5.75 % $\pm$ IS Tolerance
Tapping Detail (Range & Type)	: +10% to -10% with OCTC

### **6.10 HT Panles**

The HT panel is an interface between the transformers and grid providing the protection required for the system.

The circuit breaker and accessories will be conforming to IS 10118/ IS 13118/IEC60947 standards. The circuit breaker will be totally re-strike free under all duty conditions and will be capable of breaking magnetizing current of transformer and capacitive current of unloaded overhead lines without causing over voltages of abnormal magnitudes. HT panel shall consist of VCB and the associated C & R Panel for each PV quadrant. VCB shall conform to IEC-62271-100. The switchgear will contain all equipment viz. Circuit breakers, CTs, PTs, relays and associated equipment.

6.0kV Outdoor type (IP-55) MCVCB rated at 630A VCB (EDO type), 40kA/1 sec, 50Hz with Al busbars, all internal wiring, indicating lamps and as per SLD shall be used in this project.

Vacuum Circuit Breaker : 6.0kV, 630A,

Refer SLD for detail.

### **6.11 PV Module Cleaning System**

Since the site is situated on the left bank of river Hooghly, fresh water would be easily available. Water based Cleaning System shall be suitable for this project. Pipeline will be laid on the roof with suitable capacity of water pump.

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Water used for PV module cleaning purpose shall be of potable quality and fit for cleaning the modules with TDS generally not more than 75 PPM. In case of higher salt contents, the water shall be thoroughly squeezed off to prevent salt deposition over module surface. However, water with TDS more than 200 PPM shall not be used directly for module cleaning without suitable treatment to control the TDS within acceptable limits. The water must be free from any grit and any physical contaminants that could damage the panel surface.

If available water is not suitable to be used directly for cleaning PV modules, RO Plant of required capacity should be provided with storage facilities.

## 6.12 SCADA

The PV power plant will be monitored through the SCADA system. This will enable monitoring the status of inverters to gather information on energy generation. Periodic reports of the plant's performance will be provided by the monitoring system. A suitable display system shall also be installed in the plant to access live data on the performance of the solar system. Remote data access will be provided through secured gateway connectivity.

Data Logging Provision for plant control and monitoring, time and date stamped system data logs for analysis with the high quality, suitable PC. Metering and Instrumentation for display of systems parameters and status indication to be provided.

The following parameters are accessible via the operating interface display in real time separately for solar power plant:

- AC Voltage
- AC Output current
- Output Power
- Power factor
- DC Input Voltage
- DC Input Current
- Time Active
- Time disabled

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- Time Idle
- Power produced
- Protective function limits

### 6.13 Solar Radiation and Environment Monitoring System

solar radiation and environment monitoring system shall be installed on one of the shed roof along with the solar PV power plant. The system shall consist of various sensors, signal conditioning, data acquisition, LCD display and remote monitoring.

Global and diffuse beam solar radiation in the plane of array (POA) shall be monitored on continuous basis. Global Horizontal Irradiation at the collector panel is required to be measured.

Solar Irradiance : An integrating Pyranometer (Class II or better) provided, with the sensor mounted in the plane of the array readout integrated with data logging system.

Temperature: Temperature probes for recording the Solar panel temperature and ambient temperature to be provided complete with readouts integrated with the data logging system.

Anemometer: A hemispherical cup anemometer should be provided to measure the wind speed.

### 6.14 Evacuation Plan and Termination

The power of this roof top PV plants will be evacuated to the grid of M/s. CESC. For this purpose, M/s. CESC will provide an 6.0 kV RMU (with suitable breaker rating ) at the Gate of the dock, which is located near the entry gate of this dockyard , and approximately 21 metre away from the shed nearest (Shed No. 22) to the gate.

Power generated from the solar PV power plants has to be stepping up the generated voltage 415V to the grid voltage level 6.0 kV through inverter duty transformers (IDT) and then connected to the HT Panel and Metering panel then fed to this RMU.

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## 7. Technology for 2X2.5 MVA 415/6KV Sub Station

### 7.1 TECHNICAL SPECIFICATION FOR SUPPLY OF TRANSFORMER

**Name of the Work:** Design, Manufacture, Supply, installation, testing and commissioning of 415V/6KV, YNd1, 2500KVA oil filled Transformer

Sl. No.	Description	Requirement	Remarks
<b>1.</b>	<b>General Description</b>		
1.1	Capacity	2.5MVA	
1.2	Nominal secondary Voltage Rating	6000V	
1.3	Maximum System Voltage	6600V	
1.4	Nominal primary Voltage	415V	
1.5	Frequency	50Hz +/-3%	
1.6	Vector Group	Dyn1	
1.7	Method of Connection		
1.7.1	HV	Delta	
1.7.2	LV	Star	
1.8	No. of Phase	3	
1.9	Painting	Epoxy	
1.10	Colour	Shade 632 as per IS : 5	
1.11	Duty	continuous	
1.12	Minimum guaranteed efficiency include of all tolerances	99.5% at 75% load at 0.8pf	
1.13	Type of cooling	ONAN	
1.14	Outdoor/ Indoor Type	Outdoor	
1.15	System Earthing	Neutral of LV side to be solidly earthed	
1.16	Impedance Voltage (%), at Nominal Tap	5.75	
1.17	Thermal Class Insulation	H	
<b>2.</b>	<b>Codes And Standards</b>		
2.1	The equipment shall comply with the latest edition of the following and other relevant Indian Standards /Manual		
2.1.1	IS 335	Insulating oil	
2.1.2	IS 1271	Thermal evaluation and Classification of electrical insulation.	
2.1.3	IS 2026	Power transformers	
2.1.4	IS 2099	Bushing for Alternative voltages above 1000 V	
2.1.5	IS 2705	Current transformers.	
2.1.6	IS 3347	Dimensions for porcelain Transformer Bushings	

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2.1.7	IS 3637	Gas operated relays	
2.1.8	IS 3639	Fitting & accessories for power transformers	
2.1.9	IS 4201	Application guide for CTs	
2.1.10	IS 6600	Guide for loading of oil immersed transformers	
<b>3</b>	<b>Operating Conditions</b>		
3.1	Ambient temperature	35 Deg C, temperature variations (+45 Deg C max. and 15 Deg C min.)	
3.2	The transformer shall be connected to a Solar Inverter.		
3.3	At full load and maximum ambient temperature, the oil temperature should not exceed 90 Deg C.		
3.4	The transformer shall have a nameplate as specified in IS2026/IEC 60076		
<b>4</b>	<b>Connections</b>		
4.1	The station transformer shall be wound in Star/Delta configuration according to IEC Vector reference Dyn1, with an Off Load Tap Changer on the HV side.		
<b>5</b>	<b>Transformer Winding</b>		
5.1	<b>Core Material</b>	The magnetic circuit shall be of low loss, cold rolled, grain oriented high grade steel.	
5.2	<b>Winding Insulation</b>	The insulation on the winding shall be class H as defined in IS2026/IEC60076.	
<b>6</b>	<b>Voltage Tappings</b>		
6.1	The HV winding shall have a nominal rating of 6KV while the LV winding shall have a rating of 415V.		
6.2	The voltage variations of the tap changer shall be of Constant Flux Voltage Variation category as defined in IEC 60076 -1. There shall be no current limitation due to tap variations.		
6.3	The tapping shall be carried out by an off-load tap-changer.		
6.4	Tap position indication should be clearly visible from ground level.		
<b>7</b>	<b>LV and HV Terminations</b>		
7.1	The transformer LV and HV windings shall be brought out separately through bushings in accordance with BS 137. The HV terminals shall be labeled as 2U, 2V, and 2W while the LV terminals shall be labeled as 1u, 1v, and 1w		
7.3	Air clearance on the LV terminals shall be observed as specified in IS 2026/ IEC60076.		
7.4	First filling of oil. Shall be included in scope of vendor.		
7.5	Cable box shall be weatherproof to IP-65. For fixed portion of cable box, inspection cover with lifting handle shall be provided.		
7.6	Marshalling box shall be mounted on transformer and shall be		



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	weather proof to IP-65. All protective devices and neutral CTs shall be wired by means of PVC insulated copper conductor armored cables up to the marshalling box. Terminals shall be clamp type. Removable gland plate with double compression type glands shall be provided.	
7.7	Lamp with switch & socket shall be provided in the marshalling box. Preferably, marshalling box shall be located on the front side of transformer.	
7.8	A separate neutral bushing shall be provided for neutral earthing of transformers. The neutral CT shall be mounted as below:- a) CT for 51G shall be located in the earth path after bifurcation of neutral. b) CT for 64 R can be located before bifurcation of neutral. Supporting arrangement for GI strip/cable as applicable shall be provided for connection of neutral bushing to earth.	
<b>8</b>	<b>ACCESSORIES</b>	
8.1	The following accessories shall be provided as a minimum:	
8.2	Rating plate	
8.3	Terminal marking plate	
8.4	Two earthing terminals	
8.5	De-hydrating breather	
8.6	<b>Conservator</b> : The Conservator tank shall have adequate capacity between highest and lowest visible levels to meet the requirement of expansion of the total cold oil volume in the transformer and cooling equipment.	
8.7	Air release Device (for transformers with conservator)	
8.8	Thermometer pocket	
8.9	Dial type thermo meter with contacts for OTI & WTI	
8.10	Explosion Vent shall be provided as per standard.	
8.11	Pressure relief valve	
8.12	Sampling valve	
8.13	Conservator drain valve	
8.14	Top oil filter valve	
8.15	Drain cum bottom filter valve	
8.16	Double float Buchholz relay	
8.17	Separate neutral bushing outside terminal box with connector assembly	
8.18	Inspection cover	
<b>9</b>	<b>Inspection &amp; Testing</b>	
9.1	<b>Type Test:</b> Type test should be carried out in accordance with the standard specified in each case as indicated in the following.	

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9.1.1	Temperature Rise Test :IEC 76/IS 2026/IS6600	
9.1.2	Impulse Volt age Withstand Test: IEC 76/IS 2026	
9.1.3	Noise Level Measurement: IEC 551	
9.2	<b>Special test:</b> Special test should be carried out in accordance with the standard specified in each case as indicated in the following	
9.2.1	Short Circuit Test: IEC 76 / IS 2026	
9.3	<b>Routine Tests:</b> Transformer routine tests shall include tests stated in latest issue of IS: 2026 (Part – 1)	

## 7.2 TECHNICAL SPECIFICATION FOR SUPPLY OF HV SWITCHGEAR

**Name of the Work:** Design, Manufacture, Supply, installation, testing and commissioning of HV Switchgear.

This specification covers the minimum requirements for the design, material, manufacturing, inspection, testing, supply, shipment and delivery to site of High Voltage Switchboard for Solar Power Plant Sub Station at Syama Prasad Mookerjee Port, Kolkata

Vendor shall be fully responsible for the design, material, manufacturing, inspection, testing and delivery of High Voltage Switchboard at site, installation and commissioning.

Sl. No.	Description	Requirement	Remarks
<b>1</b>	<b>Site Condition</b>		
1.1	Maximum Ambient Temperature	45 Deg C	
1.2	Minimum Ambient temperature	15 Deg C	
1.3	Design Temp	35 Deg C	
1.4	Relative Humidity	Heavy humidity of up to 93%.	
<b>2</b>	<b>Operating Conditions</b>		
2.1	Voltage	6 KV $\pm$ 10%	
2.2	Frequency	50Hz $\pm$ 3%	
2.3	Rated Continuous Current	630A	
2.4	No. of Phase	3	
2.5	System Fault Level	As required	
2.6	System Earthing	Direct earthed	
2.7	Auxiliary supply	DC 110 V + 10% -15%	
<b>3</b>	<b>Codes And Standards</b>		
3.1	The equipment shall comply with the latest edition of the following and other relevant Indian Standards /Manual		

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3.1.1	IS 5	Colours for ready mixed paints and enamels	
3.1.2	IS 694	Polyvinyl chloride insulated unsheathed and sheathed cables/cords with rigid and flexible conductor for rated voltages up to and including 450/750 V	
3.1.3	IS 1248	Direct acting indicating analogue electrical measuring instruments and their accessories	
3.1.4	IS 2071	High voltage test techniques.	
3.1.5	IS 2544	Porcelain post-insulators for systems with nominal voltage greater than 1000 volts	
3.1.6	IS 2705	Current transformers.	
3.1.7	IS 3156	Voltage transformers	
3.1.8	IS 3231	Electrical relays for power system protection	
3.1.9	IS 3427	AC Metal enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV	
3.1.10	IS 3618	Phosphate treatment of iron and steel for protection against corrosion	
3.1.11	IS 5082	Wrought aluminium and aluminium alloy bars, rods, tubes and sections for electrical purposes	
3.1.12	IS 5578	Guide for marking of insulated conductors	
3.1.13	IS 6005	Code of practice of phosphating of iron and steel.	
3.1.14	IS 9385	High voltage fuses	
3.1.15	IS 9920	High voltage switches	
3.1.16	IS 9921	Specification for alternating current disconnectors (isolators) and earthing switches for voltage above 1 000V	
3.1.17	IS 10601	Dimensions of terminals of high voltage switchgear and controlgear.	
3.1.18	IS 11353	Guide for uniform system of marking and identification of conductors & apparatus terminals	
3.1.19	IS 12729	Common specification for high-voltage switchgear and control gear standards.	
3.1.20	IS 13703	Low voltage fuses for voltages not exceeding 1 000V ac or 1500V dc	
3.1.21	IS/IEC 60470	High voltage switchgear alternating current contactor and contactor based motor starters	
3.1.22	IS/IEC 60529	Degree of protection provided by enclosures (IP code)	
3.1.23	IS/IEC 60947	Low voltage switchgear and control gear	
3.1.24	IS/IEC 62271-1	High voltage switchgear and controlgear - Part 1: Common specifications	
3.1.25	IS/IEC 62271-100	High-voltage switchgear and controlgear - Part 100 Alternating current circuit breakers.	
3.1.26	IS/IEC 62271-	High voltage switchgear and controlgear - Part 102:	

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	102	Alternating current disconnectors and earthing switches.	
3.1.27	IS/IEC 62271-105	High voltage switchgear and control gear - Part 105: Alternating current switch fuse combinations	
3.1.28	IS/IEC 62271-200	High-voltage switchgear and control gear - Part 200: AC metal enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV.	
3.2	In case of imported equipment, standards of the country of origin shall be applicable, if these standards are equivalent or stringent than the applicable Indian standards.		
3.3	The equipment shall also conform to the provisions of Indian Electricity rules and other statutory regulations currently in force in the country.		
<b>4</b>	<b>DESIGN AND FABRICATION REQUIREMENTS</b>		
4.1	Vertical panels shall be assembled to form a continuous line-up of uniform height.		
4.2	The High Voltage Switchboard shall be totally enclosed and vermin-proof. If necessary, openings for natural ventilation shall be provided.		
4.3	All openings, covers and doors shall be provided with suitable neoprene gaskets		
4.4	The drawout carriage on the High Voltage Switchboard shall have three positions: "Service", "Test" and "Drawout"		
4.4.1	- <b>"Service" position</b> - In this position both power and control circuits shall be connected. This shall be the normal operating position of the circuit breaker.		
4.4.2	- <b>"Test" position</b> - The power contacts shall be disconnected in this position but the control connections shall not be disturbed, it shall be possible to close and trip the circuit breakers in this position.		
4.4.3	- <b>"Draw out" Position</b> - both power and control circuits shall be disconnected in this position.		
<b>5</b>	<b>Auxiliary wiring and terminals</b>		
5.1	Inside the cubicles, the wiring for control, signalling, protection and instrument circuits shall be done with BIS approved, PVC insulated, flame retardant type, copper conductor wire.		
5.2	A minimum of 10% spare terminals shall be provided on each terminal block.		
5.3	Each wire shall be identified at both ends by correctly sized PVC ferrules.		
5.4	Shorting links shall be provided for all CT terminals.		
5.5	All inter-panel control wiring within each shipping section shall be by switchgear vendor.		
<b>6</b>	<b>Control and Indication</b>		

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6.1	Circuit breaker tripping, closing and spring charging devices shall be fed with 110V DC control power supply	
6.2	Circuit breaker positions (CLOSE, OPEN, spring-charged, test position, service position) shall be indicated mechanically & electrically.	
6.3	A common DC control supply fail indication shall be provided for each bus section with a blue coloured lamp	
<b>7</b>	<b>Earthing</b>	
7.1	All cubicles shall be connected to an earth bus bar running throughout the length of the switchboard. The minimum earth bus bar size shall be minimum 50 x 6 mm <sup>2</sup> copper, for a short-circuit withstand capacity above 31.5 kA	
7.2	All doors and movable parts shall be connected to the earth bus with flexible copper connections	
7.3	Provision shall be made to connect the earthing bus bar to the plant earthing grid at two ends.	
7.4	All non current-carrying metallic parts of the equipment and components shall be earthed	
<b>8</b>	<b>Space heaters</b>	
8.1	The panels shall be provided with space heaters to prevent moisture condensation, and maintain cubicle temperature 5°C above the ambient.	
8.2	The space heaters shall be controlled through a MCB and a thermostat with an adjustable setting	
<b>9</b>	<b>Nameplates</b>	
9.1	A nameplate with the switchboard designation shall be fixed at the top of the central panel.	
9.2	A separate nameplate giving details for each feeder compartment of all panels shall be provided.	
9.3	Danger plate (Red) shall be provided at the front and rear for each panel.	
<b>10</b>	<b>Painting</b>	
10.1	All metal surfaces shall be thoroughly cleaned and degreased to remove mill scale, rust, grease and dirt. Fabricated structures shall be pickled and then rinsed to remove any trace of acid. The under surface shall be prepared by applying a coat of phosphate paint and coat of yellow zinc chromate primer	
10.2	After preparation of the under surface, the switchboard shall be spray painted with two coats of epoxy based final paint or shall be powder coated	
10.3	Colour shade of final paint shall be as specified in the data sheet	

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<b>11</b>	<b>SWITCHBOARD COMPONENTS</b>	
11.1	<b>Circuit Breakers</b>	
11.1.1	Vacuum circuit breakers shall be used in the switchboard	
11.1.2	The circuit breakers shall have a motor-operated, spring-charged mechanism. . It shall also be possible to charge the springs manually. Spring charging motors in HT switchboards shall be suitable for 110V DC control supply	
11.1.3	The closing spring shall get re-charged (for subsequent closing) soon after a closing shot and prior to circuit breaker tripping	
11.1.4	The control circuit shall be suitable for local as well as remote control.	
11.1.5	All circuit breakers shall be provided with mechanically operated emergency trip device	
11.2	<b>Instrument Transformers</b>	
11.2.1	Current transformers shall conform to IS 2705.	
11.2.2	The voltage transformers shall conform to IS 3156	
11.3	<b>Measuring Instruments</b>	
11.3.1	All measuring instruments shall be of square pattern, flush-mounted type.	
11.3.2	The accuracy class for all instruments shall be 1.0 as per IS 1248	
11.3.3	All AC ammeters and voltmeters type shall be as specified in the data sheet.	
11.3.4	All frequency meters and power factor meters type shall be as specified in the data sheet	
11.3.5	The kW/kWH meters type shall be as specified in the data sheet	
11.3.6	The kW / kWh meters shall be suitable to measure unbalanced loads on a 3-phase, 3-wire system	
11.4	<b>Relays</b>	
11.4.1	All the relays shall be used Numerical type.	
11.4.2	All protective relays shall have hand reset facility and clear operating indication.	
11.4.3	The relay cases shall have a provision for insertion of a test plug at the front for testing and calibration using an external power supply without disconnecting the permanent wiring.	
11.4.4	All tripping relays shall be of lockout type with hand-reset contacts	
11.4.5	The vendor shall be solely responsible for coordinating the relay characteristics with suppliers for the proper selection of all CTs with special attention to CTs of class PS.	
11.5	<b>Auxiliary equipments</b>	

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11.5.1	Auxiliary relays and contactors shall generally be used for interlocking and multiplying contacts. Auxiliary contacts shall be capable of carrying the maximum anticipated current	
11.5.2	All control switches shall be rotary type, having a cam-operated contact mechanism.	
11.6	<b>INSPECTION AND TESTING</b>	
11.6.1	During fabrication, high voltage switchboard shall be subject to inspection by Purchaser or by an agency authorized by the Purchaser.	
11.6.2	Vendor shall furnish all necessary information concerning the supply to Purchaser	
11.6.3	The Purchaser shall have free access to the Vendor's works for the purpose of inspecting the process of manufacture in all its stages and he will have the power to reject any material, which appears to him to be of unsuitable description or of unsatisfactory quality	
11.6.4	High voltage switchboards shall be tested in accordance with applicable standards	
11.6.5	All acceptance and routine tests as follows shall be carried out at Vendor's work under his care and expense	
11.6.6	Vendor's internal test reports shall be provided for Purchaser's review prior to inspection and testing	
11.6.7	All type tests shall be performed at Vendor's work or independent approved testing laboratory under his care and expense.	
11.6.8	For equipment bought from other sub-suppliers, certified test reports of tests carried out at the sub-supplier's works shall be submitted	

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### 7.3 TECHNICAL SPECIFICATION FOR SUPPLY OF MV SWITCHGEAR

**Name of the Work:** Design, Manufacture, Supply, installation, testing and commissioning of MV Switchgear.

This specification covers the minimum requirements for the design, material, manufacturing, inspection, testing, supply, shipment and delivery to site of High Voltage Switchboard for Solar Power Plant Sub Station at Syama Prasad Mookerjee Port, Kolkata

Vendor shall be fully responsible for the design, material, manufacturing, inspection, testing and delivery of Medium Voltage Switchboard at site, installation and commissioning.

Sl. No.	Description	Requirement	Remarks
<b>1</b>	<b>Site Condition</b>		
1.1	Maximum Ambient Temperature	45 Deg C	
1.2	Minimum Ambient temperature	15 Deg C	
1.3	Design Temp	35 Deg C	
1.4	Relative Humidity	Heavy humidity of up to 93%.	
<b>2</b>	<b>Operating Conditions</b>		
2.1	Voltage	0.415 KV $\pm$ 10%	
2.2	Frequency	50Hz $\pm$ 3%	
2.3	No. of Phase	3	
2.4	Current Rating	3600 A/ 800A	
2.5	System Fault Level	As required	
2.6	Type	Electrically Operated Draw Out (EDO) type.	
2.7	Tripping coil	110V DC communicable type	
2.8	Closing coil	110V DC communicable type	
2.9	Spring Charging Motor	110V DC	
2.10	System Earthing	Resistance earthed	
2.11	Auxiliary supply	DC 110 V + 10% -15%	
<b>3</b>	<b>Codes And Standards</b>		
3.1	The equipment shall comply with the latest edition of the following and other relevant Indian Standards /Manual		
3.1.1	IS 5	Colours for ready mixed paints and enamels	
3.1.2	IS 1248	Direct acting indicating analogue electrical measuring instruments and their accessories	



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3.1.3	IS 2705	Current transformers.	
3.1.4	IS 2824	Method for determining of the proof and the comparative tracking indices of solid insulating materials	
3.1.5	IS 3156	Voltage transformers	
3.1.6	IS 3231	Electrical relays for power system protection	
3.1.7	IS 3618	Phosphate treatment of iron and steel for protection against corrosion	
3.1.8	IS 5082	Wrought aluminium and aluminium alloy bars, rods, tubes and sections for electrical purposes	
3.1.9	IS 5553	Reactors	
3.1.10	IS 5578	Guide for marking of insulated conductors	
3.1.11	IS 6005	Code of practice of phosphating of iron and steel.	
3.1.12	IS 8623	Low voltage switchgear and control gear assemblies	
3.1.13	IS 11353	Guide for uniform system of marking and identification of conductors & apparatus terminals	
3.1.14	IS 12672	Internal fuses and internal overpressure disconnectors for shunt capacitors.	
3.1.15	IS 3340	Power capacitors of self-healing type for AC power systems having rated voltage upto 650V.	
3.1.16	IS 3341	Requirements for ageing test, self-healing test and destruction test on shunt capacitors of the self-healing type for ac power systems having a rated voltage upto and including 650V	
3.1.17	IS/IEC 60529	Degree of protection provided by enclosures (IP code)	
3.1.18	IS/IEC 60947	Low voltage switchgear and controlgear	
3.1.19	IS 61641	Enclosed low-voltage switchgear and controlgear assemblies - Guide for testing under conditions of arcing due to internal fault	
3.2	In case of imported equipment, standards of the country of origin shall be applicable, if these standards are equivalent or stringent than the applicable Indian standards.		
3.3	The equipment shall also conform to the provisions of Indian Electricity rules and other statutory regulations currently in force in the country.		
<b>4</b>	<b>DESIGN AND FABRICATION REQUIREMENTS</b>		
4.1	The switchboard shall be metal enclosed, free standing, floor mounting, compartmentalized, modular type, fully draw out or fixed type.		
4.2	The switchboard enclosure shall be dust and vermin proof and shall provide a degree of protection.		

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4.3	The switchboard shall be assembled out of vertical panels of uniform height in single line up .The switchboard height shall be restricted to 2300 mm	
4.4	The switchboard shall be designed to ensure maximum safety during operation, inspection, connection of cables, relocation of outgoing circuits and maintenance, with the bus bar system energised and without taking any special precautions.	
4.5	All openings, covers and doors shall be provided with neoprene Gaskets	
4.6	All hardware shall be corrosion resistant	
4.7	Removable, CRCA or non-magnetic gland plates having minimum 3mm thickness shall be provided	
<b>5</b>	<b>Bus Bar</b>	
5.1	Bus bars shall be of high conductivity electrolytic aluminium supported on insulators made of non-hygroscopic, non-inflammable material with tracking index equal to or more than that defined in Indian standards	
5.2	The main bus bars shall have uniform current ratings throughout their length.	
5.3	Both horizontal and vertical bus bars, bus joints and supports shall be capable of withstanding dynamic and thermal stresses of short circuit currents for 1 second	
5.4	The short circuit capacity of the neutral bus bars shall be in line with IS/IEC 60947	
5.5	All bus bars shall be insulated with heat shrunk PVC sleeves of 1100 V grade. Red, yellow and blue colour shall be used for phase bus bars and black colour shall be used for neutral bus bars. Removable type shrouds shall be provided for joints.	
<b>6</b>	<b>Auxiliary wiring and terminals</b>	
6.1	Inside the cubicles, the wiring for control, signalling, protection and instrument circuits shall be done with BIS approved, PVC insulated, flame retardant type, copper conductor wire.	
6.2	A minimum of 10% spare terminals shall be provided on each terminal block.	
6.3	Each wire shall be identified at both ends by correctly sized PVC ferrules.	
6.4	Shorting links shall be provided for all CT terminals.	
6.5	All inter-panel control wiring within each shipping section shall be by switchgear vendor.	
<b>7</b>	<b>Control and Indication</b>	
7.1	Circuit breaker tripping, closing and spring charging devices shall be fed	

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	with 110V DC control power supply	
7.2	Circuit breaker positions (CLOSE, OPEN, spring-charged, test position, service position) shall be indicated mechanically & electrically.	
7.3	A common DC control supply fail indication shall be provided for each bus section with a blue coloured lamp	
<b>8</b>	<b>Earthing</b>	
8.1	All panels shall be connected to a tinned copper earth bus bar running throughout the length of the switchboard	
8.2	The minimum earth bus size shall be 30x6 mm <sup>2</sup> copper for fault level up to 31.5 kA and 50 x 6 mm <sup>2</sup> copper for fault level above 31.5kA. However vendor to ensure the size of conductor as per the fault level specified.	
8.3	All doors and movable parts shall be connected to the earth bus with flexible copper connections	
8.4	Provision shall be made to connect the earthing bus bar to the plant earthing grid at two ends.	
8.5	All non current-carrying metallic parts of the equipment and components shall be earthed	
<b>9</b>	<b>Space heaters</b>	
9.1	The switchboard panels shall be provided with space heaters to prevent moisture condensation. The space heater shall be supplied from 110 V DC auxiliary bus for space heater. And the space heater shall be controlled through a MCB and Thermostat with adjustable settings.	
<b>10</b>	<b>Nameplates</b>	
10.1	A nameplate with the switchboard designation shall be fixed at the top of the central panel.	
10.2	A separate nameplate giving details for each feeder compartment of all panels shall be provided.	
10.3	Danger plate (Red) shall be provided at the front and rear for each panel.	
10.4	Blank nameplates shall be provided for all spare and vacant modules.	
<b>11</b>	<b>Painting</b>	
11.1	All metal surfaces shall be thoroughly cleaned and degreased to remove mill scale, rust, grease and dirt. Fabricated structures shall be pickled and then rinsed to remove any trace of acid. The under surface shall be prepared by applying a coat of phosphate paint and coat of yellow zinc chromate primer	
11.2	After preparation of the under surface, the switchboard shall be spray painted with two coats of epoxy based final paint or shall be powder	

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	coated	
11.3	Colour shade of final paint shall be as specified in the data sheet	
<b>12</b>	<b>SWITCHBOARD COMPONENTS</b>	
12.1	<b>Circuit Breakers</b>	
12.1.1	Air circuit breakers shall be used in the switchboard	
12.1.2	The circuit breakers shall have a motor-operated, spring-charged mechanism. . It shall also be possible to charge the springs manually. Spring charging motors in LT switchboards shall be suitable for 110V DC control supply.	
12.1.3	The closing spring shall get re-charged (for subsequent closing) soon after a closing shot and prior to circuit breaker tripping	
12.1.4	The control circuit shall be suitable for local as well as remote control.	
12.1.5	All circuit breakers shall be provided with mechanically operated emergency trip device	
13	<b>Operating Mechanism</b>	
13.1	For air circuit breakers with electrical power operating mechanism, provision shall also be made for manual spring charging.	
13.2	The air circuit breakers shall be provided with mechanically operated emergency tripping device	
13.3	Air circuit breakers open and closed positions, service and test locations and spring charged condition shall also be indicated mechanically in addition to electrical indications.	
13.4	Castle lock arrangement shall be provided for all the air circuit breakers so that air circuit breakers can be locked in the test position while carrying out the maintenance of down steam equipment.	
13.5	Air circuit breakers shall be provided with operation counters	

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#### 7.4 TECHNICAL SPECIFICATION FOR SUPPLY OF DC UPS SYSTEM AND BATTERIES

**Name of the Work:** Design, Manufacture, Supply, installation, testing and commissioning of 110V DC UPS System for Solar Power Plant Sub Station at Syama Prasad Mookerjee Port, Kolkata.

Vendor shall be fully responsible for the design, material, manufacturing, inspection, testing and delivery of High Voltage Switchboard at site, installation and commissioning.

Sl. No.	Description	Requirement	Remarks
<b>1</b>	<b>Site Condition</b>		
1.1	Maximum Ambient Temperature	45 Deg C	
1.2	Minimum Ambient temperature	15 Deg C	
1.3	Design Temp	35 Deg C	
<b>2</b>	<b>Codes and Standards</b>		
2.1	IS 1248	Direct acting indicating analogue electrical measuring instruments and their accessories	
2.2	IS 2705	Current transformers	
2.3	IS 1651	Stationary cells and batteries, lead acid type	
2.4	IS 1652	Stationary cells and batteries, lead acid type	
2.5	IS 3700 Part 7	Essential ratings and characteristics of semiconductor devices - Part VII : Reverse blocking triode thyristors	
2.6	IS 3715 Part 4	Letter symbols for semiconductor devices: Part 4 thyristors	
2.7	IS 4411	Code for designation of semi-conductor devices	
2.8	IS 5001	Guide for preparation of drawings of semiconductor devices	
2.9	IS 5469	Code of practice for the use of semi-conductor junction devices	
2.10	IS 6304	Stationary batteries, lead acid type with pasted positive plates	
2.11	IS 7204	Stabilized power supplies de output.	
2.12	IS 8320	General requirement and method of test for lead acid storage batteries	
2.13	IS 12021	Control transformers for switchgear and controlgear for voltages not exceeding 1000 V ac	
2.14	IS 13703	L V fuses for voltage not exceeding 1 000V ac or	

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		1500V dc	
2.15	IS 14901	Semiconductor Devices - Discrete Devices and Integrated Circuits	
2.16	IS/IEC 60529	Degree of protection provided by enclosures (IP code)	
2.17	IS/IEC 60947	Low voltage switchgear and controlgear	
2.18	IEC 60146-1-1	Semiconductor converters - General commutated converters - Part 1-1 requirements	
2.19	In case of imported equipment, standards of the country of origin shall be applicable, if these standards are equivalent or stringent than the applicable Indian standards.		
	The equipment shall also conform to the provisions of Indian Electricity rules and other statutory regulations currently in force in the country.		
<b>3</b>	<b>General Requirements</b>		
3.1	The DC UPS system shall be an integrated system comprising of static battery chargers, batteries, DC Distribution Board, isolating and protection devices and all other equipment, accessories required for completeness of the system whether specifically mentioned herein or not, but necessary for completeness and satisfactory performance of the system.		
<b>4</b>	<b>Site Conditions</b>		
4.1	The DC UPS system shall be suitable for installation and satisfactory operation in indoor installation.		
<b>5</b>	<b>Input Power Supply</b>		
5.1	Voltage	415V ± 10%	
5.2	Frequency	50 Hz ± 5%	
<b>6</b>	<b>DC UPS System Configuration and Operational requirements</b>		
6.1	The DC UPS system shall comprise 2 Nos. Float cum Boost Battery Chargers (each value for 100% capacity) with 1 set of battery (Refer Sketch - 1 ). The DC UPS system shall have the following design philosophy		
6.2	Normal operation requires that the battery assembly shall be float charged simultaneously by both battery chargers-1 & 2 while feeding the DC load. The battery chargers are thus operating in parallel and equally sharing the total load.		
6.3	However in case of failure of either of the battery chargers, the other battery charger shall float charge the battery while feeding the complete DC load. Faulty battery charger shall automatically get disconnected from the healthy system.		

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6.4	In case of AC mains failure, the battery shall continue to supply the load	
6.5	Upon resumption of supply, one of the battery chargers shall supply the entire DC load and the other shall start boost charging the battery.	
6.6	The process of changeover from float to boost charging and reverting from boost to float charging shall be selectable in Automatic or Manual mode by means of an Auto / Manual selector switch	
6.7	Interlock shall be provided to ensure that when either of the battery chargers is selected in boost charging mode, it will be disconnected from both the DC load and the other battery charger operating under float charging mode	
6.8	The battery chargers shall have facility for manual mode of operation in the event of failure of controller under closed loop control. The selection shall be done through Auto / Manual selector switch	
6.9	Facility for initial charging of the uncharged battery shall also be provided	
<b>7</b>	<b>Battery</b>	
7.1	Lead Acid batteries shall have been type tested to meet the performance requirements for each design and AH rating of cells as per Indian standard IS-1651	
7.2	Sealed maintenance free batteries (SMF) or Valve Regulated Lead acid (VRLA) cell. / battery shall be suitable for float duty operation at constant voltage permanently applied to its terminals which is sufficient to maintain it in a state close to full charge and shall be designed to supply load in the event of normal power supply failure.	
7.3	The standard rated ampere hour capacity of the cell/ battery shall be at reference temperature of constant current discharge at 10 hours rate	
7.4	Number of cells and end cell voltage shall be decided by the vendor on the basis of maximum permissible voltage to the load when batteries are float charged while feeding the load and minimum DC system voltage	
7.5	The battery shall be suitable for being boost charged to, fully charged condition from fully discharged Condition within 8 hours unless otherwise specified.	
<b>8</b>	<b>Indication</b>	
8.1	The Charger shall be provided with following LED of reputed make Indication:	
	(i) Supply of power--Green (ii) Charger on –Green (iii) Battery reverse polarity (iv) Input power supply fail–Red (v) Output over/under voltage	

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	(vi) Earth fault	
8.2	Audio/Visual alarm to indicate:-	
	(i) AC input Power failure. (ii) Charger Output failure. (iii) Battery disconnection/failure. (iv) DC under/Overvoltage (v) Condenser Fuse failure. (vi) In case of failure of charger on fault, it should give buzzer as well as LED indication	
9	<b>Inspection And Testing</b>	
9.1	During fabrication, the equipment shall be subjected to inspection by Purchaser or by an agency authorized by the Purchaser. Vendor shall furnish all necessary information concerning the supply to Purchaser	
9.2	The Purchaser shall have free access to the Vendor's works for the purpose of inspecting the process of manufacture in all its stages and he will have the power to reject any material, which appears to him to be of unsuitable description or of unsatisfactory quality	
9.3	DC UPS system shall be tested in accordance with applicable standards. Following acceptance tests on each DC UPS system as a minimum shall be carried out at Vendor's works under his care and expense. (i) Insulation Test (ii) Heat Run Test (iii) Functional Tests (iv) Charger efficiency test (v) Auxiliary Equipment and Control Circuit Tests (vi) Parallel Operation (vii) Audible Noise Test	
9.4	Batteries shall be tested in accordance with applicable standards. Following acceptance tests on each AH rating of cells/battery shall be carried out at Vendor's works under his care and expense. (i) Physical examination (ii) Polarity and absence of short circuit (iii) Marking and packing (iv) Verification of dimensions (v) Air pressure test (vi) Test for voltages during discharge (vii) Test for AH capacity (viii) Insulation resistance	
9.5	Battery duty cycle test to meet the load cycle requirement shall also be performed at site after installation as part of commissioning.	



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## 8. Generation Simulation and Estimation

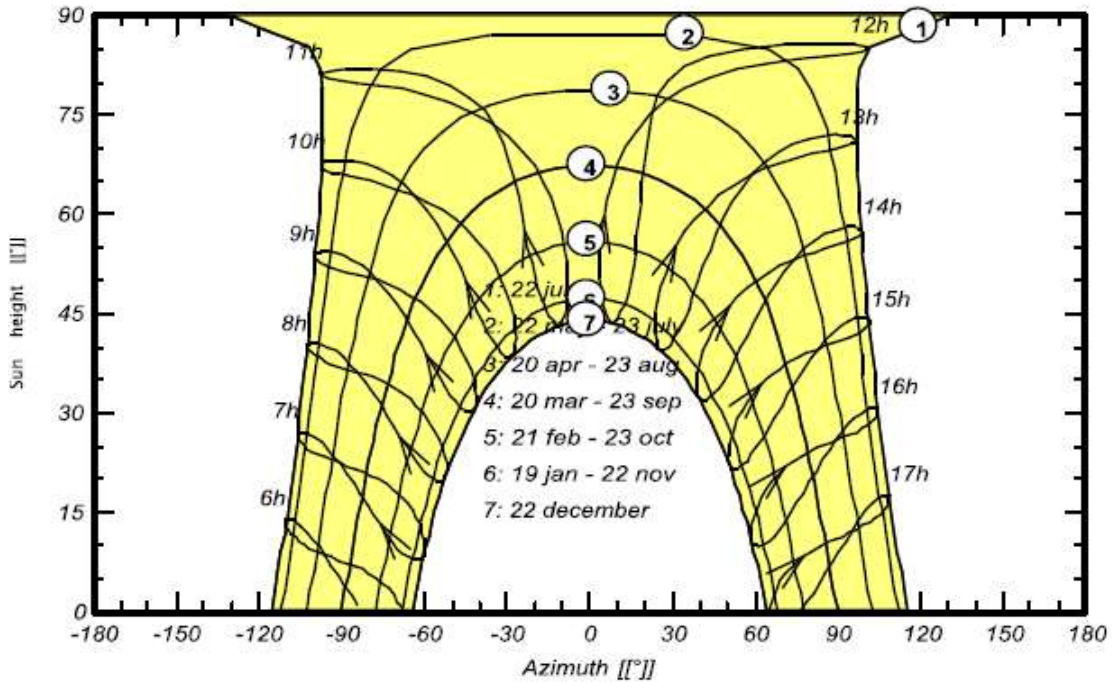
There are certain parameters that estimate of the quality of a PV power plant such as Performance Ratio (PR) and specific yield. The later is annual energy generated for every kWp of installed capacity. These parameters are influenced by various losses which reduce the overall output of SPV plant.

### Monthly Irradiation Data

Site	<b>Shyama Prasad Mukherjee Port Trust, Kolkata (India)</b>					
Data source	Meteonorm 7.2					
	<b>Horizontal global irradiation</b>	<b>Horizontal diffuse irradiation</b>	<b>Temperature</b>	<b>Wind Velocity</b>	<b>Linke Turbidity</b>	<b>Relative Humidity</b>
	kWh/m <sup>2</sup> .mth	kWh/m <sup>2</sup> .mth	°C	m/s	[-]	%
January	128.5	54.6	17.7	0.99	5.991	75.9
February	138.8	58.4	22.1	1.01	5.831	68.0
March	165.2	76.7	27.0	1.40	5.512	62.8
April	199.4	80.1	29.8	1.40	6.310	70.0
May	199.5	96.4	31.1	1.09	7.589	69.2
June	145.3	92.7	30.2	0.88	6.870	77.8
July	134.0	92.2	29.5	0.70	5.751	80.0
August	136.7	87.2	29.2	1.40	5.991	82.4
September	129.4	76.7	28.0	1.40	5.112	86.7
October	148.5	65.0	27.0	0.98	4.394	81.0
November	136.2	49.9	23.3	0.80	5.112	77.0
December	120.5	52.4	18.9	0.82	5.592	77.3
<b>Year</b>	<b>1782.0</b>	<b>882.4</b>	<b>26.1</b>	<b>1.1</b>	<b>5.838</b>	<b>75.7</b>
<b>Horizontal global irradiation year-to-year variability 3.2%</b>						

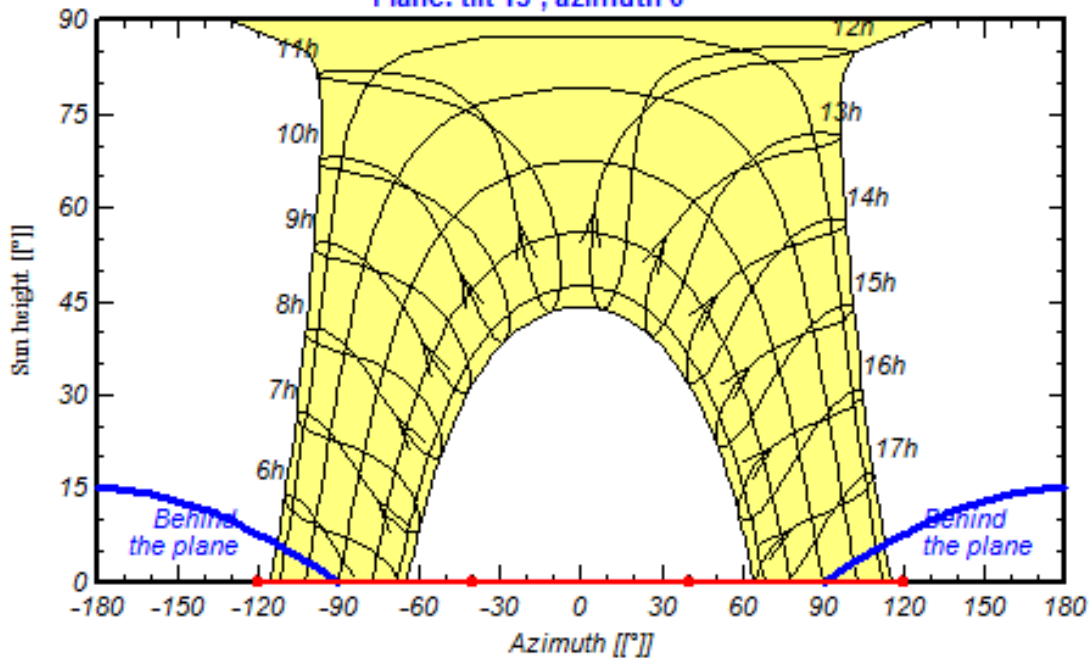
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### Solar Path of Kolkata



### Horizon line drawing - Legal Time

Plane: tilt 15°, azimuth 0°



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Losses such as soiling loss account for the particulate accumulation (coal dust, dirt, bird droppings etc) on the module surface. PV panels also suffer from loss due to varying temperature. As increase in temperature is detrimental to the energy production of the PV panel and it accounts for substantial amount of the total loss. Other losses arise due to changing irradiation level, module quality loss and Light induced degradation , The operational losses i.e. DC loss and AC loss are mainly

The voltage drop in the cables also matters. There are certain losses due to shading from nearby structures like trees, buildings etc or which is termed as near-shading loss which is dependent on the site conditions. Loss due to the performance of the chosen inverter is dependent on the chosen inverter type.

Performance Ratio" (PR) means the ratio of plant output versus installed plant capacity at any instance with respect to the radiation measured.  $PR = \frac{\text{Measured output in kW}}{\text{Installed Plant capacity in kW} * (1000 \text{ W/m}^2 / \text{Measured radiation intensity in W/m}^2)}$ .

## 9. Design :

The system design is as per MNRE / State Guidelines / Applicable Indian Standards. The system is for safe operation and easy maintenance. The shadow free area has been fully utilized for installation of solar PV modules / arrays. Maximum power point trackers (MPPTs) are integrated in the PCU/Inverter to harvest maximum energy from the arrays. The design of MMS structure is common for all locations. The concept of earthing is also common for all locations. The average voltage drop in the DC cables (Modules to Inverter) has been limited to 2 % of the rated voltage and for AC LT side (From inverter to Transformer –IDT) has been limited to within 5 % of the rated voltage .

All the roof / shed have been studied comprehensively. The shadow free areas have been studied and considered for installation of PV modules, capacities etc. The capacities Shed wise have been arrived at as under:-

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S.No.	Building Name	No of Module	DC capacity @SPV 540 Wp	Proposed AC Capacity	Rated Inverter Capacity			AC/DC Ratio
					125 kW	100 kW	50 kW	
1	Shed 22	882	476.28 kWp	475 kW	3	1	0	1.0
2	Shed 23	860	464.40 kWp	475 kW	3	1	0	1.0
3	Shed 24	840	453.60 kWp	450 kW	2	2	0	1.0
4	Shed 25	800	432.00 kWp	425 kW	3	0	1	1.0
5	Shed 26	880	475.20 kWp	475 kW	3	1	0	1.0
		<b>4262</b>	<b>2301 kWp</b>	<b>2300 kW</b>	<b>14</b>	<b>5</b>	<b>1</b>	

## 10. Project Cost Estimation and BOM

### 10.1 EPC including Plant & Machinery:

The plant machinery cost is inclusive of all costs associated with mechanical, electrical & control requirements of a solar power project. Apart from main equipment, the project cost also includes all auxiliary equipment and all the civil and structural work covered in this cost. All costs involved in the plant erection, testing and commissioning are included in the overall plant & machinery cost. The installation costs (EPC Cost) varies depend on the detailed design engineering and the selection of components and may can vary installer to installer, however for our calculation we have considered cost as per the latest market trend.

Sl No	Particulars	Description
1	PV Modules	As mentioned in the document, Consideration of panels is from Tier-I Company Solar PV Mono-Crystalline Modules with 25year performance guarantee and 12year product warranty. This consists of using a panel with of capacity 540 Wp or above. The modules will have an efficiency above 21% under STC and will have a depreciation of only 0.5% per year.

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- |   |  |  |
|---|--|--|
| 2 | Civil & General Works  | <p>RCC Foundations casting on the roof and other civil requirements. The calculation of foundation and structure is based on the wind velocity of the site location. The total weight of civil foundation on roof for solar module mounting structure is approx. 910 Ton. Other civil work is for construction Control Rooms and transformer foundation, Trenches for cable routing and other minor civil works</p>  |
| 3 | Mounting Structures  | <p>As mentioned in the justification sheet, under this section we will cover hot dipped Galvanized MMS above the ground level of approx. 60 MT per such as rafters, purlins, Hardware etc. This is an extension of the civil and general works section, but more specifically we will use rafters, purlins, structures, nuts, bolts, L shaped cleats etc. All of these components are galvanized.</p>  |
| 4 | String Inverter  | <p>We will be using the combination of latest string inverters of capacity 125kW and 50kW for total capacity.</p>  |
| 5 | AC Side and DC Side cable and Accessories                                    | <p>We will be using armored cables for AC side and Flexible cables for DC side all over the site. We will be using 4Sq.mm, 35Sq.mm, 70sq.mm, 400sq.mm cables. The core varies from 3.5 core to 4 core aluminum with multiple runs. LT panel is required to club all inverter, for each shed there is four inverters. At substation there will be a main LT panel where all five sheds LT panel will be combined. There is another HT panels after transformer.</p> |
| 6 | SCADA, Module cleaning system , cable trenches and other AC side requirement | <p>Monitoring system shall be installed to monitor the plant performance including weather station, Module cleaning system shall be provided for regular cleaning of solar panels.</p>   |

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7	All other mechanical, electrical small item called balance of system required to complete the site	For a solar PV Plant, the small mechanical and electrical items are required to complete the site. Often assigned secondary importance irrespective of their being a significant cost component, BoS are critical determinants of the actual plant life. High technical standards of BoS components should therefore be ensured as a matter of standard practice.
8	Design, engineering, Installation, testing and commissioning of solar plant	Installation and commissioning of solar plant including all equipment and machinery required to complete civil, mechanical and electrical work.
9	Sub station for solar power plant	Substation for solar power plant includes 2X 2.5MVA Power transformer, 415V ACDB, 6KV HT Panel, Complete earthing system for substation, It also includes miscellaneous expenses including inter substation cable laying and termination. It also included construction of 10MX25M substation building with foundation of 2 nos outdoor power transformer including supply of all material and labours etc.

## 11. Warranty details and Operation and maintenance

The warranty of solar plant includes the product warranty of each items offered by the manufacturer, the major item warranties given by the manufacturer or contractor shall be as below.

1. Solar Module – Product warranty 12 years and performance warranty 25 years
2. String Inverters – Product warranty of 5 years
3. Structure warranty – 5 years
4. Workmanship warranty – 1 year from the date of commissioning



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### **Operation and Maintenance - 10 years after completion of workmanship warranty**

The workmanship warranty of the project is 1 years from the date of commissioning of solar plant.

The Regular operation & maintenance of the SPV Power Plant for a period of 10 years after completion of 1 year warranty period along with supply of consumable items as and when necessary and submission of daily performance data of the power plant shall come, under the operation & maintenance contract. The break down maintenance of the entire system including supply of necessary spare parts, if any, are already under the coverage of warranty clause of the specific condition for a period of 120 months from date of completion of 1 year workmanship warranty of power plant.

The cost for comprehensive Operation and Maintenance of entire project that is 2.3MW DC is approx. 60 Lacs/year.

# GENERAL TECHNICAL SPECIFICATIONS

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## TECHNICAL SPECIFICATIONS FOR CIVIL WORKS CONTENTS

### SL NO DESCRIPTION OF ITEM PAGE NO

1. General TS-General
2. Pile foundation TS-Piling
3. Earthwork in excavation and back filling TS-Earthwork
4. Anti-termite treatment TS-Anti-termite
5. Plain & reinforced cement concrete TS-RCC
6. Brick masonry TS-Brickwork
7. Plastering TS-Plastering
8. Water proofing TS-Water proofing
9. Painting TS-Painting
10. Flooring, skirting and cladding TS-Flooring
11. False ceiling TS-False ceiling
12. Wood work and joinery Ts-Wood work
13. Structural glazing/Upvc doors & Windows TS-structural glazing 15 Water supply and drainage TS-Water supply
14. Internal & External electrification TS-Electrification
15. Interior furnishing TS-Interior furnishing
16. Landscaping & Horticulture TS-Landscaping & horticulture
17. Approved make/Manufacturers List of approved make

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## GENERAL CONTENTS

- 1.0 Preamble.
- 2.0 Reference to Standard Codes of Practice
- 3.0 Dimensions
- 4.0 Materials
- 5.0 Workmanship
- 6.0 Inclusive Documents
- 7.0 Measurements & payments
- 8.0 Unacceptable Work.

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### 1.0 PREAMBLE

These Specifications cover the items of work in structural and non-structural parts of the works coming under Preview of this document. All work shall be carried out in conformation with this. In general, provisions of Indian Standards, Indian Roads Congress Codes and other national standards have been followed. These specifications are not intended to cover the minute details. All codes and standards referred to in these specifications shall be the latest thereof. These specifications shall be read in conjunction with the Particular Specifications for various items of work. The Contractor shall carefully acquaint himself with the general specifications, coordinate the same with any other specifications forming a part of the Contract Document and determine his contractual obligations for the execution of various items of work in accordance with good engineering practices.

### 2.0 REFERENCE TO THE STANDARD CODES OF PRACTICE

2.1 All standards, tentative specifications, specifications, code of practice referred to shall be the latest editions including all applicable official amendments and revisions. The contractor shall make available at site all relevant Indian Standard Codes of Practice as applicable.



2.2 In case of discrepancy between standards, codes of practice, tentative specifications, and specifications referred to, the specifications of Indian Standard Codes of practice shall govern.

### **3.0 DIMENSIONS**

3.1 Written dimensions on drawings shall supersede measurement by scale and drawings to a large scale shall take precedence over those to a smaller scale. Special dimensions or directions in the specifications shall supersede all others. All dimensions shall be checked on site prior to execution.

3.2 The dimensions where stated do not allow for waste, laps, joints, etc. but the Contractor shall provide at his own cost sufficient labour and materials to cover such waste, laps, joints, etc. and the rate quoted is inclusive of such provision and no separate payment will be made for the same.

3.3 The levels, measurements and other information concerning the existing site as shown on the drawings are believed to be correct, but the Contractor should verify them for himself and also examine the nature of the ground as no claim or allowance whatsoever will be entertained on account of any errors or omissions in the levels or the description of the ground levels or strata turning out different from what was expected or shown on the drawings.

### **4.0 MATERIALS**

#### **4.1 QUALITY**

All materials used in the Works shall be of the best quality of their respective kinds as specified herein, obtained from sources and suppliers approved by the Engineer and shall comply strictly with the tests prescribed hereafter, or where tests are not laid down in the specifications, with the requirements of the latest issues of the relevant Indian Standards.

#### **4.2 SAMPLING AND TESTING**

All materials used in the Works shall be subjected to inspection and tests in addition to test certificates. Samples of all materials proposed to be employed in permanent Works shall be submitted to the Engineer for approval before they are brought to the site. Samples provided to the Engineer for their retention are to be labelled in boxes suitable for storage. Materials or workmanship not corresponding in character and quality with approved samples will be rejected by the Engineer. Samples required for approval and testing must be supplied sufficiently in advance to allow for testing and approval, due allowance being made for the fact that if the first samples are rejected further samples may be required. Delay to the Works arising from the late submission of samples will not be acceptable as a reason for delay in completion of the Works. Materials shall be tested before leaving the manufacturer's premises, quarry or source, wherever possible. Materials shall also be tested on the site and they may be rejected if not found suitable or in accordance with the specifications, notwithstanding the results of the tests at the manufacturer's Works or elsewhere or test certificates or any approval given earlier.

The contractor will bear all expenses for sampling and testing, whether at the manufacturer's premises at source, at site or at any testing laboratory or institution as directed by the Engineer. No extra payment shall be made on this account.

#### **4.3 DISPATCH OF MATERIALS**

Materials shall not be dispatched from the manufacturer's Works to the site without written authority from the Engineer.

#### **4.4 TEST CERTIFICATES**

All manufacturer's certificates of test, proof sheets, etc. showing that the materials have been tested in accordance with the requirement of this specifications and of the appropriate Indian Standard are to be supplied free of charge on request to the Engineer.

#### 4.5 REJECTION

Any materials that have not been found to conform to the specifications will be rejected forthwith and shall be removed from the site by the Contractor at his own cost. The Engineer shall have power to cause the Contractors to purchase and use such materials from any particular source, as may in his opinion be necessary for the proper execution of the work.

#### 4.6 STORING OF MATERIALS AT SITE

All materials used in the Works shall be stored on racks, supports, in bins, under cover etc. as appropriate to prevent deterioration or damage from any cause whatsoever to the entire satisfaction of the Engineer. The storage of materials shall be in accordance with IS 4082 "Recommendation on stacking and storage of construction materials on site" and as per IS 7969 "Safety code for handling and storage of building materials". This shall include the safe custody of all materials until they are required on the works and till the completion of the works. The same shall be applicable for the materials supplied by the Employer or materials supplied by any specialized firms.

The materials shall be stored in a proper manner at places at site approved by the Engineer. Should the place where material is stored by the Contractor be required by the Employer for any other purpose, the Contractor shall forthwith remove the material from that place at his own cost and clear the place for the use of the Employer.

#### 4.7 WATER

4.7.1 Water for construction: Clean fresh water only shall be used for the Works. The water shall be free from any deleterious matter in solution or in suspension. The quality of water shall conform to IS 465.

4.7.2 Storage of water: The Contractor shall make his own arrangements for storing water, if necessary, in drums or tanks or cisterns, to the approval of the Engineer. Care shall be exercised to see that water is not contaminated in any way.

#### 5.0 WORKMANSHIP

5.1 All Works shall be true to level, plumb and square and the corners, edges and corners in all cases shall be unbroken and neat.

5.2 Any work not to the satisfaction of the Engineer or his representative will be rejected and the same shall be rectified, or removed and replaced with work of the required workmanship at no extra cost.

#### 6.0 INCLUSIVE DOCUMENTS

The provision of Special Conditions of Contract, General Conditions of Contract, those specified on the tender as well as execution drawings and notes or other specifications issued in writing by the Engineer-In-Charge shall form part of these specifications.

#### 7.0 MEASUREMENT AND PAYMENTS

The methods of measurement and payment shall be as described under various items and in the bill of quantity. Where specific definitions are not given, the methods described in IS code will be followed. Should there be any detail of construction or materials which has not been referred to in specification or in the bill of quantities and drawings but the necessity for which may be implied or inferred wherefrom, or which are usual or essential to the completion of the work in the trades, the same shall be deemed to be included in the rates and prices quoted by the contractor in the bill of quantities.

#### 8.0 UNACCEPTABLE WORKS

All defective works are liable to be demolished, rebuilt and defective materials replaced by the contractor at his own cost. In the event of such works being accepted by carrying out repairs etc. as specified by the engineer, the cost of repairs will be borne by the contractor.

In the event of the work being accepted by giving 'Design Concession', arising out of but not limited to under-sizing, under-strength, shift in location and alignment, etc. And accepting design stresses in members which are higher than those provided for in the original design or by accepting materials not fully meeting the specifications etc. The contractor will be paid for the works actually carried out by him at the suitable reduced rate of the tendered rates for the portion of the work thus accepted.

## PILE FOUNDATION

### PILE FOUNDATION : CONTENTS

#### SL NO DESCRIPTION

- 1.0 SCOPE
- 2.0 MATERIAL & STRESSES
- 3.0 WORKMANSHIP / PILE DRIVING
- 4.0 BASIC PROPERTIES OF DRILLING MUD ( BENTONITE )
- 5.0 TEST OF PILE
- 6.0 MEASUREMENT

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#### 1.0 SCOPE

This standard covers the design and construction of load bearing concrete bored cast-in-situ piles of diameter less than or equal to 2 500 mm which transmit the load of the structure to the soil by resistance developed either at the tip by end-bearing or along the surface of the shaft by friction or by both. This also covers piles having non-circular cross-sections.

This standard does not cover the use of bored cast-in-situ piles for any other purpose, for example, temporary or permanent retaining -structures, etc. The bored cast-in-situ piles having bulb(s) known as under-reamed piles are covered in IS: 2911 (Part III)-1980\*.

#### 2.0 MATERIAL & STRESSES

2.1 CEMENT: The cement used shall conform to the requirements of IS : 269-1976f, IS : 455-1976, IS : 8841-1978 II and IS : 6903-1973 as the case may be.

2.2 REINFORCEMENT: Reinforcement steel shall conform to IS : 432 ( Part I )-1966\*\* or IS : 1139-1966 or IS : 786-1966 or IS : 226-1975. The stresses allowed in steel should conform to IS : 456-1978

2.3 CONCRETE: Materials and methods of manufacture for cement concrete shall in general be in accordance with the method of concreting under the conditions of pile installation. Consistency of concrete for cast-in-situ piles shall be suitable to the method of installation of piles. Concrete shall be so designed or chosen as to have homogeneous mix having a flowable character consistent with the method of concreting under the given conditions of pile installation. In achieving these results, minor deviations in the mix proportions used in structural concrete may be necessary.

For pile of smaller diameter and depth of up to 10 m, the minimum cement content should be 350 kg/m<sup>3</sup> of concrete. For piles of large diameter and/or deeper piles, the minimum cement content should be 400 kg/m<sup>3</sup> of concrete. For design purposes, the strength of concrete mix using the quantities of cement mentioned above, may be taken equivalent to M 20 and M 25 respectively for concrete with cement content of 400 kg/m<sup>3</sup> and 450 kg/m<sup>3</sup>. Where concrete of higher strength is needed, richer concrete mix with greater cement content may be designed. In case of piles subsequently exposed to free water or in case of piles where concreting is done under water or drilling mud using methods other than the tremie, 10 percent extra cement over that required for the design grade of concrete at the specified slump shall be used subject to minimum quantities of cement specified above. Clean water, free from acids and other impurities, shall be used in the manufacture of concrete. The average compressive stress under working load should not exceed 25 percent of the specified works cube strength at 28 days calculated on the total cross sectional area of the pile. When concreting is done using a

tremie, allowable stress in concrete may be 33.33 percent of the specified works cube strength at 28 days and aggregates more than 20 mm shall not be used.

### 3.0 WORKMANSHIP/PILE DRIVING

#### 3.1 CONTROL OF PILE INSTALLATION

Bored cast-in-situ piles may be adopted by suitable choice of installation techniques; covering the manner of. Soil stabilization that is use of casing and/or use of drilling mud; manner of concreting that is direct pouring and placing or by use of tremie and choice of boring tools in order to permit a satisfactory installation of a pile at a given site. Sufficient detailed information about the subsoil conditions is essential to predetermine the details of the installation technique.

3.1.1 CONTROL OF ALIGNMENT - Piles shall be installed as accurately as possible as per the designs and drawings either vertically or to the specified batter. Greater care should be exercised in respect of installation of single pile or piles in two pile groups. As a guide, for vertical piles a deviation of 1.5 percent and for raker piles a deviation of 4 percent should not normally be exceeded although in special cases a closer tolerance may be necessary. Piles should not deviate more than 75 mm or  $D/10$  whichever is more in case of piles having diameter more than 600 mm from their designed positions at the working level of the piling rig. In the case of a single pile in a column positional tolerance should not be more than 50 mm (100 mm in case of piles having diameter more than 600 mm). Greater tolerance may be prescribed for piles driven over water and for raking piles. For piles to be cut-off at a substantial depth, the design should provide for the worst combination of the above tolerances in position and inclination. In case of piles deviating beyond these limits and to such an extent that the resulting eccentricity cannot be taken care of by a redesign of the pile cap or pile ties, the piles should be replaced or supplemented by one or more additional piles. In case of piles, with non-circular cross section 'D' should be taken as the dimensions of pile, along which the deviation is computed. In such cases the permissible deviation in each direction should be different depending upon the dimension of the pile along that direction.

Any deviation from the designed location, alignment or load capacity of any pile shall be noted and adequate measures taken well before the concreting of the pile cap and plinth beam. A minimum length of one metre of temporary casing shall be inserted in each bored pile unless otherwise specifically desired. Additional length of temporary casing may be used depending on the condition of the strata, ground water level, etc. Drilling mud of suitable consistency may, also be used instead of temporary casings for stabilizing sides of the holes.

In case, a bored pile is stabilized by drilling mud or by maintaining water heads within the hole, the bottom of the hole shall be handed very carefully before concreting work is taken up. The cleaning of the hole may be ensured by careful operation of boring tool and/or flushing of the drilling mud through the bottom of the hole. Flushing of bore holes before concreting with fresh drilling fluid/mud is preferred.

In case a hole is bored by use of drilling mud, the specific gravity of the mud suspension near about the bottom of the hole shall, whenever practicable, be determined by suitable slurry sampler in a first few piles and at suitable interval of piles and recorded. Consistency of the drilling mud suspension shall be controlled throughout the boring as well as concreting operations in order to keep the hole stabilized as well as to avoid concrete getting mixed up with the thicker suspension of the mud.

The concreting operations should not be taken up when the specific gravity of bottom slurry is more than 1-2. Concreting shall be done by tremie method in all such cases. The slurry should be maintained at 1.5 m above the ground water level if casing is not used. Concreting under water may be done either with the use of tremie method or by the use of specially designed underwater placer to permit deposition of concrete in successive layers, without permitting the concrete within the placer to fall through free water.

3.1.2 TREMIE METHOD-In addition to the normal precautions to be taken in tremie concreting, the following requirements are particularly applicable to the use of tremie concrete in pipes.

- a) The concrete should be coherent, rich in cement (not less than 370 kg/m<sup>3</sup>) and of slump not less than 150 mm.
- b) When concreting is carried out under water a temporary casing should be installed to the full depth of the bore hole or 2 m into non-collapsible stratum, so that fragments of ground cannot drop from the sides of the hole into the concrete as it is placed. The temporary casing may not be required except near the top when concreting under drilling mud.
- c) The hopper and tremie should be a closed system embedded in the placed concrete, through which water cannot pass.
- d) The tremie should be large enough with due regard to the size of the aggregate. For 20 mm aggregate the tremie pile should be of diameter not less than 200 mm, aggregates more than 20 mm shall not be used.
- e) The first charge of concrete should be placed with a sliding plug pushed down the tube ahead of it or with a steel plate of adequate charge to prevent mixing of concrete and water. However, the plug should not be left in the concrete as a lump.
- f) The tremie pipe should always penetrate well into the concrete with an adequate margin if safety against accidental withdrawal of the pipe is surged to discharge the concrete.
- g) The pile should be concreted wholly by tremie and the method of deposition should not be changed part way up the pile, to prevent the laitance from being entrapped within the pile.
- h) All tremie tubes should be scrupulously cleaned after use. Normally concreting of the piles should be uninterrupted. In the exceptional case of interruption of concreting; but which can be resumed within 1 or 2 hours, the tremie shall not be taken out of the concrete. Instead it shall be raised and lowered slowly, from time to time to prevent the concrete around the tremie from setting. Concreting should be resumed by introducing a little richer concrete with a slump of about 200 mm for easy displacement of the partly set concrete. If the concreting cannot be resumed before final set up concrete already placed, the pile. So cast may be rejected or accepted with modifications.

In case of withdrawal of tremie out of the concrete, either accidentally or to remove a choke in the tremie, the tremie may be re-introduced in the following manner to prevent impregnation of laitance or scum lying on the top of the concrete already deposited in the bore.

The tremie shall be gently lowered on to the old concrete with very little penetration initially. A vermiculite plug should be introduced in the tremie. Fresh concrete of slump between 150 mm and 175 mm should be filled in the tremie which will push the plug forward and will emerge out of the tremie displacing the laitance/scum. The tremie will be pushed further in steps making fresh concrete sweep away laitance/scum in its way.

When tremie is buried by about 69 to 103 cm, concreting may be resumed. During installation of bored cast-in-situ piles, the convenience of installation may be taken into account while determining the sequence of piling in a group. The top of concrete in a pile shall be brought above the cut-off level to permit removal of all laitance and weak concrete before capping and to ensure good concrete at the cut-off level for proper embedment into the pile cap. Where cut-off level is less than 1.5 metre below the working level concrete shall be cast to a minimum of 300 mm above cut-off level. For each additional 0.3 m increase in cut-off level below the working level additional coverage of 50 mm minimum shall be allowed. Higher allowance may be necessary depending on the length of the pile. When concrete is placed by tremie method, concrete shall be cast to the piling platform level to permit overflow of concrete for visual inspection or to a minimum of one metre above cut-off level. In the circumstance where cut-off level is below ground water level the need to maintain a pressure on the unset concrete equal to or greater than water pressure should be observed and accordingly length of extra concrete above cut-off level shall be determined.

3.1.3 DEFECTIVE PILE: In case, defective piles are formed, they shall be removed or left in place whichever is convenient without affecting performance of the adjacent piles or the cap as a whole. Additional piles shall be provided to replace them as directed. Any deviation from the designed location alignment or load capacity of any pile shall be noted and adequate measures taken well before the concreting of the pile cap and plinth beam if the deviations are beyond the permissible limit. During chipping of the pile top manual chipping may be permitted after three days of pile casting; pneumatic tools for chipping shall not be used before seven days after pile casting.

After concreting the actual quantity of concrete shall be compared with the average obtained from observations actually made in the case of a few piles initially cast. If the actual quantity is found to be considerably less, special investigations shall be conducted and appropriate measures taken.

3.1.4 RECORDING OF DATA: A competent inspector shall be maintained at site to record necessary information during installation of piles and the data to be recorded shall include:

- a) Sequence of installation of piles in a group;
- b) Dimensions of the pile, including the reinforcement details and mark of the pile;
- c) Depth bored;
- d) Time taken for concreting;
- e) Cut off level/working level;
- f) When drilling mud is used, the specific gravity of the fresh supply and contaminated mud in the hole before concreting is taken up, shall be recorded in case of first ten piles, and subsequently at an approximate interval of 10 piles or earlier; and Any other important observation.

#### 3.1.5 STRIPPING PILE HEADS

The concrete should be stripped to a level such that the remaining concrete of a pile will project minimum 50 mm into the pile cap. The effect of this projection on the position of any reinforcement in the pile cap should be considered in design. The pile reinforcement should be left with adequate projecting length above the cut off level for proper embedment into the pile cap. Exposing such length should be done carefully to avoid shattering or otherwise damaging the rest of the pile. Any cracked or defective concrete should be cut away and made good with new concrete properly bonded to the old.

#### 3.1.6 DRIVING

There is some evidence to suggest that a larger ratio of hammer weight to pile weight is required to avoid damaging the pile. Driving of pre-stressed concrete piles should follow the recommendations for reinforced concrete piles as in 7.5. Although the effect of pre-stressing is to reduce tension cracks induced by stress waves, such cracking may still occur, particularly when driving is 'light', or if too light a hammer is used. A careful check for tension cracks should be made during the driving of the first pile and, if these occur, the hammer drop should be reduced. If the cracks persist or recur when the full drop has to be used, then a heavier hammer should be substituted.

#### 3.1.7 BONDING OF HEAD OF PILE INTO PILE CAP

The concrete of the pile may be stripped to expose the pre-stressing wires. The concrete should be stripped to such a level that the remaining concrete projects 50 mm to 7.5 mm into the pile cap. Where tension has to be developed between the cap and pile, the exposed pre-stressing wires should extend at least 600 mm into the cap. An alternative method is to incorporate mild steel reinforcement in the upper part of the pile. After stripping the concrete this reinforcement should be bonded into the cap.

#### 3.1.8 FLUSHING

The central duct/hole shall be connected to a suitable pump and water drilling fluid allowed to flow through the bottom of the pile removing loose material.

#### 3.1.9 GROUTING

Sand and cement grout mixed with water in a high speed colloidal mixer is to be fed into the pile with a grout pump of suitable capacity connected to the central duct through a manifold. A grout of sand and cement with

additives as necessary, of strength not less than 1: 2 cement and sand suitable for pumping into the annulus, may also be used. The temporary casing here used shall be removed in stages with the rise of the level of grout. After final removal of the temporary casing, the grout level shall be brought up to the top by pouring in additional grout as required.

### 3.2 CASTING AND CURING

The piles should be cast in a continuous operation from end to end of each pile. The concrete should be thoroughly compacted against the forms and around the reinforcement by means of immersion and/or shutter vibrators. The faces of the pile including those exposed at the top of pile should be dense as far as possible. Immediately on completion of the casting the top surface should be finished level without excessive trowel ling. Care should be taken to ensure that vibration from adjoining work does not & the previously placed concrete for piles during the setting period.

Where Portland cement concrete with ordinary or rapid-hardening cement is used, piles shall be kept continuously wet for at least 7 days, but longer curing shall be applied when hard driving is expected and in all cases where it is practicable to do so. When piles are stacked between the period of wet curing and driving, they shall be protected from rapid drying by sheltering them from the wind and direct sunlight by covering the stacks. Though from consideration of speed and economy precast concrete piles will have to be driven with the least possible delay after casting, it shall be kept in mind that a thorough curing and hardening is necessary before the piles are driven and proper schedule to take care of this shall be decided for the operations of casting, stacking and driving. The most important factors affecting the time of curing are the method of curing, weather during hardening, probable hardness of driving and the method of lifting and pitching.

### 3.3 STORING AND HANDLING

Piles shall be\_ stored on firm ground free from liability to unequal subsidence or settlement under the weight of the stack of piles. The piles shall be placed on timber supports which are truly level and spaced so as to avoid undue bending in the piles. The supports shall be vertically one above the other. Spaces shall be left round the piles to enable them to be lifted without difficulty. The order of stacking shall be such that the older pile can be withdrawn for driving without disturbing the newer piles. Separate stacks shall be provided for different lengths of piles. Wherever curing is needed during storage, arrangements shall be made to enable the piles to be watered if weather conditions so require. For &tailed precautions with regard to curing operations reference may be made to IS : 456-1978. Care shall be taken at all stages of transporting, lifting and handling of the piles that they are not damaged or cracked. During transportation the piles shall be supported at the appropriate lifting holes provided for the purpose. If the piles are put down temporarily after being lifted they shall be placed on trestles or blocks located at the lifting points.

### 3.4 SEQUENCE OF PILING

In a pile group the sequence of installation of piles shall normally be from the centre to the periphery of the group or from one side to the other.

Consideration should be given to the possibility of doing harm to a pile recently formed by driving the tube nearby before the concrete has sufficiently set. The danger of doing harm is greater in compact soils than in loose soils. Driving piles in loose sand tends to compact the sand which, in turn, increases the skin friction. Therefore, the order of installing of such a pile in a group should avoid creating a compacting block of ground into which further piles cannot be driven.

In case where stiff clay or compact sand layers have to be penetrated, similar precautions need be taken. This may be overcome by driving the piles from the centre outwards or by beginning at a selected edge or working across the group. However, in the case of very soft soils, the driving may have to proceed from outside to inside so that the soil is restrained from flowing out during operations.

### 3.5 CONTROL OF PILE DRIVING

The hammer blow generates a stress wave which traverses the length of the pile, and failure, whether by compression or tension, may occur anywhere along the pile. Failure due to excessive compressive stress most commonly occurs at the head. Head stresses, which in general are independent of ground conditions, depend

upon the weight of the hammer, its drop and the stiffness of head cushion. The maximum set for a given stress is obtained by using the heaviest hammer and the softest packing, the hammer drop being adjusted to suit the allowable stress in the concrete. Since head-packing materials increase in stiffness with repeated use, optimum driving conditions can be maintained only by regular replacement of the packing. Failure in the lower sections of a pile can only occur in exceptionally hard driving where in theory the compressive stresses of toe can reach twice the head stresses. In practice, however, this rarely occurs and more than the maximum compressive stress tends to be fairly uniform over a considerable length of the pile.

Longitudinal tension is caused by reflection of the compressive wave at a 'free' end. Tensile stresses, therefore, may arise when the ground resistance is low and/or when the head conditions result in hammer rebound, that is, with hard packing and light hammer. In addition, a relatively long length of pile unsupported above a hard stratum may encourage transverse or flexural vibrations which may be set up if the hammer blow becomes non-axial or the pile is not restrained. Piles may be driven with any type of hammer, provided they penetrate to the prescribed depth or attain the specific resistance without being damaged. The hammer, helmet, dolly and pile should be coaxial and should sit squarely one upon the other.' It is always preferable to employ the heaviest hammer practicable and to limit the stroke so as not to damage the pile. When choosing the size of the hammer, regard should be given to whether the pile is to be driven to a given resistance or to a given depth. The stroke of a single acting or drop hammer should be limited to 1-2 m, preferably 1 m. A shorter stroke with particular care should be used when there is a danger of damaging the pile. The following are examples of such conditions:

- o Where in the early stages of driving a long pile, a hard layer near the ground surface has to be penetrated.
- o Where there is a very soft ground up to a considerable depth, so that a large penetration is achieved at each hammer blow.
- o Where the pile is expected suddenly to reach refusal on rock or other- virtually impenetrable soil. When a satisfactory set with an appropriate hammer and drop for the last 10 blows has been achieved, repeat sets should only be carried out with caution and long-continued driving, after the pile has almost ceased to penetrate, should be avoided, especially when a hammer of moderate weight is used. It is desirable that a full driving record be taken on one pile in every hundred driven, and on the first few piles in a new area. Any sudden change in the rate of penetration which cannot be ascribed to normal changes in the nature of the ground should be noted and the cause ascertained, if possible, before driving is continued

When the acceptance of piling determined by driving to a set, the driving conditions when taking the set should be the same as those used when the sets of test piles were obtained. The head of precast concrete pile should be protected with packing of resilient material, care being taken to ensure that it is evenly spread and held securely in place. A helmet should be placed over the packing and provided with a dolly of hardwood or other material not thicker than the width of the pile. Jetting may be used as a means of minimizing or eliminating the resistance at the toe: frictional resistance along the surface of the pile shaft may also be reduced. By reducing the toe resistance very hard driving and vibration can be avoided and greater rates and depths of penetration can be achieved than by percussive methods. Jetting is effective in cohesion less soils such as sand, gravel and fine-grained soils provided the percentage of clay is small; it is not effective in clay soils. Jetting of piles should be carried out only when it is desired and in such a manner as not to impair the bearing capacity of the piles already in place, the stability of the ground or the safety of any adjoining buildings. The quantity of water required for effective jetting is directly related to the cross-sectional area of the piles (including external jet piles); up to 2 litres per minute per square centimeter of pile cross-section may be required at the pile in dense cohesion less soils; loosely compacted soils may require less water. The pressure should be from 5.6 kgf/cm<sup>2</sup> to 106 kgf/cm<sup>2</sup> or more. If large quantities of water are used, it may be necessary to make provision for leading away the water that emerges at the ground surface so that the stability of the piling equipment is not endangered by the softening of the ground.

The arrangement of the jets should be balanced to ensure that the pile penetrates vertically. Independent piles surged down or two pipes attached to the opposite sides of the pile may be used. To minimize the risk of blockages the nozzles should not be positioned at the point of the toe. Acceptable verticality may be achieved by the use of rigid leaders and allowing the pile to enter the ground gradually, after operating the water under weight of the pile and hammer, the rate of penetration being controlled by the pile winch. Once maximum apparent



penetration is achieved by this method, further penetration may generally be obtained in cohesion less soils by light driving whilst the water jets are running. When jetting is completed the piles should be driven to the final penetration or set. Jetting should be stopped before completing the driving, which should always be finished by ordinary methods. Jetting should be stopped if there is any tendency for the pile tips to be drawn towards the piles already driven owing to disturbance to the ground. Jets shall be tested before driving commences. If it becomes necessary to jet a pile which is not provided with built-in-jet, satisfactory results can be obtained by working on independent jet pipes down the outside of the pile, the jet being worked alternatively down the several faces of the pile to assist verticality.

#### 4.0 BASIC PROPERTIES OF DRILLING MUD (BENTONITE)

##### 4.1 PROPERTIES

The bentonite suspension used in bore holes is basically a clay of montmorillonite group having exchangeable sodium cations. Because of the presence of sodium cations, bentonite on dispersion will break down into small plate like particles having a negative charge on the surfaces and positive charge on the edges. When the dispersion is left to stand undisturbed, the particles become oriented building up a mechanical structure at its own. This mechanical structure held by electrical bonds is observable as a jelly like mass or jell material. When the jelly is agitated, the weak electrical bonds are broken and the dispersion becomes fluid.

##### 4.2 FUNCTIONS

The action of bentonite in stabilizing the sides of bore holes is primarily due to the thixotropic property of bentonite suspension. The thixotropic property of bentonite suspension permits the material to have the consistency of a fluid when introduced into the excavation and when undisturbed forms a jelly which when agitated become a fluid again.

In the case of a granular soil, the bentonite suspension penetrates into the sides under positive pressure and after a while forms a jelly. The bentonite suspension gets deposited on the sides of the hole and makes the surface impervious and imparts a plastering effect. In impervious clay, the bentonite does not penetrate into the soil, but deposits only a thin film on the surface of the hole. Under such condition stability is derived from the hydrostatic head of the suspension.

##### 4.3 SPECIFICATION

The bentonite suspension used for piling work shall satisfy the following requirements:

- o The liquid limit of bentonite when tested in accordance with IS : 2720 ( Part V ) - 1965\* shall be more than 300 percent and less than 450 percent.
- o The sand content of the bentonite powder shall not be greater than 7 percent.

NOTE - The purpose of limiting the sand content is mainly to control and reduce the wear and tear of the pumping equipment.

- o Bentonite solution should be made by mixing it with fresh water using pump for circulation. The density of the bentonite solution should be about 1.12.
- o The Marsh viscosity when tested by a Marsh cone should be about 37 seconds.
- o The swelling index as measured by the swelled volume after 12 hours in abundant quantity of water shall be at least 2 times its dry volume.
- o The pH value of the bentonite suspension shall be less than 11.5.

#### 5.0 TEST OF PILE

There are two types of tests for each type of loading (that is, vertical, lateral and pull out) namely, initial and routine test.

##### 5.1 INITIAL TEST

This test is required for one or more of the following purposes. This is done in case of important and or major projects and number of tests may be one or more depending upon the number of piles required.

- a) Determination of ultimate load capacities and arrival at safe load by application of factor of safety,
- b) To provide guidelines for setting up the limits of acceptance for routine tests,
- c) To study the effect of piling on adjacent existing structures and takes decision for the suitability of type of piles to be used,
- d) To get an idea of suitability of piling system, and
- e) To have a check on calculated load by dynamic or static approaches.

## 5.2 ROUTINE TEST

This test is required for one or more of the following purposes. The number of tests may generally be one-half percent of the total number of piles required. The number of the test may be increased up to 2 percent in a particular case depending upon nature, type of structure and strata condition:

- a) One of the criteria to determine the safe load of the pile;
- b) Checking safe load and extent of safety for the specific functional requirement of the pile at-working load; and
- c) Detection of any unusual performance contrary to the findings of the initial test, if carried out.

## 5.3 GENERAL REQUIREMENTS APPLICABLE TO ALL TYPES OF TESTS

Pile test may be carried out on a single pile or a group of piles as required. In case of pile groups, caps will be provided such that the required conditions of actual use are fulfilled.

Generally the load application and deflection observation will be made at the pile top. In particular cases where upper part of pile is likely to be exposed later on due to scour, dredging or otherwise then capacity contributed by that portion of the pile during load test shall be duly accounted for. The pile groups in these conditions shall be tested without their cap resting on the ground.

The test should be carried out at cut-off level wherever practicable, otherwise suitable allowance shall be made in the interpretation of the test results test load if the test is not carried out at cut-off level.

## 5.4 VERTICLE LOAD TEST

### 5.4.1 GENERAL

In this type of test, compression load is applied to the pile top by means of a hydraulic jack against rolled steel joist or suitable load frame capable of providing reaction and the settlement is recorded by suitably positioned dial gauges. Maintained load method as given later should be used for determination of safe load. However, for specific requirements cyclic and CRP methods, which are alternate methods, may be used as mentioned later. The general requirements applicable for these three methods are given under here, unless otherwise specified.

5.4.2 Preparation of Pile Head - The pile head should be chipped off to natural horizontal plane till sound concrete is met. The projecting reinforcement should be cut off or bent suitably and the top finished smooth and level with plaster of Paris or similar synthetic material where required. A bearing plate with a hole at the centre should be placed on the head of the pile for the jacks to rest.

5.4.3 Application of Load - (Not applicable to CRP method.) The test should be carried out by applying a series of vertical downward incremental load each increment being of about 20 percent of safe load on the pile. For testing of raker piles it is essential that loading is along the axis.

5.4.4 Reaction - The reaction may be obtained from the following: Kent ledge placed on a platform supported clear of the test pile. In case of load test below under-pinned structure, the existing structure if having adequate weight and suitable construction may serve as ken ledge. The centre of gravity of the ken ledge should generally be on the axis of the pile and the load applied by the jack should also be coaxial with this pile.

Anchor piles with centre-to-centre distance with the test pile not less than 3 times the test pile shaft diameter subject to minimum of 2 m. If the anchor piles are permanent working piles, it should be ensured that their residual uplift is within limits. Care should be exercised to ensure that the datum bar supports are not affected by

heaving up of the soil. Rock anchors with distance from the nearest edge "of the piles at rock level being 2 times the test pile shaft diameter or 1.5 m whichever is greater.

5.4.5 Settlement - (Not Applicable for CRP Test.) Settlement shall be recorded with minimum 2 dial gauges for single pile and 4 dial gauges of 0.01 mm sensitivity for groups, each positioned at equal distance around the piles and normally held by datum bars resting on immovable supports at a distance of 3 D (subject to minimum of 1.5m) from the edge of the piles, where D is the pile stem diameter of circular piles or diameter of the circumscribing circle in the case of square or non-circular piles.

5.4.6 The safe load on single pile for the initial test should be least of the following: Two-thirds of the final load at which the total displacement attains a value of 12 mm unless otherwise required in a given case on the basis of nature and type of structure in which case, the safe load should be corresponding to the stated total displacement permissible. 50 percent of the final load at which the total displacement equal 10 percent of the pile diameter in case of uniform diameter piles and 7.5 percent of bulb diameter in case of under-reamed piles.

5.4.7 Maintained Load Method - This applicable for both initial and routine test. In this method application of increment of test load and taking of measurement or displacement in each stage of loading is maintained till rate of displacement of the pile top is either 0.1 mm in first 30 minutes or 0.2 mm in first one hour or till 2 h whichever occur first. If the limit of permissible displacement as given in earlier is not exceeded, testing of pile is not required to be continued further. The test load shall be maintained for 24 h.

5.4.8 Cyclic Method - This method is used in case of initial test to find out separately skin friction and point bearing load on single piles of uniform diameter. The procedure as given in Appendix A or by instrumentation may be used.

5.4.9 CRP Method-This method which is used for initial test is generally considered to be more suitable for determining ultimate bearing capacity than the maintained load test but the load/deflection characteristics are quite different from those of the maintained load test and cannot be used to predict settlement of the pile under working load conditions. This method should not be included in routine test.

## 6.0 MEASUREMENT

Payment for piling work will be done as per the Odisha Public Works Department Schedule.

# EARTH WORK IN EXCAVATION & BACK FILLING

## EARTH WORK IN EXCAVATION & BACK FILLING CONTENTS

### SL NO DESCRIPTION

- 1.0 Scope
- 2.0 Applicable codes
- 3.0 Drawings
- 4.0 Classification of earth
- 5.0 General
- 6.0 Clearing
- 7.0 Precious objects, Relics, objects of Antiquities etc
- 8.0 Excavation for structure
- 9.0 Measurement and rates

### 1.0 SCOPE

This part of the specification deals with general requirement for earth in excavation in different materials, site grading, filling in areas shown in drawings, filling back around foundations, plinths and approach ramps, conveyance and disposal of excess excavated soil or stacking them properly as shown on the drawings or as directed by the Engineer - in-charge and all operations covered within the intent and purpose of the specifications. The excavation in rock by blasting etc. shall be as per relevant specifications.

### 2.0 APPLICABLE CODES

The provisions of the latest Indian Standards listed below, but not restricted to from part of these specifications:

IS: 783 Code of practice for laying concrete pipes

IS: 1200 Method of measurement of building and (Part I) Civil Engineering Works - Part I Earth Work.

IS: 1498 Classification and identification of soils for general Engineering purposes.

IS: 2720 Methods of test for soil

IS: 2809 Glossary of terms and symbols relating to soil Engineering.

IS: 3764 Safety code for excavation work

IS: 4081 Safety Code for blasting and related drilling operations

IS: 4988 Glossary of terms and classifications of earth moving machinery

### 3.0 DRAWING

The Engineer-in-charge will furnish drawings wherever in his opinion such drawings are required to show the areas to be excavated/filled, sequence of priorities etc. The Contractor shall follow such drawings strictly.

### 4.0 CLASSIFICATION OF EARTH

For purpose of earthwork soil shall be classified as under:

Loose / soft soil: Any soil which generally yields to the application of picks and shovels, phawras, rakes or any such ordinary excavating implements or organic soil, gravel, silt, sand, turf loam, clay, peat etc. fall under this category.

Dense / Hard soil: Any soil, which generally requires the close application of picks, or jumpers or scarifiers to loosen it. Stiff clay gravel and cobble stone etc. fall under this category. (Note: Cobble stones are the rock fragments usually rounded or semi-rounded having maximum diameter in any one direction between 80 & 300mm)

Mud: Mud is a mixture of ordinary soft soil and water in fluid or weak solid state. Soft / Disintegrated rock (Not requiring blasting): This shall include the type of rock and boulder, which may be quarried or split with crowbars.

Laterite, hard conglomerate and amygdaloidal basalts also come under this category.

Hard rock (Requiring blasting where blasting is prohibited): Under this category shall fall hard rocks, which though normally requires blasting for their removal but blasting is prohibited and excavation has to be done by chiseling, wedging or other suitable method.

## 5.0 GENERAL

5.1 The Contractor shall furnish all tools, plant, instruments, qualified supervisory staff, labor, materials, any temporary works, consumable and everything necessary, whether or not such items are specifically stated herein, for completion of the job in accordance with the specification requirements.

5.2 The Contractor shall carry out the surveys of the site before excavation and set out properly all lines and establish levels for various works such as earth work in excavation for grading, foundations, plinth filling, road drains, cable trenches, pipe lines, culverts, retaining walls etc. Such surveys shall be carried out taking accurate cross sections of the area perpendicular to the grid lines at intervals determined by the Engineer-in-Charge, depending on the ground profiles. These will be checked by the Engineer-in-Charge or his representative and thereafter properly recorded.

5.3 The excavation shall be done to correct lines and levels. This shall include where required, proper shoring to maintain excavation and also the furnishing, erection and maintaining of substantial barricades around excavations and warning lamps at night for safety purposes.

5.4 The rates quoted shall include for dumping of excavated material in regular heaps, bunds, and rip rap with regular slopes as directed by the Engineer-in-charge within the lead specified and leveling the same so as to provide natural drainage. Rock/ soil excavation shall be properly stacked as directed by the Engineer-in-charge. As a rule all softer materials shall be laid along the centre of the heaps, the harder and more resistant materials, forming the casting on the sides and the top. Rock shall be stacked separately.

## 6.0 CLEARING

The area to be excavated / filled shall be cleared of all fences, trees, plant logs, stumps, bush, vegetation, rubbish, slush etc. and other objectionable matter. If any roots or stumps of trees are met during excavation, they shall be removed. The material so removed shall be disposed off as directed by the Engineer-in-charge. Where earth fill is intended, the area shall be cleared of all loose or soft patches, top soil containing objectionable matter/ materials before filling commences. No separate payment shall be made for such clearing works.

## 7.0 PRECIOUS OBJECTS, RELICS, OBJECTS OF ANTIQUITIES ETC.

All gold, silver, oil, minerals, archaeological and other findings of importance or other materials of any description and all precious stones, coins, treasures trove, relics, antiquities and similar things which may be found in or upon the site shall be property of the Employer and the Contractor shall duly preserve the same to the satisfaction of the Engineer-in-charge and from time to time deliver the same to him.

## 8.0 EXCAVATION FOR STRUCTURES

8.1 DESCRIPTION: Excavation for structures shall consist of removal of materials for the construction of the foundations, retaining walls, pipe trenches, tunnels and other similar structures in accordance with the requirements of this specification and the lines and dimensions shown on the drawings or as indicated by the Engineer-in-charge. The work shall include construction of shoring, bracing, draining and pumping; the removal of all logs, stumps, grubs and other deleterious matter and obstruction necessary for placing the foundations, trimming bottoms of excavation; backfilling, cleaning up the site and disposal of all surplus materials.

8.2 SETTING OUT: After the site has been cleared as per clause 5 above, the limits of excavation shall be set out true to lines, curves, slopes, grades and sections as shown on the drawings or as directed by the Engineer-in-charge. The Contractor shall provide all labour, survey instruments and materials such string, pegs, nails, bamboo, stones, lime, mortar, concrete etc. required in connection with the setting out of works and establishment of bench marks. The Contractor shall be responsible for the maintenance of bench marks and other marks and stakes as long as they are required for the work in the opinion of the Engineer in- charge.

8.3 EXCAVATION: Excavation shall be taken to the width of the lowest step of footing or the pile caps and the sides shall be left plumb where the nature of the soil allows it. Where the nature of the soil or the depth excavated trench/ pit does not permit vertical sides, the Contractor at his own expense shall put up the necessary shoring, strutting and planking or cut slopes to a safe angle or both with due regard to the safety of personnel and the works and to the satisfaction of the Engineer-in-Charge. the depth to which the excavation is to be carried out shall be as shown on the drawings unless the type of material encountered is such as to require changes, in which case the depth shall be as ordered by the Engineer-in-Charge.

8.4 DEWATERING AND PROTECTION: Where water is met within excavation due to stream flow, seepage, springs, rain or other reasons, the Contractor shall take adequate measures such as bailing, pumping, construction of diversion channels, drainage channels, bunds and other necessary works to keep the foundation trenches/ pits dry when so required and to keep the green concrete/ masonry against damage by erosion or sudden rise of water level. The method to be adopted in this regard and other details thereof shall be left to choice of the Contractor but subject to the approval of the Engineer-in-charge. Approval of the Engineer-in-charge shall, however, not relieve the Contractor of his responsibility for the adequacy of dewatering and protection arrangements and the safety of the works. Pumping from inside of any foundation enclosure shall be done in such a manner as to preclude the possibility for the movement of water through any freshly placed concrete. No pumping shall be permitted during the placing of concrete or any period of at least 24 hours thereafter, unless it is done from a suitable sump separated from the concrete work by a watertight wall or similar means. At the discretion of the Contractor and at his cost, cement grouting or other approved methods may be used to prevent or reduce seepage and to protect the excavation area. The Contractor shall take all precautions in diverting channels and in discharging the drained water so as not to cause damage to the works or to adjoining property.

8.5 PREPARATION OF FOUNDATION: The bottom of the foundation shall be levelled both longitudinally and transversally or stepped as directed by the Engineer-in-charge. Before the footing is laid, the surface shall be slightly watered and rammed. In the event of the excavation having been made deeper than that shown on the drawing or as otherwise ordered by the Engineer-in-charge, the extra depth shall be made up with concrete of the foundation grade at the cost of the Contractor. Ordinary filling shall not be used for the purpose to bring the foundation to level.

When rock or other hard strata is encountered, it shall be freed of all loose and soft materials, cleaned and cut to a firm surface either level, stepped, or serrated as directed by the Engineer-in-charge. All seams shall be cleaned out and filled with cement mortar or grout to the satisfaction of the Engineer-in-charge.

8.6 SLIPS & BLOWS: If there are any slips or blows in the excavation, these shall be removed by the Contractor at his own cost.

8.7 BACK FILLING: To the extent available, selected surpluses soil from the excavation shall be used as backfill. Fill material shall be free from clods, salts, sulphates, organic or other foreign materials. All clods of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not larger than 75 mm size mixed with properly graded fine materials consisting of moorum or earth fill up the voids and the mixture used for filling.

If any selected fill is required to be borrowed, the Contractor shall make arrangement for bringing the material from outside borrow pits. The material sources shall be subject to the prior approval of the Engineer-in-Charge. The Contractor shall make necessary access roads to such borrow areas at his own cost, if such access roads do not exist. Use of surplus selected soil from excavated stuff for backfilling can be permitted only up to the original ground level. Above this level, only selected borrowed material shall be used. Backfilling of the foundation/ pits shall be done as soon as the foundation work has been completed to the satisfaction of the Engineer-in-Charge and measured but not earlier than the full setting of the concrete or masonry of the foundation. Backfilling shall be carried out in such manner as to not cause undue thrust on any part of the structure. Backfilling shall be done in space around the foundations after clearing it of all debris and in layers

of 150 mm. loose thicknesses, watered and compacted to the satisfaction of the Engineer-in-charge and to the original surface. For embankments, initially the top width is to be increased by 600mm on either side for enabling proper compaction upto the edge. The embankment shall be cut and sectioned for correct profile. This additional earthwork on either side of 600mm width shall not be paid for and shall be included in the respective item of road work quoted by the tenderer. The slopes of embankment shall be compacted by using mechanical earth compactors of adequate capacity wherever necessary as directed by the Engineer-in-charge.

**8.8 DISPOSAL OF SURPLUS EXCAVATED MATERIALS:** All the excavated material shall be the property of the employer. Where the excavated material is directed to be used in the construction of the works for general grading, plinth filling or embankments, the operation shall be arranged in such a manner that the capacity for cutting, haulage and compaction are nearly the same.

All hard materials such as hard moorum, rubble etc. not intended for filling in foundations, plinth or embankments shall be stacked neatly for future use as directed by the Engineer in-Charge within the lead specified. Unsuitable or surplus materials not intended for use in part of the works or for reuse shall be disposed off outside the complex as directed by the Engineer-in-Charge.

#### 9.0 MEASUREMENT & RATES

The measurement shall be generally confirming to IS: 1200 Part-I unless otherwise specified. Measurement for excavation of foundations and footings shall be as required for the exact width, length and depth as shown or figured on the drawings or as may be directed by the Engineer-in-Charge. If taken out to a greater width, length or depth than shown or required, the extra work occasioned thereby shall be done at the Contractor's expenses.

The dimensions of the trenches and pits shall be measured correct to the nearest cm. And cubical contents worked out in cubic meters, correct to two places of decimal.

**Footings :** Area of excavation for footing shall be measured equally to the area of the lowest concrete course as shown on the drawing -Depth shall be measured vertically from ground level to bottom of concrete course or dry rubble packing or brick flat soling as the case may be.

**Plinth Beams :** Depth of excavation for plinth beam shall be measured from ground level up to bottom of beam and width equal to width of beam. If a levelling course is ordered. It shall be measured up to the bottom of the levelling course. Where the excavations is made in trenches, measurements for cutting shall be taken by means of taps and staff and after completion of work and total quantity of excavation computed from these levels in manner approved by the architect/Employer.

Where excavation is made for leveling the site, levels shall be taken before start and after completion of work and work and total quantity of excavation computed from these levels in manner approved by the Architect. Where soil including soft rock is mixed hard rock after excavation shall be stacked separately. Measurement of the entire excavation shall be taken as indicated above. Excavation of hard rock shall be measured from stacks of excavated hard rock and reduced by 40% for bulkage and voids. The quantity so arrived at shall be paid for under hard rock. The quantity so arrived at shall be paid as soil including and quantity payable under hard rock shall be paid as soil including soft rock.

Any additional excavation required for working space from work showing, planning, dewatering etc, shall not be measured for separately. Rates quoted for excavation shall include all these factors and filling back the trenches with available soil.

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To open spaces: Filling shall be measured from cross sections of embankment, levels of which are recorded by means of levels before start of work and after completion of work. When it is not possible to measure filling from cross sections, it may be measured from loose stack of lorry measurements with previous written permission from the Owner's Engineer and 20% deduction shall be made from the measured quantity to arrive at the net quantity payable.

Rate for earthwork shall include the following:

- o Excavation and disposing earth as specified.
- o Setting out works, profiles etc.
- o Site clearance such as cleaning of rank vegetation, shrubs, bush wood.
- o Forming (or leaving) "Dead men" or "Tell Tales" and their removal after measurement o Bailing/ pumping out water in excavation from rains, sub-soil water etc.
- o Protection, temporarily supporting of existing service, i.e. pipes, water mains, cables etc. met within the course of excavation. Care shall be taken not to disturb electric and communication cables, removal of such cables, if necessary, shall be arranged by the Engineer-in-charge.
- o Forming (or leaving) steps in sides of deep trenches and their removal:
- o Removing slips or falls in excavation.
- o Fencing and/or suitable measures for protection against risk of accidents as approved by the Engineer-in-charge.
- o Excavation for insertion of planking and strutting where required o Backfilling the trenches with selected excavated material.



# PRE-CONSTRUCTIONAL ANTI-TERMITE TREATMENT

## PRE-CONSTRUCTIONAL ANTI-TERMITE TREATMENT CONTENTS

### SL NO DESCRIPTION

- 1.0 Chemicals
- 2.0 Treatment of Column Pits, Wall Trenches and Basement excavations
- 3.0 Treatment to backfill earth
- 4.0 Treatment to R.C.C. Framed Structures
- 5.0 Treatment of Top Surface of Plinth Filling
- 6.0 Treatment at Junction of Walls and Floor
- 7.0 Treatment to Soil along External Perimeter of Building
- 8.0 Treatment of Soil Surrounding Pipes, Wastes and Conduits
- 9.0 Spraying Equipment
- 10.0 Measurement / Rate

### 1.0 CHEMICALS

The chemicals used for the soil treatment shall be any one or combination of the following with the concentration shown against each aqueous emulsion:

- Chemicals Concentration:
- Endosulfan 35EC 0.5% (by weight)
- Chlorpyrifos 20 EC 1.0% (by weight)

The tender shall clearly indicate along with the quotation the chemical he proposed to use. A daunt record shall be maintained by the Contractor indicating the amount of work done and the quantity of chemical consumed for the work. This record shall be the property of the employer.

### 2.0 TREATMENT OF COLUMN PITS, WALL TRENCHES & BASEMENT EXCAVATION

The bottom surface and sides (up to a height of 30 cm from the bottom) of the excavations made for column pits, trenches and basements shall be treated with the chemical emulsion mentioned above at 5 liters/ sq. meter of surface area.

### 3.0 TREATMENT TO BACK FILL EARTH

After the column foundations, wall foundations and retaining walls of the basement come up, the backfill in immediate contact with the foundation structure shall be treated with the chemical emulsion at the rate of 15 liters/ sq.m of the vertical surface of the sub-structure for each side. The earth is usually returned in layers and each side. The earth is usually returned in layers and the treatment shall be carried out in similar stages. The chemical emulsion shall be directed towards the concrete or masonry surfaces of the columns and walls so that the earth in contact with these surfaces is well treated with the chemical.

### 4.0 TREATMENT FOR R.C.C FRAMED STRUCTURE

The treatment described in 2 and 3 above applies essentially to masonry foundations where there are voids in the joints through which termites can seek entry into the superstructure. Hence the foundations require to be completely enveloped by a chemical barrier. In the case of RCC framed structures with columns and plinth beams RCC basements the concrete mix is rich and dense (being 1:2:4 or richer), it is unnecessary to start the treatment from the bottom excavations for columns, plinth beams and basement walls. The treatment shall start at depth of 50cm below ground level. From this depth, the backfill around the columns, beams and RCC basement walls shall be treated at the rate of 15 liters/ sq.m. of the vertical surface. The other details of the treatment shall be as laid down in 3 above.

### 5.0 TREATMENT OF TOP SURFACE OF PLINTH FILLING

After the earth filling is completed in the plinth area and before the dry rubble packing or Sub grade is laid; the entire surface of the filled earth shall be treated with the chemical emulsion at the rate of the 5 litres per sq.m. Light rodding may be carried out in the soil surface to facilitate absorption of the emulsion.

#### 6.0 TREATMENT AT JUNCTION OF WALLS & FLOOR

Special care shall be taken to establish continuity of the vertical chemical barrier on inner wall surface from the ground level (where it had stopped with the treatment described in 3 above) upto the level of the filled earth surface. To achieve this, a small channel 3 x 3 cm shall be made at all the junctions of wall and columns with floor (before laying the subgrade) and rod holes made in the channel up to the ground level 15 cm apart and the rod moved backward and forward to break up the earth and chemical emulsion poured along the channel at the rate of 15 liter/ sq.m of the area of the vertical surface of the wall surface of the sub-structure so as to soak the soil right to the bottom. The soil should be tamped back into place after this operation.

#### 7.0 TREATMENT OF SOIL ALONG EXTERNAL PERIMETER OF BUILDING

Finally the earth around the external perimeter of the building up to a depth of 30cm shall be treated at the rate of 4.5 liter per running meter of plinth wall. To facilitate this treatment, solid M.S. rods should be driven into the soil as close as possible to plinth wall at intervals of 15 cm and up to a depth of 30 cms and the rods moved backwards and forwards in a direction parallel to the wall to break up the earth so that the chemical emulsion mixes intimately with soil.

#### 8.0 TREATMENT OF SOIL SURROUNDING PIPES WASTES AND CONDUITS

When pipes, wastes and conduits enter the soil inside the area of the foundation, the soil Surrounding the point of entry must be loosened around each such pipe waste or conduit for a distance of 15 cm and upto a depth of 7.5 cm before the treatment is commenced. When they enter the soil external to the foundations, they shall be similarly treated unless They stand clear of the walls of the building by about 7.5 cm for a distance of over 30cm.

#### 9.0 SPRAYING EQUIPMENT

A pressure pump shall be used to carry out spraying operations to facilitate proper penetration of chemicals into the earth. The above specifications are in line with the IS code of Practice for Anti-termite Measures in Building, IS 6313 (Part II) - 1981.

#### 10.0 MEASUREMENT & RATE

The item shall be measured in sq. metre area. Plinth area of building at ground floor will be measured and paid for.

## PLAIN & REINFORCED CEMENT CONCRETE

### PLAIN & REINFORCED CEMENT CONCRETE CONTENTS

#### SL NO DESCRIPTION

- 1.0 General
- 2.0 Grade of concrete
- 3.0 Strength Requirement of Concrete
- 4.0 Materials
- 5.0 Proportioning Concrete
- 6.0 Mixing concrete
- 7.0 Transport, Placing and Compaction of Concrete
- 8.0 Expansion joint
- 9.0 Curing concrete
- 10.0 Working in Extreme Weather
- 11.0 Finishing
- 12.0 Construction joints
- 13.0 Tests & Standards of Acceptance
- 14.0 Use of Plums in Ordinary / Plain Concrete
- 15.0 Measurements for Payment
- 16.0 Rate
- 17.0 Steel reinforcement
- 18.0 Form work, False work and scaffolding Forms, Centering and Temporary works
- 19.0 Tolerances
- 20.0 Vacuum Dewatering
- 21.0 Ready mixed concrete

#### 1.0 GENERAL

These specifications cover the requirement of plain & reinforced concrete for use in various components of structures. For all items of concrete in any portion of the structure or its associated works controlled concrete shall be used unless otherwise specified.

When ordinary concrete of the mix is shown on drawings or directed by the Engineer, the same may be used. The provision of the latest revision of the following IS Codes shall form a part of this specification to the extent they are relevant.

IS – 226 Specification for structural steel (standard quality)

IS – 269 Specification for ordinary and low heat Portland cement

IS – 280 Specification for mild steel wire for general engineering purpose IS – 303 Plywood for general purposes

IS – 383 Specification for coarse and fine aggregate

IS – 432

(All Parts) - Specifications for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement.

Part – I : Mild steel and medium tensile bars

Part – II : Hard drawn steel wire

IS – 455 Specification for Portland blast furnace slag cement

IS – 456 Code of practice for plain and reinforced concrete for general building construction IS – 460 Specification for test sieves

IS – 516 Methods of test for strength of concrete

IS – 650 Standard sand for testing of cement

IS – 1139 Hot rolled mild steel, medium tensile steel and HYSD bars for concrete reinforcement IS – 1199 Sampling and analysis of concrete

- IS – 1200 Part II Method of measurement of building works
- IS – 1343 Code of practice for pre-stressed concrete
- IS – 1489 Specification for Portland pozzolana cement
- IS – 1542 Sand for plaster
- IS – 1566 Specification for hard - drawn steel wire fabric
- IS – 1732 Dimensions for round & square steel bars for structural & general engineering purposes.
- IS – 1785 Plain hard drawn steel wire prestressed concrete (Part I) Cold drawn stress- relieved wire.
- IS – 1786 Specification for high strength deformed steel bars & wires for concrete reinforcement
- IS – 1791 Batch type concrete mixers
- IS – 2062 Weldable structural steel
- IS – 2386 (8 Parts) Method of test for aggregates for concrete
- IS – 2502 Code of practice for bending and fixing of bars for concrete reinforcement.
- IS – 2505 Immersion type concrete vibrators
- IS – 2506 Screed board concrete vibrators
- IS – 2722 Specification for portable swing weigh batcher (Single and double bucket type)
- IS – 2751 Code of practice for welding of MS bars
- IS – 2911 Code of practice for design and construction of pile foundation
- IS – 3366 Pan Vibrators
- IS - 3370  
(All Parts) Code of practice for concrete structure for the storage of liquids.
- IS – 3558 Code of practice for the use of immersion vibrators for consolidating concrete.
- IS – 4656 Form vibrators for concrete
- IS – 4926 Ready Mixed Concrete
- IS – 5525 Recommendation for detailing of reinforcement in reinforced concrete works.
- IS – 5640 Method of test for determining aggregate impact value of soft, coarse aggregate.
- IS – 5816 Methods of test for splitting strength of concrete cylinder
- IS – 6006 Uncoated stress relieved strand for pre-stressed concrete.
- IS - 6461 Cement concrete : glossary of terms
- IS – 6925 Methods of tests for determination of water soluble chlorides in concrete admixtures. IS - 8041  
Specifications for rapid hardening Portland Cement IS - 8043 Specifications for hydrophobic Portland Cement
- IS - 8112 Specification for high strength ordinary Portland cement. (43 grade OPC)
- IS - 9103 Admixtures for concrete.
- IS - 12269 Specification for high strength ordinary Portland cement. (53 grade OPC).

### 1.1 OTHER CODES & SPECIFICATION

Other IS codes pertaining to the items of cement concrete work in structural work and not listed above shall also be deemed to come under the purview of this clause. All Indian Roads Congress Standards, Specifications and codes of practice also come under this purview

### 2.0 GRADE OF CONCRETE

Controlled concrete of minimum grade M-20 design mix shall only be used for all reinforced & plain cement concrete works. In the event of design mix cannot be used for any reason on the work, for grades M20 or lower, nominal mix may be permitted at the discretion of the Engineer-In-Charge.

2.1 Controlled Concrete: For controlled concrete, design of the mix shall be arrived at after preliminary tests and in its production all necessary precautions shall be taken to ensure that the required works cube strength is attained and maintained. The controlled concrete shall be in grades designated as M20, M25, M30, M35, M40, M45 and M50.

2.2 Ordinary Concrete: In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, fine aggregates and coarse aggregates are specified by volume. The ordinary concrete

shall be in grades designated as M10 and M 15 with the suffix 'Ordinary' added to it. It can also be specified by volume as given in Table 3 of this specification.

In the designation of a concrete mix. letter 'M' refers to the mix and the number to the specified 28 days works cube compressive strength of that mix on 150 mm cubes, expressed in N/sq.mm.

### 3.0 STRENGTH REQUIREMENT OF CONCRETE

Where Ordinary Portland Cement conforming to IS: 269 or Portland Blast Furnace Cement conforming to IS : 456 is used, the compressive strength requirements for various grades of concrete controlled as well as ordinary shall be as given in Table 1.

Where rapid hardening Portland cement is used, the 28 days compressive strength requirements specified in Table 1 shall be met at 7 days. For controlled concrete, the mix shall be so designed as to attain in preliminary tests strength at least 33 percent higher than that required on work tests, for concrete upto and including M25 and 25 % higher for higher strengths. Preliminary tests need not be made in case of 'ordinary concrete'.

#### TABLE-1

Grade of concrete Compressive works test strength in N/sq.m mm on 150mm cubes after testing conducted in accordance With IS: 516

Min at 7 days Min at 28 days

M10	7	10
M15	10	15
M20	13.5	20
M25	17	25
M30	20	30
M35	23.5	35
M40	27	40
M45	30	45
M50	33.5	50

Note: In all cases, the 28 days compressive strength specified in Table 1 shall alone be the criterion for acceptance or rejection of the concrete. Where the strength of a concrete mix, as indicated by tests, lies between the strength for any two grades specified in table 1, such concrete shall be classified for all purposes as a concrete belonging to the lower of the two grades between which its strength lies.

### 4.0 MATERIALS

4.1 CEMENT: All types and brands of cement shall be subjected to the approval of the Engineer-in-charge.

A) Following types of Cement shall be used.

o All cement used for the work shall be ordinary Portland cement or such other cement as may be permitted by the Engineer-in-charge. Portland Cement shall comply with requirements of the latest issue of IS 269. High alumina cement, rapid hardening cement and Portland Slag cement etc., can be used only when permitted by the Engineer-in-charge. Such cements shall be in accordance with relevant IS codes. Portland Pozzolana cement when permitted by the Engineer-in-charge shall conform to IS 1489.

o Cement which has remained in bulk storage at the mill for more than 6 months, or which has remained in bags at the dealer's storage for over 3 months, or which has been stored at project site for more than 3 months shall be re-tested before use. Cement shall also be rejected if it fails to conform to any of the requirements of these specifications.

o The Cement to be used in the work shall be of grade not less than Grade 43 which shall be got approved by the Engineer-in-charge.

4.2 FINE AGGREGATES: Fine aggregates shall consist of natural sand, manufactured sand, or an approved combination thereof and shall conform to IS: 383. The grading zone of sand proposed for use shall be supplied by the contractor and got approved by the Engineer-in-charge.

The sand shall be of siliceous material, sharp, hard, strong and durable and shall be free from adherent coatings, clay, dust, alkali, organic material, deleterious matter, lumps, etc. Either natural or manufactured sand shall be prepared for use by such screening or washing, or both, as necessary, to remove all objectionable foreign matter. Natural sand shall be mechanically washed, unless specific written authority is given by the Engineer-in-charge to use sand that meets specifications and standards of cleanliness without washing. The cost of screening and washing must be borne by the contractor. The fine aggregate shall be taken from a source approved by the Engineer-in-charge.

4.3 COARSE AGGREGATES: Coarse aggregates shall consist of hard, strong, durable particles of crushed stone and shall be free from thin elongated soft pieces, organic or other deleterious matter. It shall not have adherent coatings. It will be from a source approved by the Engineer-in-charge. Coarse aggregate shall conform to IS: 383 Coarse aggregate shall be washed if necessary to remove all vegetation and other perishable substances and objectionable amounts of other foreign matter, the cost of washing and screening being borne by the contractor.

4.3.1 SIZE OF COARSE AGGREGATE: The nominal maximum size of coarse aggregate should be as large as possible within the limit specified but in no case greater than one-fourth of the minimum thickness of the member, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of the form. In no case nominal maximum size of coarse aggregate shall be greater than 20mm. For heavily reinforced concrete members as in the case of ribs of main beams, the nominal maximum size of aggregate shall usually be restricted to 5 mm less than the minimum lateral clear distance between the main bars, or 5 mm less than the minimum cover to the reinforcement, whichever is smaller. However, if required under special circumstances, the Engineer-in-Charge may permit nominal maximum aggregate size of 25% more than this critical spacing/ cover, provided that proper vibrating is ensured.

4.4 REINFORCING STEEL: Reinforcing steel shall be clean and free from loose mill scales, dust, loose rust and coats of paints, oil, grease or other coating, which may impair or reduce bond.

- o Mild steel and medium tensile steel bars and hard drawn steel wire shall conform to the latest edition of IS: 432.
- o High strength steel deformed bars shall conform to IS: 1786 o Hard drawn steel wire fabric shall conform to IS :1566
- o Structural steel sections and plates shall conform IS: 226 and IS: 2062.
- o Hot rolled mild steel medium tensile steel and high yield strength steel deformed bars shall conform to IS : 1139.

4.5 WATER: Water for mixing Cement/lime/ Surkhi mortar or concrete shall not be salty or brackish and shall be clean, reasonable clean and free from objectionable quantities of slit traces of oil, acid and injurious alkali, salts, organic matter and other deleterious materials which will either weaken the mortar or concrete on cause efflorescence or attack the steel in reinforced cement concrete water shall be obtained from sources approved by the Architect portable water is generally considered satisfactory for mixing and curing concrete, mortar, masonry etc. Where water other than Municipal source is used this shall be tested in an approved testing laboratory to establish its suitability.

All charges connected herewith shall be borne by the Contractor.

4.6 ADMIXTURES: No materials other than the essential ingredients, i.e., cement, aggregates and water, shall ordinarily be used in the manufacture of concrete or mortar. But the Engineer-in-charge may permit the use of approved admixtures conforming to IS : 6925 for imparting special characteristics to the concrete, on satisfactory evidence that its use does not in any way adversely affect the properties of concrete particularly its strength, volume changes, durability and has no deleterious effect on the reinforcement. Admixtures where allowed will generally be conforming to relevant ASTM standards and IS : 9103.

4.7 MATERIALS FOR REPAIR WORKS: The use of epoxy for bonding fresh concrete used for repairs will be permitted on written approval of the Engineer-in Charge. Epoxies shall be applied in accordance with the instructions of the Manufacturer. The cost of such repair when approved by the Engineer-in-charge shall be borne by the contractor.

#### 4.8 STORAGE OF MATERIALS

o CEMENT: The contractor shall make arrangements to the satisfaction of Engineer-in-charge for the storage of cement to prevent deterioration due to moisture and/or intrusion of foreign matter. Bulk cement shall be stored in approved waterproof bin or silo. Bagged cement shall be stored in a suitable weather tight warehouse in a manner to provide easy access for identification and inspection of each consignment. Stored cement shall meet the test requirements as per IS - 269 at any time after storage, when a retest is ordered by Engineer-in-charge. Each consignment shall be stacked separately with the date of receipt of flagged on it, not more than 12 bags being stacked height, the bags being arranged with header and stretchers. Normally consignments shall be used in the order of receipt at site unless otherwise directed. In case of large concrete pours the Engineer-in-Charge will decide on the batch of cement to be used taking into consideration the quantity of cement with particular reference to the concerned concrete pours. Any additional work in handling and storage of cement contingent upon this requirement shall be to the contractors' account and no extra claim will be entertained. Cement shall be protected from exposure to moisture in transit, in storage at the works and until; it enters the concrete mixes. The contractor shall keep accurate record of the deliveries of the cement and of its use in the work.

o AGGREGATES: Coarse and fine aggregates shall be stacked separately in such manner as to prevent contamination by foreign materials. All aggregates shall be stored on concrete or masonry platforms. Each size shall be kept separate with wooden, steel, concrete, or masonry bulk heads, or shall be stored in separate stacks, taking care to prevent the materials at the edges of the stock piles from getting intermixed. Stacks of fine and coarse aggregates shall be kept sufficiently apart. The aggregates shall be stored in easily measurable stacks of suitable heights as may be directed by the Engineer-in-Charge.

o REINFORCING STEEL: Reinforcing steel shall not be stored directly on the ground. These shall be stored under cover and shall be protected from rusting, oil, grease and distortions as directed by the Engineer-in-Charge.

#### 5.0 PROPORTIONING CONCRETE

5.1 CONTROLLED CONCRETE: Concrete mix shall be designed on the basis of preliminary tests. The proportions for ingredients chosen shall be such that concrete has adequate workability for conditions prevailing on the work in question and can be properly compacted with the means available. Except where it can be shown to the satisfaction of Engineer-in-charge that a supply of properly graded aggregate of uniform quality can be maintained till the completion of work, grading of aggregate should be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions as required. The different sizes, shall be stocked in separate stock piles. Required quantity of material shall be stockpiled several hours, preferably a day, before use. Grading of coarse and fine aggregate shall be checked as frequently as possible, frequency for given job being determined by the Engineer-in-Charge to ensure that the suppliers are maintaining the uniform grading as approved for samples used in the preliminary tests. In proportioning concrete, the quantity of both cement and aggregate shall be determined by weight. Water shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in a clean, and serviceable condition. Their accuracy shall be periodically checked. It is most important to keep the specified water-cement ratio constant and at its correct value. To this end, the moisture content in both fine and coarse aggregates shall be determined by Engineer-in-Charge according to weather conditions. The amount of mixing water shall then be adjusted to compensate for variations in the moisture content.

For the determination of moisture content in the aggregates, IS 2386 (Part III) shall be referred to. Suitable adjustments shall also be made in the weights of aggregates to allow for the variation in weights of aggregates due to variation in their moisture content. The minimum quantity of cement to be used shall not less than 260 Kg/cum for plain concrete and not less than 340 Kg/cum for reinforced concrete structural members subject to a maximum limit of 540 Kg/cum.

5.2 ORDINARY CONCRETE: The ordinary concrete mix shall generally be specified by volume. For cement, which normally comes in bags and used by weight, volume shall be worked out taking 50 kg. of cement as 0.035 cubic meter in volume, shaking, ramming or hammering shall not be done. Proportioning of sand shall be as per its dry volume and in case it is damp, allowance for bulking shall be made as per IS : 2386 (Part III).

Ingredients required for ordinary concrete containing one (50kg.) bag of cement for different proportions of mix shall be as given in Table 3. Grade of concrete Total qty. of dry aggregates by volume per 50 kg. Cement to be taken as the sum of individual vol. of fine & coarse aggregate (max.) Proportion of fine aggregate to coarse aggregate. Quantity of water per 50Kg of cement max.\*\* M10 300 Ltr Generally 1:2 for fine aggregate to coarse aggregate by volume but subject to upper limit of 1:1.5 and lower limit of 1:2.5 \* 34 Ltr M15 220 Ltr 32 Ltr M20 160Ltr 30 Ltr M25 100 Ltr 27 Ltr

\* The proportions of the aggregate shall be adjusted from upper limit to lower limit progressively as the grading of the fine aggregates becomes finer and the maximum size of coarse aggregate becomes larger.

\*\* The amount of water should be kept minimum required for proper workability. The quantity given in col. 4 is not to be exceeded.

#### EXAMPLE

For an average grading of the fine aggregate (that is Zone II of IS:383-1963) the proportions shall be 1:1.5, 1:2 and 1:3, for maximum size of aggregates 10mm, 20 mm and 40 mm respectively. Note: A mix leaner than M10 (1:3:6) may be used for non-structural parts if specified on the drawing or provided in the contract. In such case grading of aggregate shall be as specified in the contract or on the drawings. Other requirements for mixing, placing and curing shall be the same as specified in this section.

5.3 QUANTITY OF WATER: The quantity of water shall be just sufficient to produce a dense concrete of required workability and strength for the job. An accurate and strict control shall be kept on the quantity of mixing water. In the case of reinforced concrete work, workability shall be such that the concrete surrounds and properly grips, all reinforcement. The degree of consistency, which shall depend upon the nature of work and the methods of vibration of concrete, shall be determined by regular slump tests. The following slumps shall be adopted for different types of works.

Note: With use of ordinary concrete the slump requirement specified above would not be applicable.

#### 6.0 MIXING CONCRETE

For all works concrete shall be mixed in a mechanical mixer, which along with other accessories shall be kept in first class working condition and so maintained throughout the construction. Mixing shall be continued till materials are uniformly distributed and a uniform colour of the entire mass is obtained and each individual particle of the coarse aggregate shows a complete coating of mortar containing its proportionate amount of cement. In no case shall the mixing be done for less than 2 minutes after all ingredients have been put into the mixer. In hand mixing quantity of cement shall be increased by 10% above that specified in clause 5.2 above, the cost of increased cement being borne by the Contractor. Hand mixing will be permitted only under exceptional conditions and the contractor must take the permission of the Engineer-in-charge in advance. Mixers, which have been out of use more than 30 minutes, shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to by the Engineer-in-charge, the first batch of concrete from the mixer shall contain only two thirds of the normal quantity of coarse aggregate. The mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

6.1 All structural concrete shall be weigh batched. All ingredients for concrete shall be batched by weight using a weigh batcher of approved make conforming to IS : 2722. Batching shall be to an accuracy of 0.50kg and the weigh batcher shall be tested for accuracy of calibration before commencement of the works and at least once a week thereafter or more frequently if so required by the Engineer.

6.2 Use of Ready Mixed Concrete (RMC) may be permitted at the discretion of the Engineer-In-Charge without any extra cost.



## 7.0 TRANSPORT, PLACING AND COMPACTION OF CONCRETE SL NO

### TYPE OF WORK SLUMPS

Where Vibrators are used

Where Vibrators are not used

1 Mass concrete in RCC foundations, footings & retaining walls. 10mm to 25mm 80mm

2 Beams, slabs & columns simply reinforced 25mm to 40mm 100mm to 120mm

3 Thin RCC section or section with congested steel 40mm to 50mm 125mm to 150mm

The method of transporting and placing concrete shall be approved by the Engineer in charge. Concrete shall be transported and placed such that no contamination, segregation or loss of its constituent materials takes place. All formwork and reinforcement contained in it shall be cleaned and made free from standing water or dust, immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the Engineer in-charge has been obtained in writing. If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer-in-charge. Concreting shall then proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete, which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete when deposited shall have a temperature of not less than 4.5 deg. C and not more than 38 deg. C unless otherwise specified. It shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried on properly designed agitators, operating continuously, in which case this time shall be within 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator. Except where otherwise agreed to by the Engineer-in-Charge, concrete shall be deposited in horizontal layers to a compacted depth of not more than 0.45 m when internal vibrators are used and not exceeding 0.30m in all other cases. Unless otherwise agreed to by the Engineer-in-charge, concrete shall not be dropped into place from a height exceeding 2 meters. When trunking or chutes are used, they shall be kept clean and used in such a way as to avoid segregation.

When concrete is conveyed by chute, the plant shall be of such size and design as to ensure practically continuous flow. Slope of the chute shall be so adjusted that the concrete flows without the use of an excessive quantity of water and without any segregation of its ingredients. The delivery end of the chute shall be as close as possible to the point of deposit. The chute shall be thoroughly flushed with water before and after each working period and the water used for this purpose shall be discharged outside the formwork. When concreting has to be resumed on a surface, which has hardened, it shall be roughened, swept clean, thoroughly wetted and covered with a layer of neat cement grout and placed immediately before placing of new concrete.

Where concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of any particles of coarse aggregate. The surface shall then be thoroughly wetted, all free water removed, and then coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 150mm in thickness, and shall be well rammed against old work, particular attention being given to corners and close spots. All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrator. For exceptional cases, where vibrators can not be used an alternate scheme of compaction shall be approved by the Engineer-in-charge. Sufficient vibrators in serviceable condition shall be kept at site so that spare equipment is always available in the event of break down.

The performance requirements of vibrators shall conform to relevant IS codes. Vibration shall not be applied through reinforcement, and where vibrators of the immersion type are used, contact with reinforcement and all inserts shall be avoided as far as practicable.

## 8.0 EXPANSION JOINTS

Expansion joints shall be provided where shown on the drawings. They shall be constructed with an initial gap between the adjoining parts of the works of the width specified in the drawings. The contractor shall ensure that no debris is allowed to enter and be lodged in expansion joints. Expansion joints shall be provided with approved joints filler, a joint sealing compound.

8.1 OPEN JOINT FILLER: Where shown on the drawings, open joints in the structure shall be filled with one of the following of approved expansion joint fillers :- o In internal areas a material conforming to IS:1838 Part-I, containing Sikadur combiflex SG (150mm x 2 mm) with supporting epoxy adhesive Sikadur 31C on top & bottom at the both side of expansion joint gap . There should be a minimum overlap of 50mm to either side of the supporting wall/slab/beam. The item also includes Fixing of aluminum sheet over the combiflex fixed area with one side free with slotted arrangement & other side fixed to provide protection against mechanical abasement.

o The joints filler shall be easily and uniformly compressible to its original thickness, tappable, easily cut or sawn, robust, durable, resistant to decay due to termite or weathering, unaffected by water and free of any constituent, which will bleed into or stain the concrete.

o The joint filler shall be of same thickness of the joint width, it shall extend through the full thickness of the concrete unless otherwise specified and shall be sufficiently rigid during handling and placing to permit the formation of straight joints.

8.2 JIONT SEALING COMPOUND: Joint sealing compounds shall be in accordance with the IS:3037:1986 and approved by the Engineer and shall seal joints in concrete against the passage of water, prevent the ingress of grit or other foreign material and protect the joint filler. The compound shall have good extensibility and adhesion to concrete surfaces and shall be resistant to flow and weathering. Where so specified joints shall be sealed with approved polysulphide liquid polymer, stored, mixed, handled, applied and cured strictly in accordance with the manufacturer's printed instructions. Such joints shall be formed to the correct dimensions, thoroughly cleaned and treated with recommended primer. The contractor shall use only competent personnel experienced in the application of polysulphide sealant for such work.

Where specified in the drawings, rubber / bituminous based sealants shall be of an approved manufacturer. The treatment of the joint and the use of sealing compound shall be strictly in accordance with the manufacturer's printed instructions.

## 9.0 CURING OF CONCRETE

### 9.1 PROTECTION & WATER CURING

Immediately after compaction, concrete shall be protected against harmful effect of weather, including rain, running water, shocks, vibration, traffic, rapid temperature changes and premature drying out. It shall be covered with wet sacking, Hessian or other similar absorbent material approved by the Engineer-in-charge soon after the initial set, and shall be kept continuously wet for a period of not less than 21 days from the date of placement. Masonry work over the foundation concrete may be started after 48 hours of its laying but the curing of concrete shall be continued for a minimum period of 21 days.

### 9.2 STEAM CURING

When steam curing is adopted it shall be ensured that it is done in a suitable enclosure to contain the live steam in order to minimize moisture and heat losses. The initial application of the steam shall be from two to four hours after the final placement of concrete to allow the initial set of the concrete to take place. Where retarders are used, the waiting period before application of the steam shall be increased from four to six hours. The steam shall be at 100% relative humidity to prevent loss of moisture and to provide excess moisture for proper hydration of the cement. The application of steam shall not be directly on the concrete, and the ambient air temperature shall increase at a rate not exceeding 5 deg. cent. per hour until a maximum temperature of 60 deg. cent. to 70 deg. cent is reached. The maximum temperature shall be maintained until the concrete has reached the desired strength.

When steam curing is discontinued the ambient air temperature shall not drop at a rate exceeding 5 deg. cent per hour until a temperature of about 10 deg. cent above the temperature of the air to which the concrete will be exposed, has been reached.

## 10.0 WORKING IN EXTREME WEATHER

When depositing concrete in very hot weather, precaution shall be taken so that the temperature of wet concrete does not exceed 38 deg. C. while placing. This shall be achieved by stacking aggregate under sheds and keeping it moist using cold water or crushed or flaked ice if specified and permitted by the Engineer, reducing the time between mixing and placing to the minimum, cooling formwork by sprinkling water on the exterior, starting curing before the concrete dries out and restricting concreting, as far as possible, to mornings and evenings.

During hot weather and rains the concrete shall be covered with tarpaulin and transported and placed in the forms and consolidated to final state in as short a time as possible. Commencement of concrete pours shall be avoided during heavy rains, storms and high winds.

## 11.0 FINISHING

### 11.1 GENERAL

Immediately after the removal of forms, all exposed bars or bolts passing through the reinforced cement concrete member and used for shuttering or any other purpose shall be cut inside the reinforced cement concrete member to a depth of at least 25 mm below the surface of the concrete and the resulting holes be closed by cement mortar. All fins caused by form joints shall be broken. All cavities produced by the removal of form ties, all holes and depressions, honeycomb spots, broken edges or corners and all other defects shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry a consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which have been filled/ pointed shall be kept moist for period of twenty-four hours. Any repair and rectification of defective work is to be undertaken and carried out as directed by the Engineer-in-charge and the cost is to be borne by the contractor. If rock pockets/ honeycombs, in the opinion of the Engineer-in-charge, are of such an extent or character as to affect the strength of the structure materially or to endanger the life of the steel reinforcement, he may declare the concrete defective and require the removal and replacement of the affected portion of the structure.

All construction and expansion joints in the completed work shall be left carefully tooled and free from any mortar and concrete. Expansion joint filler shall be left exposed for its full length with clean and true edges. The contractor shall be responsible for providing an adequate key in concrete where plastering or rendering is specified to be applied. Hacking of the concrete surface after striking the formwork will be permitted only after seven days after concrete is done. Curing of the surface shall be continued for a period of 21 days.

### 11.2 CLASSES OF FINISHING

The surface finish for formed and unformed surfaces are classified and defined as below. Surface irregularities permitted for the various classes of finishes are termed either "abrupt" or "gradual". Fins or offsets caused by displaced or misplaced from sheeting, lining or form sections, by loose knots in form timber or by otherwise defective form timber are considered abrupt irregularities. All other cases are described as gradual irregularities. Gradual irregularities will be measured with a template consisting of a straight edge for plane surfaces or its equivalent for curved surfaces. The length of template for testing gradual irregularities on formed surfaces shall be 1.5 m in length, the permissible gradual irregularities being measured over this length of the template. Special surfaces, finishes and treatments falling outside the classes described here but defined elsewhere by the Engineer-in-charge shall also form part of these specifications.

## 12.0 CONSTRUCTION JOINTS

Concreting shall be carried out continuously upto the construction joints, the position and details of which shall be as shown on approved drawings or as directed by the Engineer-in- Charge. Such joints shall, however, be kept to the minimum. For a vertical construction joint, a stopping board shall be fixed previously at the predetermined position and shall be properly stayed for sufficient lateral rigidity to prevent its displacement or bulging when concrete is compacted against it. Concreting shall be continued right up to the board. The board shall not be removed before the expiry of the specified period for removal of vertical forms. Before resuming work at a construction joint where the concrete has not yet fully hardened, all laitance shall be removed thoroughly, care

being taken to avoid dislodgement of coarse aggregates. When work has to be resumed on a surface, which has hardened, the surface shall be thoroughly hacked, swept clean, wetted and covered with a layer of neat cement grout. The first batch of concrete shall be rammed against the old work to avoid formation of any stone pockets, particular attention being paid to corners and close spots. In all cases, the position and detailed arrangement of all construction joints shall be predetermined and got approved by the Engineer-in-Charge.

### 13.0 TESTS AND STANDARDS OF ACCEPTANCE

13.1 Preliminary Tests for Controlled Concrete: For controlled concrete preliminary tests referred to in Paras 2.1 & 3.0 shall consist of three sets of separate tests, and in each set tests shall be conducted on six specimens. Not more than one set of six specimens shall be made on any particular day. Of the six specimens in each set, three shall be tested at seven days and the remaining three at 28 days. The preliminary tests of 7 days are intended only to indicate the strength likely to be attained at 28 days.

13.2 Work Strength Tests for Controlled and Ordinary Concrete: Works strength tests shall be made in accordance with IS 516. Each test shall be conducted on ten specimens, five of which shall be tested at seven days and the remaining five at 28 days. The cubes shall be made at the rate of one set for every 50 cubic metre of concrete or a part thereof for each grade. However, if in each grade concreting done in a days less than 15 cubic metre, the number of cubes can be reduced to 6 with the specific permission of the Engineer-in-Charge. Similar works tests shall be carried out whenever the quality and grading of materials is changed irrespective of the quantity of concrete poured. The number of specimens may be suitably increased as deemed necessary by the Engineer-in-Charge, when procedure of tests given above reveals a poor quality of concrete and in other special cases. All work shall be carried out under the supervision of a qualified and competent Engineer who will supervise proportioning, placing and compacting of concrete at all stages. All necessary labor, materials, equipment, etc. for sampling, preparing test cubes, curing, etc., shall be provided by the Contractor. Testing of materials and concrete may be arranged by the Engineer-in-Charge in an approved laboratory at the cost of the contractor.

13.3 Standard of acceptance: The strength of concrete shall conform to clause 16.0, Acceptance Criteria, as specified in IS : 456 – 2000.

13.4 Manufacture's Certification / Testing Results etc: For all materials required for concrete construction including cement, aggregate, water, reinforcing and pre-stressing steel the original copies of test certificates, test results etc. either carried out by the manufacturer or any other agency, the mix design recommendations etc. shall be submitted to the Engineer-in-Charge for his approval and record. It shall remain the property of the Employer.

13.5 Chloride Contents: Since the chloride contents of the constituent materials of the concrete would be additive, it is desirable to keep a check on the overall chloride content of the concrete to keep it minimal. Specially, for pre-stressed concrete, the total chloride content of the concrete when manufactured according to the requirements of workability and strength shall not exceed 500 ppm. by weight of cement. The costs of testing for the chloride content of the ingredients of concrete and of undertaking remedial measures if the chloride content is more than the permissible limit shall be borne by the contractor.

### 14.0 USE OF PLUMS IN ORDINARY / PLAIN CONCRETE

Stone plums shall not be used unless specified on the drawings. When used the size of stone plums may be from 160 to 300 mm. The maximum dimension of these stones or plums shall not exceed 1/3rd the least dimension of the members. All plums shall be hard, durable, clean and free from soft materials or loose piece or deleterious substance in them and shall not have sharp corners. During concreting the first layer of concrete of the specified mix shall be laid to a thickness of at least two and a half times the thickness of the maximum size of plums to be used. The plums shall then be laid while the top portion of this concrete is still green but sufficiently stiff to prevent complete submergence of the plums under their own weight. These plums shall be about half embedded in the concrete and the remaining part exposed so as to form a key with the next layer of concrete. No plums shall be used for concrete laid under water.

While placing the plums, care shall be taken to see that the clear distance between any two plums is not less than either the width or thickness of either of the plums. The distance from plums to the outer surface or from any steel reinforcement shall be equal to greatest width of the plum. If plums of stratified stone are used, they shall be laid on their natural bed. Stones with concave faces shall be laid with the concave upwards. The thickness of the next and successive layers of concrete shall be at least twice that of the largest plums. The total volume of plums shall not exceed 20% of the volume of the finished concrete.

#### 15.0 MEASUREMENT FOR PAYMENT

o The cement concrete shall be measured in cubic meters. In reinforced concrete the volume occupied by reinforcement shall not be deducted.

o Any concrete used in excess of the theoretical dimensions as shown on the drawings will not be paid for.

o Unacceptable work: All defective concreting work, including but not limited to defects arising out of honey-combing, under-sizing, under-strength, etc. Are liable to be demolished and rebuilt by the Contractor at his own cost. In the event of such works being accepted by carrying out repairs etc. as specified by the Engineer-in-charge, the cost of repair will be borne by the Contractor. In the event of the works being accepted by giving a design concession arising out of but not limited to under-sizing, under-strength accepting higher than design stresses in members or accepting materials not fully meeting the specifications etc. the contractor will be paid for the work actually carried out by him at the reduced rate of 75% of the tendered rate or as decided by the Engineer-in-Charge for portion of the work thus accepted. The decision of the Engineer-in-Charge shall be final and binding.

#### 16.0 RATE

The unit rate for concrete shall include the cost of all materials, labour, tools and plant required for mixing, placing in position, vibrating and compacting, finishing as per directions of the Engineer-in-Charge, curing and all other incidental expenses for producing concrete of specified strength to complete the structure or its components as shown on the drawings and according to these specifications. The rate shall also include the cost of making, fixing and removing of all centres and forms required for the work unless otherwise specified in the contract. All expenses likely to be incurred by the contractor in transporting materials supplied to him to the site of works, the expenses incurred in improving the quality of materials to acceptable levels (such as screening, washing, etc.) and expenses incurred in proper storage of materials as directed by the Engineer-in-charge etc. are to be including in the unit rate

#### 17.0 STEEL REINFORCEMENT

17.1 BENDING OF REINFORCEMENT: Reinforcing steel shall conform accurately to the dimensions shown on relevant drawings and conforming to IS: 2502 The contractor shall make bar bending schedules, based on the drawings furnished to him and submit the same for the Engineer's approval at no extra cost. Approval by the Engineer does not relieve the contractor of his responsibility to ensure correctness in respect of details / placing.

Bars shall be bent cold to the specified shape and dimensions or as directed by the Engineer-in-Charge using a proper bar bender, operated by hand or power to attain proper radii of bends. Bars shall not be bent or straightened in a manner that will injure the material. Bars bent during transport or handling shall be straightened before being used on work; they shall not be heated to facilitate bending. Unless otherwise specified, a U type hook at the end of each bar shall invariably be provided. The radius of the bend shall not be less than twice the diameter of the round bar for mild steel plain bars and not less than four times the diameter for high strength deformed bars. In case of bars with diameters greater than 25mm, the minimum radius should be three times the diameter for mild steel bars and six times the diameter for high strength deformed bars the length of the straight part of the bar beyond the end of the curve shall be at least four times the diameter of the bar. In the case of bars, which are not round, and in the case of deformed bars, the diameter shall be taken as the diameter of a circle having an equivalent effective area. The hook shall be suitably encased to prevent any splitting of the concrete.

17.2 PLACING OF REINFORCEMENT: All reinforcing bars shall be accurately placed in the exact position shown on the drawings, and shall be securely held in position during placing of concrete by annealed binding

wire not less than 1 mm in size and conforming to IS: 280, and by using stays, blocks or metal chairs, spacers, metal hangers, supporting wires or other approved devices at sufficiently close intervals. Bars will not be allowed to sag between supports nor displaced during concreting or any other operation over the work. All devices used for positioning shall be of non-corrodible material. Wooden and metal supports will not extend to the surface of concrete, except where shown on the drawings. Placing bars on layers of freshly laid concrete as the work progresses for adjusting bar spacing will not be allowed. Pieces of broken stone, brick or wooden blocks shall not be used. Layers of bars shall be separated by spacer bars, precast mortar blocks or other approved devices. Reinforcement after being placed in position shall be maintained in a clear condition until completely imbedded in concrete. Special care shall be exercised to prevent any displacement of reinforcement in concrete already placed. To protect reinforcement from corrosion, concrete cover shall be provided as indicated on the drawings. All bars protruding from concrete to which other bars are to be spliced and which are likely to be exposed for an indefinite period shall be protected by a thick coat of neat cement grout. In the case of columns and walls, vertical bars shall be kept in normal position with timber templates having slots accurately cut in for bar position. Such templates shall be removed after the concreting has progressed upto a level just below them. Bars crossing each other, where required, shall be secured by iron binding wire not less than 1 mm in size in such a manner that they do not slip over each other at the time of fixing and concreting All binding wires shall be galvanized. As far as possible, bars of full length shall be used. In case this is not possible, overlapping of bars shall be done as directed by the Engineer-in-Charge. When practicable, overlapping bars shall not touch each other, but be kept apart by 25 mm or 1.25 times the maximum size of the coarse aggregate in the concrete between them,, whichever is greater. Where this is not feasible, overlapping bars shall be bound with annealed steel wire, not less than 1 mm thickness twisted tight. The overlaps shall be staggered for different bars and located at points along the span where neither shear nor bending moment is maximum. Bars of less than 3.0 M length shall not be used as main reinforcement.

**17.3 WELDING OF BARS:** When permitted or specified on the drawings, joints of reinforcement bars shall be butt welded so as to transmit their full strength. Welded joints shall preferably be located at points where the reinforcement steel will not be subject to more than 75 percent of the maximum permissible stresses and the welded joints should be staggered such that at any one section, not more than 33 percent of the bars are welded. Only electric arc welding using a process which excludes air from the molten metal and conforms to any or all other special provisions for the work will be accepted. Suitable means shall be provided for holding the bars securely in position during welding. It must be ensured that no voids are left in welding and when welding is done in 2 or 3 stages, the previous surfaces shall be cleaned properly. Ends of the bars shall be cleaned of all loose scale, rust, grease, paint and other foreign matter before welding. Only competent welders shall be employed on the work. The M. S. Electrodes used for welding shall conform to IS: 814. Welded pieces of reinforcement shall be tested. Specimens shall be taken from the actual site and their number and the frequency of tests shall be as directed by the Engineer-in-Charge.

**17.4 MEASUREMENT:** Reinforcement shall be measured in length, separately for different diameters, as actually used in the work including authorized overlaps, special chairs / separators specified in the drawings and due to limitations of available bar length. From the length so measured the weight of reinforcement shall be calculated in tonnes on the basis of standard weights specified in IS: 1732. Lengths shall also include hooks at ends. Wastage, avoidable overlaps, coupling, welded joints and annealed steel wire for binding and cover blocks shall not be measured and cost of these items shall be deemed to be included in the rates for reinforcement. **17.5 RATES:** Rate for reinforcement shall include cost of all steel, its bending, binding and fixing in position as shown on the drawings and as directed by the Engineer-in-charge. It shall also include cost of all devices for keeping reinforcement in approved position, cost of jointing as per approved method, and all wastage, overlaps and spacer bars etc.

#### **18.0 FORM WORK, FALSE WORK AND SCAFFOLDING, FORM, CENTERING AND TEMPORARY WORKS**

All centering, formwork and temporary works shall be constructed according to drawings and specifications prepared by the Contractor and approved by the Engineer-in-charge. The design criteria and loading for these works shall be as per American Concrete Institutes' relevant specifications. As soon as practicable after the acceptance of his tender the contractor shall submit a scheme showing the order of the procedure and methods by which he proposes to carry out the work together with such details as are necessary to demonstrate the

adequacy, stability and safety of the methods which the contractor proposes to adopt. The approval to this general scheme of centering as well as design criteria and loading shall be obtained in good time to facilitate all preparatory work. Any delay on this account shall be the responsibility of the contractor.

After approval of the general scheme the contractor will prepare detailed designs and drawings for execution of the work, centering and temporary works. These shall also be forwarded for approval. No work shall be carried out without prior approval of the Engineer-in-Charge. Notwithstanding the approval given to design criteria and loading and the general scheme for the centering, the entire responsibility for the satisfactory execution of the centering and all temporary works shall rest with the contractor and he shall be liable to pay all claims and compensations arising from any loss or damage to life and property due to any deficiency, failure or malfunctioning of the centering or any of the temporary works.

18.1 RE-USE OF FORMS, ETC: Forms required to be used more than once shall be maintained in serviceable condition and shall be thoroughly cleaned and repaired before reuse. Where metal sheets are used for lining forms the sheets shall be placed and maintained in the forms with minimum amount of wrinkles, lumps or other imperfections. All forms shall be checked for shape and strength before reuse. Steel forms shall be cleaned by buffing before reuse.

#### 18.2 EXECUTION & REMOVAL OF FORMS:

o Before placing concrete the surface of all forms shall be coated with suitable non-staining form releasing agents such as raw linseed oil so as to prevent adhesion of concrete and to facilitate removal of forms.

o The form-releasing agent shall cover the forms fully and evenly without excess over drip. Care shall be taken to prevent form-releasing agents from getting on the surface of the construction joints and on reinforcement bars. Special care shall be taken to thoroughly cover form strips for narrow grooves, so as to prevent swelling of the forms and the consequent damage to concrete prior to or during removal of forms.

o Immediately before concrete is placed care shall be taken to see that all forms are in proper alignment and the supports and fixtures are properly secured and tightened.

o Where forms for continuous surfaces are placed in successive units, the forms shall lap and fit tightly over the completed surface so as to prevent leakage of cement slurry from the fresh concrete and to maintain accurate alignment of the surface

o Forms shall be left in place until their removal is authorized and shall then be removed with care so as to avoid injury to concrete.

o Removal of forms shall never be started until the concrete is thoroughly set and adequately hardened such that it can carry its own weight, besides the live load which is likely to come on the work during construction. The length of time for which the forms shall remain in place shall be decided by the Engineer-in-Charge, with reference to weather conditions, shape and position of the structure or structural member and nature and amount of dead and live loads. In normal circumstances and where ordinary Portland cement is used, forms can be allowed to be struck as under:

- a) Beam sides, walls, unloaded columns - after 24 hours
- b) Slabs and arches (props left under) - after 4 days
- c) Props to slabs and arches - after 10 days
- d) Beam soffit (props left under) - after 8 days
- e) Props to beams - after 21 days
- f) Lean concrete (sides) - after 2 days

Note: Time shall be measured from last batch concreted in respect to the structural member under consideration. In no case shall forms be removed until there is an assurance that removal can be accomplished without damaging the concrete surface. Heavy loads shall not be permitted until after the concrete has reached its design strength. The forms shall be removed with great caution and without jerking the structure.

### 18.3 SETTLEMENT OF FORMWORK & CAMBER

Due to various reasons such as closure of form joints, shrinkage of timber, dead load deflections, elastic shortening of form members or formwork, deflections, settlement may occur. The contractor shall take precautions, including using adequately rigid formwork, in order to prevent excessive settlement/deflection; the usual acceptable limit being 1/500 of the spans of the formwork.

In the absence of any specified camber on the drawings, soffit of all beams more than 5 m. in span and other than prestressed concrete beams shall be laid to a camber, the amount of which at mid span shall not be less than 1/500 of the span of the structure. The profile of soffit shall be parabolic.

### 19.0 TOLERANCE

All works will be carried out true to the lines, levels and grades shown on the drawings and within the tolerances specified below. The contractor shall establish, erect and maintain in an undisturbed condition until final completion and acceptance of the project control, points and benchmarks necessary and adequate to establish these tolerances.

For all elements, departure from established alignment : 30 mm

Departure from established grades : 10 mm Variation from plumb or specified : 12 mm in 3 m.

if exposed batter in lines and surfaces of piers, wall and abutments :25 mm in 3 m.

if backfilled Variation from level or indicated :12 mm in 3 m.

If grade in slabs, beams, horizontal exposed and railing offsets :25 mm in 3 m.

if backfilled. Variation in cross sectional dimensions of columns, piers, :-6 mm, + 12 mm slabs, walls, beams and similar parts Variation in slab thickness -3 mm, + 6 mm

Footings: Plan dimensions -15 mm, + 30 mm

Misplacement or eccentricity : 2% of footing width in the direction of misplacement and not exceeding 30mm.

Reduction in thickness : 5% of specified thickness

Variations in size and locations of slab or wall openings 12 mm

Pre-stressed concrete cables - will be laid such that their profile is a smooth curve unless otherwise specified.

The alignment tolerances shall be as under:

Member with a depth of upto Tolerance in direction of depth 'd' of members.

Upto 200 mm +d/40

200 - 1000 mm + 5 mm

more than 1000 mm + 10 mm

Tolerance in direction

of width of member @ the

level of tendon.

Upto 200 mm wide +5 mm

200 - 1000 mm wide +10 mm

Slabs and beams of more than +20 mm

1000 mm wide

Tendon extensions will be measured upto 1 mm accuracy. The total pre-stressing force applied to a beam shall not vary more than + 3% from the design force specified and **measured** in terms of the total elongation of all the tendons in that member. In the case of slabs this variation shall be measured and restricted over a range of 5 consecutive tendons.

### 20.0 VACCUM DEWATERING

The RCC/PCC in slabs & floors should be vacuum dewatered if directed by the Engineer-In-Charge, using vacuum dewatering system consisting of vibrating screed, filter pads, suction mat, skim floater cum troweler with necessary safety mechanism etc. as per manufacturer's specification.

### 21.0 READY-MIXED CONCRETE

Ready-mixed concrete is concrete supplied by an independent vendor having a Ready-mixed plant outside the site. All specifications for plain, reinforced & pre-stressed concrete shall be applicable to this section of Ready-mixed concrete also.



21.1 READY MIX CONCRETE SUPPLIER: The Contractor shall identify a supplier in such a manner that concrete is available at site without hindrance and quality is maintained during concreting. Due attention shall be paid to the quality of Plant and Machinery, laboratory facilities available with the supplier, proper documentation procedures maintained by the supplier and trained, qualified staff shall be employed by the supplier. Consideration shall also be given to distance of plant from site, quality of transporting equipments and documentation procedures maintained by the supplier related to transport. After identifying Ready-mixed Concrete supplier the contractors must submit necessary documentation as indicated above to the Engineer for his approval. The Ready mixed concrete manufacturer / supplier will be an approved specialist agency as per method of working approved by the Engineer.

21.2 DOCUMENT TO BE SUBMITTED & MAINTAINED BY THE CONTRACTOR DURING CONSTRUCTION: Mix design used for concrete should include type and quality of cement, admixture, aggregates, water, etc. including test results for all materials. The document shall also include laboratory tests carried out for confirmation of workability, strength, setting time, etc. Quality Control / Assurance certificate from the manufacturer / supplier of the ready mixed concrete indicating the type and quantity of each component of concrete shall be submitted for each batch of concrete. The document shall also indicate the date and time of concrete and 'use before' time. Documentation for on site tests carried out during concreting. Results of Cube tests and other laboratory tests carried out by the supplier in the plant.

21.3 TRANSPORTING OF READY-MIX CONCRETE: Before loading concrete in the transit mixer, the container shall be thoroughly cleaned, washed and kept moist. Method of transportation used shall ensure efficient delivery and no significant alterations of properties of concrete such as water-cement ratio, slump, air content, homogeneity, etc.

21.4 PLACING OF READY-MIX CONCRETE: The batching plant operator and the placing crew at site shall work in close co-ordination to avoid any delay in despatching the concrete as well as to stop despatch if the work at site is not ready for concrete work. Proper record of order, delivery and placement of concrete shall be maintained by the contractor on site and submitted to the Engineer-In- Charge who shall have direct access to the batching plant to control all the activities in the production and placement of concrete.

21.5 TEMPERATURE: Temperature of concrete at the time of delivery shall be in accordance with IS 4926 (1976) or any other agreed standard.

21.6 DELIVERY TIME: The time period between the initial contact of mixing water with cement and delivery to the contractor shall not generally exceed two hours. This figure is a general one and can be reduced or extended depending upon mix design, ambient temperature and the design criteria of the structure.

21.7 ADDITION OF WATER: Unless otherwise agreed no additional water shall be added to the concrete after the transit mixer has left the production plant. The contractor is responsible for the prevention of any additional water added to the concrete on site. The only exception is where properly trained Ready-mixed concrete supplier personnel adjust the workability to comply with the specified slump requirement without exceeding either the specified maximum free water cement ratio or slump tolerances. It is suggested that this is performed by using a calibrated water meter. The quantity of additional water shall be recorded on the delivery ticket and signed by the Ready-mixed concrete supplier's representative. Performance of such concrete shall be ascertained through normal testing practices.

# BRICK WORK

## BRICK WORK CONTENTS

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3.0	Materials
4.0	Construction
5.0	Measurement for payment

### 1.0 SCOPE

These specifications cover the use of Brick Masonry for the structural purposes.

### 2.0 GENERAL

The provision of the latest Indian Standards listed below form part of these specifications:

IS: 1077 Specifications for common burnt clay building bricks

IS: 1200 Measurement for Building works

IS: 1725 Specifications for solid cement blocks used in general building construction.

IS: 1905 Code of practice for structural safety of buildings Masonry walls.

IS:2116 Sand for masonry mortars.

IS:2180 Specification for heavy duty burnt clay building bricks

IS:2185 Specification for concrete masonry units: Hollow and solid concrete blocks.

IS:2212 Code of practice for brick work.

IS:2222 Specification for burnt clay perforated building bricks.

IS:2250 Code of practice for preparation and use of masonry mortar.

IS 2645 Specification for integral waterproofing compound.

IS:2691 Specification for burnt clay facing bricks.

IS:3115 Specification for lime based blocks.

IS:3414 Code of practice for design and installation of joints in buildings.

IS:3466 Specification for masonry cement.

IS:3861 Method of measurement of plinth, carpet and rent able areas of buildings.

IS:3952 Specification for burnt clay hollow blocks for walls and partitions.

IS:4098 Specification for lime-puzzolona mixture

IS:4139 Specification for sand lime bricks

IS:4441 Code of practice for use of silicate type chemical resistant mortars.

IS:4442 Code of practice for use of sulphur type chemical resistant mortars.

IS: 5495 Size & shape for fire bricks

IS 8112 Specification for high strength ordinary portland cement IS 9103 Specification for admixtures for concrete.

Other I.S. Codes not specifically mentioned here but pertaining to the use of bricks for structural purposes form part of these specifications.

### 3.0 MATERIALS

#### 3.1 Bricks

Bricks shall be of regular and uniform size, shape and colour, uniformly well burnt throughout but not over burnt. They shall have plane rectangular faces with parallel sides and sharp straight and right angled edges. They shall be free from cracks or other flaws. They shall have a frog of 10 mm. depth on one of their flat faces. They shall give a clear metallic ringing sound when struck. They shall show a fine grained, uniform homogeneous and dense texture on fracture and be free from lumps of lime, laminations, cracks, air holes, soluble salts causing efflorescence or other defects which may in any way impair their strength, durability, appearance or usefulness for the purpose intended. They shall not have any parts under-burnt. They shall not break when thrown on the ground on their flat face in a saturated condition from a height of 60 cm.

#### Size of bricks

Bricks shall comply with I. S: 1077 - 1976.

#### Absorption

After immersion in water, absorption by weight shall not exceed 20% of the dry weight of the brick when tested according to IS: 1077-1976.

#### Crushing Strength

The load to crush the brick when dry shall not be less than 50 Kg/sq.cm. and when thoroughly soaked shall not be less than 35 Kg/sq.cm.

### 3.2 CEMENT, FINE AGGREGATE AND WATER

Refer relevant clauses of these specifications.

### 3.3 MORTARS

Cement and sand shall be mixed in specified proportions given on the drawings. Cement shall be proportioned only by weight, by taking its unit weight as 1440 kg per cubic metre and the sand shall be proportioned by volume after making due allowance for bulking. The required quantity of water shall then be added and the mortar mixed to produce workable consistency.

The mixing shall be done intimately in a mechanical mixer unless hand-mixing is specifically permitted by the Engineer. If hand mixing is done, the operation shall be carried out on a clean watertight platform and cement and sand shall be first mixed dry in the required proportion to obtain a uniform colour and then the mortar shall be mixed for at least two minutes after addition of water. The mortar so prepared *shall* be used within 30 minutes of adding water. Only such quantity of mortar shall be prepared as can be used within 30 minutes. The mortar remaining unused after that period or mortar, which has partially hardened or is otherwise damaged shall not be re-tempered or re-mixed. It shall be destroyed or thrown away. In case of cement mortar that has stiffened because of evaporation of water the same shall be re-tempered by adding water as frequently as needed to restore the requisite consistency, but this re-tempering shall be permitted only within thirty minutes from the time of addition of water at the time of initial mixing. Necessary tests to determine compressive strength of the mortar, for consistency of the mortar and its water retentively shall be carried out in accordance with IS-2250. The frequency of testing shall be one cube for every 2 cubic metre of mortar prepared subject to a minimum of 3 cubes for a day's work.

### 4.0 CONSTRUCTION

#### 4.1 SOAKING OF BRICKS

Bricks shall be soaked in water for a minimum period of one hour before use so that they will be saturated and will not absorb water from the mortar. When bricks are soaked they shall be removed from the tank sufficiently in advance so that at the time of laying they are skin-dry. Such soaked bricks shall be stacked on a clean place where they are not spoil by dirt, earth, etc, 4.2 Laying of Bricks

#### 4.2 LAYING OF BRICKS

All brick work shall be laid in English bond, even and true to line, plumb, level and all joints accurately kept. The bricks used on the face shall be selected whole ones of uniform size and with true rectangular face. Brick shall be laid with frogs up, if any, on a full bed of mortar. When laying, bricks shall be slightly pressed so that the mortar gets into all the surface pores of bricks to ensure proper adhesion. All joints shall be properly flushed and packed with mortar so that no hollow spaces are left. Before laying bricks in foundation, a layer of not less than 12 mm of mortar shall be spread to make the surface on which the brickwork will be laid even. Immediately thereafter, the first course of bricks shall be laid.

The brickwork shall be built in uniform layers, corners and other advanced work shall be raked back. Brickwork shall be done true to plumb or in specified batter. No part of it, during construction, shall rise more than one meter above the general construction level, to avoid unequal settlement and improper joining. The height of brick works constructed shall not exceed one metre in a day. Tothing may be done where future extension is contemplated but shall be used as an alternative to raking back..

All brick walls abutting concrete columns or walls shall be bonded to the same with approved 6mm dia 250 mm long galvanized M.S. dowels or approved G.I. butterfly ties left from the concrete columns while casting, at every 9th course of brick..4.3 Joints. The thickness of joints shall not exceed 10mm and this thickness shall be uniform throughout.

#### 4.3 JOINING WITH EXISTING STRUCTURE

When fresh masonry is to be placed against existing surfaces of structures, these shall be cleaned of all loose material, roughened and wetted as directed by the Engineer so as to affect a good bond with the new work.

#### 4.4 CURING

Green work shall be protected from rain by suitable covering. Masonry work in cement or composite mortar shall be kept constantly moist on all faces for a minimum period of seven days. The top of the masonry work shall be left flooded with water at the close of the day. During hot eather all finished or partly completed work shall be covered or wetted in such manner as will prevent rapid drying of the brick work.

#### 4.5 SCAFFOLDING

The scaffolding shall be sound and strong to withstand all loads likely to come upon it and will be double as is warranted for the particular work. The holes, which provide resting space for horizontal members, shall not be left in masonry under one metre in width or immediately near the skew backs of arches. The holes left in the masonry work for supporting the scaffolding shall be filled and made good with 1:4:8 cement concrete.

#### 4.6 CONDITION OF EQUIPMENT

All equipment used for mixing or transporting mortar and bricks shall be clean and free from set mortar, dirt or other injurious foreign substances.

#### 4.7 FINISHING OF SURFACES

For a surface which is to be subsequently plastered or pointed the joints shall be squarely raked out to a depth of 15mm while the mortar is still green. The raked joints shall be well brushed to remove dust and loose particles and the surface shall be thoroughly washed with water, cleaned and wetted.

#### 5.0 MEASUREMENT FOR PAYMENT

5.1 All brick work for 230mm thick or above shall be measured in cubic metres and 115mm thick and below shall be measured in cubic.metres. The work of plastering and pointing shall be measured in square metres of the surface treated.

5.2 Rate :- The contract unit rate for brick work shall include the cost of all labour, materials, tools and plant, scaffolding and other expenses incidental to the satisfactory completion of the work as described herein above and as shown on the drawings. The rate for work shall also include:

- (i) Dewatering required for completing this item and till the mortar of masonry pointing & plastering is properly set
- (ii) watering the masonry and
- (iii) cleaning the site round the brick-work so as to restore the area to its original condition.

The rate for work shall also include full compensation for using specially moulded bricks on the face of walls with batter and provision of weep holes.

# PLASTERING & POINTING

## PLASTERING AND POINTING

### CONTENTS

#### SL NO DESCRIPTION

- 1.0 Scope
- 2.0 Applicable Indian Standards
- 3.0 General
- 4.0 Pointing
- 5.0 Curing
- 6.0 Measurement and Rate

#### 1.0 SCOPE

These specifications cover the use of plastering for masonry and RCC work, pointing for brick and stone masonry work.

#### 2.0 APPLICABLE INDIAN STANDARDS

The provision of the latest revisions of the following IS codes shall form a part of this specification to the extent they are relevant.

IS: 269 Specification for ordinary rapid hardening and low heat Portland cement IS – 383 Specification for coarse and fine aggregate IS: 712 Building Limes

IS: 1200 (Part XII) Method of measurement of building and Civil Engg. Works - Plastering & Pointing

IS: 1542 Specification for sand for plaster

IS: 1630 Mason's Tools for Plaster work and pointing work.

IS: 1661 Code of practice for application of cement lime plaster finishes IS 2645 Specification for integral waterproofing compound. IS: 10067 Material Constants for Building Works

Other I. S. Codes, not specifically mentioned here, but pertaining to plastering work, form part of these specifications.

#### 3.0 GENERAL

##### 3.1 Cement Mortar

Cement mortar shall have the proportion of cement to sand as specified and shall comply with relevant clauses of concrete specifications.

##### 3.2 Scaffolding,

Scaffolding independent of masonry / RCC work i.e. double scaffolding shall be erected having two sets of vertical supports with steel sections or pipes of adequate strength so as to be safe for construction operations. The contractor shall take all measures to ensure the safety of the work and working people. Any instructions of the Engineer in this respect shall also be complied with. The contractor shall be entirely responsible for any damage to property or injury to persons resulting from ill erected scaffolding, defective ladders and materials or otherwise arising out of his default in this respect. Proper scaffolding shall be provided to allow easy approach to every part of the work. Overhead work shall not be allowed. Making holes of any kind for the purpose of supporting the scaffolding shall not be permitted.

##### 3.3 Tools and Accessories

Tools and accessories used in plaster work shall conform to IS: 1630. All tools shall be cleaned by scrapping and washing at the end of each day's work or after use. Metal tools shall be cleaned after each operation. All tools shall be examined to see that they are thoroughly cleaned before plastering is begun.

##### 3.4 Programme of work in relation to plastering

The programme of other building operations before, during and after plastering shall be according to the instructions contained in clause 9 of IS: 1661.

### 3.5 General Precaution in plastering

All general precautions as specified in IS.. 1661, Clause 9, shall be taken and preparation of the background shall be done as laid down in IS: 1661, Clause 13. Care shall be taken to see that other parts of the work or adjacent works are not damaged while plastering.

### 3.6 Preparatory work

All joints in the face work that is to be plastered shall be raked out to depth equal to not less than the width of the joints or as directed by the Engineer. The raking shall be done taking care not to allow by chipping of masonry. In new work the raking out shall be done when the mortar in the joints is still green. Efflorescence if any shall be removed by brushing and scrapping. Smooth surfaces of concrete, old plaster, etc. must be suitably roughened to provide necessary bond for the plaster. All dirt, soot, oil paint or any other material that might interfere with satisfactory bond shall be removed. In the case of stone masonry, scrubbing on the walls to receive the plaster shall not be more than 12 mm. The surface to be plastered shall be cleaned and scrubbed with fresh water and kept wet for 6 hours prior to plastering. It shall be kept damp during the progress of the work. The plastering shall not be commenced unless the preparatory work is passed in writing by the Engineer.

### 3.7 Chicken wire Mesh at Junction

All junctions of Masonry wall with R.C. structure e.g. column, beam, etc. which are to be plastered, shall be reinforced by fixing strips of approved G.I. Chicken wire mesh of minimum 300mm wide centrally over the length of junction. G.I. Chicken wire mesh of required width shall also be fixed over chasing for conduits, pipes, etc. on masonry walls before plastering is commenced. The mesh shall be nailed rigidly to the structure / masonry with G.I. nails of suitable type at approx. 400mm centers. The finished mesh shall be straight, rigid and laid without sagging.

### 3.8 Gauges

Patches of plaster 15cm x 15cm shall be put on about 3 m apart as gauges to ensure even plastering in one plane.

### 3.9 Workmanship

#### Plastering:

In all plaster work the mortar shall be firmly applied with somewhat more than the required thickness and well pressed into the joints and on the surface and rubbed and levelled with a flat wooden rule to give required thickness. Long straight edges shall be freely used to give perfectly plane and even surface. All corners must be finished to their true angles or rounded as directed by the Engineer. The surface shall be finished to plane or curved surface as shown on the plan or directed by the Engineer, and shall present a neat appearance. The mortar shall adhere to the masonry surface intimately when set and there should be no hollow sound when struck. Cement plastering should be done in squares or strips as directed. Plastering shall be done from top downward.

#### First or Backing Coat

The first coat of the specified thickness shall be applied as described above. The subsequent coat shall be applied after this coat has been allowed to set for 3 to 5 days depending upon weather conditions. The surface shall not be allowed to dry during this period.

### 3.10 Plastering to Ceiling

Projecting burrs of mortar formed due to the gaps at joints in shuttering shall be removed. The surface shall be scrubbed clean with wire brushes. In addition concrete surface shall be poke marked with a pointed tool at spacing of not more than 50 mm centres, the pokes being made not less than 3 mm deep, to ensure a proper key for the plaster. The mortar shall be washed off and surface cleaned of all oil, grease etc., and well wetted before the plaster is applied.

#### 4.0 POINTING

##### 4.1 General

When the type of pointing is not mentioned in the item, sunk pointing is described below shall be carried out.

##### 4.2 Raking Out Joints

Where the joints have not been raked out when the mortar is green, the joint shall be chipped (without damaging the masonry) to such a depth that the minimum depth of new mortar measured from either the sunk surface of the finished surface of the finished pointing or from the edge of the brick shall not be less than 12 mm, thoroughly cleaned off all loose particles with a stiff brush and thoroughly wetted.

##### 4.3 Pointing

The mortar shall be pressed into the raked out joints with a pointing trowel. The mortar shall not spread over the corners, edges or the surface of the masonry. With a pointing tool, the mortar shall be neatly pressed back to about 3 mm or as directed. The vertical joints shall be pressed back similarly to match the horizontal joints. The surface of masonry shall be cleaned of all mortar.

#### 5.0 CURING

Curing shall be started after 24 hours after finishing the plaster. The plaster shall be kept wet for a period of seven days. During this period it shall be suitably protected from all damages as directed by the Engineer-in-Charge. The dates on which the plastering is done shall be legibly marked on the various sections plastered so that curing for the specified period thereafter can be monitored.

#### 6.0 MEASUREMENT AND RATE

Plastering shall be measured in sq. metre areas as per IS: 1200 (Part XII). The rate shall include erecting and removal of scaffolding all labour, all materials, equipment, plants, tools and all incidental expenses to complete plastering, pointing, rubbing out joints, cleaning, wetting, filling with cement mortar, troweling etc. and making of drip moulds, grooves, vattas, bands etc. including curing.

# WATER PROOFING

## WATER PROOFING

### CONTENTS

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- 1.0 SCOPE
- 2.0 CODES & SPECIFICATION
- 3.0 GENERAL
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- 5.0 WATERPROOFING OF UNDERGROUND STRUCTURES
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- 8.0 TOILET BLOCK WATER PROOFING
- 9.0 WATERPROOFING GUARANTEE CLAUSE
- 10.0 PROFORMA FOR GUARANTEE CERTIFICATE

#### 1.0 SCOPE

These specifications cover damp proofing (excluding water under pressure) against seepage, lateral or rising moisture, water proofing against water / water under hydrostatic pressure. The work shall also cover related work such as cleaning the surfaces, application, all testing, rectification / replacement of defective work and any other work necessary to complete the work as per drawings, specifications and the directions of the Engineer. Water proofing shall be by one of the following methods as specified in the schedules and drawings – by bitumen felts and coats, by integral water proofing chemical compounds, by application of chemicals forming a film on external face of structure, by grouting of concrete with water proofing chemicals. The Contractor shall provide all materials, transportation, tools and tackles, labour and supervision and other related work for the work of water proofing various components of structures by different materials and procedures.

#### 2.0 CODES AND SPECIFICATIONS

The following codes and specifications will be applicable. In general work shall be done as per the latest editions of the applicable Indian Standards some of which are listed below. Where Indian Standards are not available, relevant British / ASTM Standards shall be referred to. Other I. S. Codes, not specifically mentioned here, but pertaining to water-proofing work, form part of these specifications. Where specialized chemicals are used for waterproofing, work shall be done as per manufacturer's recommendations for best practice.

#### 3.0 GENERAL

It should be noted that concrete should itself be properly laid the proportion so designed, mixed and laid to form as dense a concrete while in conformity with the specifications. Before applying any compound the face of concrete shall be rubbed down smooth and free of any contaminants and loose materials. All materials should be new, of fresh manufacture and stored and handled properly. Chemicals shall be stored and handled as per the manufacturer's recommendation and used well before the shelf life period expires. Where specialist chemicals are used, manufacturer's recommendations shall be followed in the use of the chemicals.

#### CODES DESCRIPTION

- IS: 269 Specification for ordinary rapid hardening and low heat Portland cement
- IS – 383 Specification for coarse and fine aggregate
- IS: 2645 Integral cement water proofing compounds
- IS: 3067 Preparatory work for water proofing of buildings
- IS: 3495 Method of test for burnt clay building bricks.
- IS: 6494 Waterproofing of underground reservoirs and swimming pools
- IS: 7290 Recommendations for use of polyethylene film for water proofing of roof.
- IS: 8112 Specification for 43 grade ordinary Portland cement
- IS: 10067 Material Constants for Building Works
- IS :12118 Two parts polysulphide based sealants



#### 4.0 INTEGRAL WATER PROOFING

In order to improve water tightness in retaining walls and in locations where waterproof concrete is required, integral water proofing chemicals / compounds shall be added to the concrete. These shall conform to IS: 2645 and shall be chloride free. The material is generally in powder form and has to be made into a solution with the prescribed quantity of water before it is added to the concrete. The dosage to be added is of the order of 1.5% to 2% of the weight of cement. The total water cement ratio should be as per the code for the particular grade of concrete and the mix design. While using a particular product, the recommendations of the manufacturer shall be given due weight.

#### 5.0 WATERPROOFING OF UNDERGROUND STRUCTURES

In underground structures, swimming pool etc, necessary precautions shall be taken as detailed below, before the application of waterproofing treatment

- a) The concrete used in the walls shall contain integral waterproofing compounds as specified in paragraph 4.0 above.
- b) The retaining wall shall also be grouted with cement slurry to which water-soluble waterproofing compound the grouting being done to refusal Where specified on the drawings or directed by the Engineer, 12 mm nozzles shall be provided on the surface of the wall of the structure in a grid of 1.5 m both ways before concreting. During concreting operations, the nozzles shall be properly protected to prevent the nozzles from being clogged with concrete. (If holes are to be made in set concrete they shall be made by careful drilling of the concrete and then grouting the nozzles.). After the nozzles are set, slurry with neat cement and a chloride free expanding grout shall be injected through the nozzles with low pressure grout pumps (pressure around 2 kg / sq.cm). Water cement ratio should be restricted to 0.35 to 0.40 and viscosity not more than 1.2 centipoises. If necessary plasticizing agent can also be used. Grouting pressure shall be low at the start of the operations and increased gradually (but within limits so as not to harm the concrete) till completion and refusal of grout. After a suitable interval, the nozzles shall be properly sealed after the approval of the Engineer. (Intraplast EP or N 200 / Cebex 100 / suitable product of the Excem range or any equivalent product can be used. Important requirements – suitability for the purpose, expanding type, absence of chloride etc

#### 6.0 CEMENT BASED WATERPROOFING

6.1 The treatment shall be laid directly over the R.C.C Slab, the detailed operations are as follows:

- a) After the RCC slab has been cleaned slurry coat consisting of the neat cement admixed with specialised acrylic based chemicals which penetrate in the minutest of crevices and fill up all the porosity in the structure shall be used. In case of construction joints between different R.C.C members the chemicals mixed with neat cement slurry shall be injected at joints to make them monolithic.

- b) A layer consisting of half cut bricks in cement mortar 1:4 (1 cement : 4 coarse sand) admixed with acrylic based chemicals to necessary gradient for proper flow of water towards the drain is then laid. The treatment will be extended upto 300 mm height of parapet walls also. The average thickness of this brick bat coba shall be 120 mm with a minimum thickness of 75 mm at the drain.

After a proper curing for about 3 days once again slurry coat consisting of cement slurry mixed with waterproofing chemicals is provided to fill in the joints.

- c) The top is then finished smoothly with cement mortar 1:4 (1 cement : 4 coarse sand) with acrylic based chemicals, such topping shall be of 25 mm thickness marked with 300 x 500 mm false rectangles and the joints between slab and walls shall be rounded off in the form of vata. The whole terrace shall be flooded with water for a period of 2 weeks for curing and for final test.

- d) The proportion of the chemicals to be used in respect of ordinary Portland cement shall be 1% by weight i.e. 1 Kg of chemicals shall be mixed with 100 Kg ordinary cement and the quantity of cement used shall be a minimum of 5 bags per 9.29 sq.m of the area treated.

- e) Mode of Measurement

For treatment over terrace

Treatment to Horizontal areas and vertical areas (wattas/core) will be measured together. Horizontal areas will be measured wall to wall faces before application of treatment and vertical areas will be measured from top of horizontal finished treatment to top of wattas/core vertically along wall of face and not girthed.

#### 7.0 IMPREGNATION (EXTERNAL) TREATMENT TO THE BASEMENT AND UNDERGROUND WATER TANK STRUCTURE.

The underground structure shall be treated with the impregnation treatment during the initial stage of construction to ensure 100% water tightness. Preparatory works shall be carried out as per clause 5.0 above. 7.1 The impregnation layers shall be laid over the evenly laid bedding course of concrete after cleaning the surface. Rough stone slabs are then laid side-by-side leaving a gap of about 15 mm to 20 mm between them. These joints thus left are raked open and cement slurry admixed with chemicals is grouted in these joints. A protective layer of about 25mm thickness of cement mortar 1:5 (1 cement : 5 Coarse sand) with stone chips embedded at random is put over the stone layer. The total thickness of the waterproofing layer shall be minimum of 75 mm. The treatment is extended 150 mm beyond the external face of the RCC raft slab and where side walls are laid the treatment shall be carried over to the side walls.

7.2 The impregnation treatment shall be continued to the external sides of the walls and upto 300 mm above ground level. The procedure shall be as follows:

Rough stone slabs of thickness 12 mm to 16 mm shall be fixed with the help of cement paste applied on the internal face of the vertical joints of the stones, leaving a gap of about 18 mm between the external face of RCC wall and internal face of the rough stones. The stones are fixed side by side without leaving any gap between the edges. In order to fix the bottom most layer of stones a groove about 25 mm deep is made in the bottom RCC slab and the stones fixed in it to ensure the water tightness at the junctions of the walls and raft if the raft is projecting beyond the external face of walls. Maximum of two to three horizontal layers of rough stones are laid at a time. A coat of very rough cement plaster 1:5 (1 cement: 5 Coarse sand) is applied to the external face of rough stones. After the layer is set, the gap between the walls and the stones layer is filled with a grout mix made up of cement slurry and acrylic based chemicals, which on gellation forms an impermeable monolithic layer. The treatment is then continued upto 300 mm above the ground level in stages.

#### 8.0 TOILET BLOCK WATERPROOFING

i) Treatment to include filling in the depressions with waterproof brickbat coba and top surface finished rough to receive flooring tiles.

ii) Special treatment shall be carried out on the walls upto a height as specified (minimum 1.0 metre) above finished floor level. The thickness of this waterproofing treatment on walls will be 10 to 18 mm. The treated surface of the walls will be left rougher to receive dado tiles over them. The toilet block waterproofing shall be carried out only after the required plumbing and drainage works are completed and tested. Rate quoted shall include for making good of walls at required height, for tucking the treatment on vertical surface.

iii) Cement mortar in a ratio of 1 : 4 (1 cement : 4 Coarse sand) shall be laid with 2% water-proofing compound over the water-proofed area / depressions where brick bat filling is to be carried out, after the area duly tested & approved by the Engineer. Brick bats shall be laid in layers and grouted in cement mortar (1:4) with 2% water-proofing compound upto the required level and top surface finished rough to receive flooring tiles.

iv) Mode of measurement

Treatment to horizontal and vertical areas will be measured separately for treatment carried out in the sunk floor of bath/WC etc. the flat area of the respective sunk floor shall be measured.

The area of treatment to the walls shall be measured by calculating the perimeter of unfinished walls of bath/WC and multiplying the same by the height of the treatment above finished treated level of such floor of bath & WC.

#### 9.0 WATERPROOFING GUARANTEE CLAUSE

The contractor shall be fully responsible for and shall guarantee proper performance of the entire waterproofing system for a period of 10 (Ten) years from the final completion of works. In addition, specific 10 years written guarantee (to be furnished in a non-judicial stamp paper of value not less than Rs.100/-) in approved proforma shall be submitted for the performance of the system, before final payment and shall not in any way limit any other rights the Employer may have under the contract.

All water-proofing work shall be carried out through an approved specialist agency as per method of working approved by the Engineer. Contractors and the waterproofing agency shall be jointly responsible for waterproofing treatment until the expiry of the above guarantee period.

**PROFORMA FOR PERFORMANCE GUARANTEE FOR WATER PROOFING WORKS** (On non-judicial

stamp paper of value Rs. 100/-)

To

(Name & Address of Employer)

.....

.....

.....

**We hereby guarantee the Entire Waterproofing System**, which we have carried out in the Complex described below :

**Building :** .....

**Location :** .....

**Employer :** .....

For a period of 10 (Ten) years from the certified date of completion, WE AGREE TO repair or replace to the satisfaction of the Employer, any or all such work that may prove defective in workmanship or materials within that period, ordinary wear and tear and unusual abuse or neglect excluded, together with any other work, which may be damaged or displaced in so doing. In the event of our failure to comply with the above-mentioned conditions within a reasonable time, after being notified in writing, we collectively and separately, do hereby authorise the Employer to proceed to have the defects repaired and made good at our expense, and we shall pay the cost and charges thereof, immediately upon demand.

Signature of the Contractor

For M/s. ....

Address & seal

Date :

Witness:

# PAINTING

## PAINTING

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- 8.0 Flat Oil Paint
- 9.0 Synthetic Textured Paint in Plain / Stone or Metallic Finish.
- 10.0 Acrylic external painting
- 11.0 Measurement

#### 1.0 SCOPE

These specifications cover the use of paints for the plastered and concrete surfaces. It also includes the painting of wood and metal surfaces.

#### 2.0 GENERAL

The provisions of the latest revisions of the following ARE: Codes shall form a part of this specification.

IS: 63 Whiting for Paint & putty.

IS: 75 Specification for Linseed oil, raw & refined.

IS: 159 Specification for ready mixed paint, brushing, acid resistant.

IS: 345 Specification wood filler, transparent, liquid.

IS: 426 Specification for paste filler for colour coats.

IS: 427 Specification for Distemper, dry colour, as required.

IS: 428 Specification for Distemper, Oil Emulsion, colour as required.

IS: 533 Specification for Gum spirit of Turpentine (Oil of Turpentine)

IS: 710 Marine Plywood

IS: 1200 (Part XIII) Method of Measurement of Building & Civil Engg Works – White Washing, colour washing, distemping & other finishes.

IS: 1477 (Part 1) Code of practice for painting of ferrous metals in buildings Pre-treatment

IS: 1477 (Part 11) Code of practice for finishing of ferrous metals in buildings, Painting

IS: 2338 (Part 1) Code of practice for finishing of wood and wood based materials Operations and workmanship for finishing.

IS: 2338 (Part 11) : Code of practice for finishing of wood and wood based materials, Schedule

IS: 2395 (Part 1) : Code of practice for painting concrete masonry and plaster surfaces. Operation & workmanship

IS: 2395 (Part 11) Code of practice for painting concrete, masonry and plaster surfaces. Schedule.

IS: 2524 (Part 1) Code of practice for painting of non-ferrous metal in buildings Pre-treatment

IS: 2524 (Part II) Code of practice for painting of non-ferrous metal in buildings Painting

IS: 3140 Code of practice for painting asbestos cement buildings:

IS: 3537 Specification for ready mixed paint, finishing, interior for general purposes to IS colour.

IS: 5410 Specification for cement paints, colour as required.

IS : 6278 Code of practice for white washing & colour washing. Other IS Codes not specifically mentioned here, but pertaining to painting form part of these specifications.

#### 3.0 MATERIALS

Materials shall strictly conform to the relevant IS: Specifications.

#### 4.0 PLASTERED OR CONCRETE SURFACES

##### 4.1 General

Wherever scaffolding is necessary, it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be painted. A properly secured and well tied suspended platforms (JHoola) may be used for painting. Where ladders are used, pieces of old gunny bags shall be tied at top and bottom to prevent scratches to the walls and floors. For painting of ceilings, proper stage scaffolding shall be erected, where necessary.

##### Preparation of surfaces:

The surface shall be thoroughly cleaned off all dirt, dust, mortar dropping and other foreign matter, before paint is to be applied. New plaster surfaces and wet patches shall be allowed to sufficiently dry, before applying paint. All unnecessary nails shall be removed. Pitting in plaster shall be made good with putty. The surface shall then be rubbed down again with a fine grade sand paper and made smooth. The surface shall be allowed to dry thoroughly before the regular coat of paint is allowed. The surface affected by moulds moss, fungi, algaecicnens, efflorescence shall be treated in accordance with IS 2395 (Part 1) before applying paint.

##### 4.2 ACRYLIC DISTEMPER

##### Preparation of Surfaces:

Any unevenness shall be made good by applying putty, made of plaster of Paris mixed with water on the entire surface including filling up the undulation and then sand papering the same after it is dry.

##### Primer Coat:

The primer where used as on undercoated surfaces shall be alkali resistance primer or distemper primer as specified in the item. These shall be of the same manufacture as of acrylic distemper. If the wall surface plaster has not dried completely alkali resistance primer shall be applied before distemping the walls. But if the distemping is done after the wall surface is dried completely, distemper primer shall be applied.

##### Application:

Primer shall be applied with a brush on the clean dry and smooth surface. Horizontal strokes shall be given first and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks. It shall be allowed to dry for at least 48 hours, before oil bound distemper or paint is applied.

##### Preparation of acrylic distemper:

The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for days work shall be prepared.

##### Application of distemper coat:

After the primer coat has dried for at least 48 hours, the surface shall be lightly sand papered to make it smooth for receiving the distemper, taking care not to rub out the priming coat. All loose particles shall be dusted off after rubbing. Minimum two coats of distemper shall be applied with brushes in horizontal strokes followed to immediately by vertical which together shall constitute one coat. The subsequent coats shall be applied after a time interval of at least 24 hours between consecutive coats to permit the proper drying of the preceding coat. The finished surface shall be even and uniform without patches, brush marks, distemper, drops, etc.

Sufficient quantity of distemper shall be mixed to finish one room at a time. The application of a coat in each room shall be finished in one operation and no work shall be started in any room, which cannot be completed the same day. 15 cm. double bristled distemper brushes shall be used. After each days work, brushes shall be thoroughly washed in hot water with soap solution and hung down to dry. Old brushes, which are dirty and caked with distemper, shall not be used on the work.

##### 4.3 WATERPROOF CEMENT PAINT

##### Preparation of Surfaces

The surfaces shall be thoroughly wetted with clean water before the water proof cement paint is applied.

### Preparation of Paint

Portland cement paints are made readily by adding paint powder to water and stirring to obtain a thick paste which shall then be diluted to a brushable consistency. Generally equal volumes of paint powder and water make a satisfactory paint. In all cases the manufacturer's instructions shall be followed. The paint shall be mixed in such quantities as can be used up within an hour of mixing as otherwise the mixture will set and thicken, affecting flow and finish.

The lids of cement paint drums shall be kept tightly closed when not in use, as by exposure to atmosphere the cement paint rapidly becomes air set due to its hygroscopic qualities. Application of Paint: No painting shall be done when the paint is likely to be exposed to a temperature of below 7°C within 48 hours after application.

When weather conditions are such as to cause the paint to dry rapidly, work shall be carried out in the shed as far as possible. This helps the proper hardening of the paint film by keeping the surface moist for a longer period. To maintain a uniform mixture and to prevent segregation the paint shall be stirred frequently in the bucket.

For undecorated surfaces, the surface shall be treated with minimum two coats of waterproof cement paint. Not less than 24 hours shall be allowed between two coats and the second or subsequent coat shall not be started until the preceding coat has become sufficiently hard to resist marking by the brush being used. In hot dry weather the preceding coat shall be slightly moistened before applying the subsequent coat. The finished surface shall be even and uniform in shade without patches, brush marks, paint drops, etc.

Cement paints shall be applied with a brush with relatively short stiff hog or fibre bristles. The paint shall be brushed in uniform thickness and shall be free of excessively heavy brush marks. The laps shall be well brushed out.

### Curing

Painted surfaces shall be sprinkled with water two or three times a day. This shall be done between coats and for at least three days following the final coat. The curing shall be started as soon as the paint has hardened so as not to be damaged by the sprinkling of water say about 12 hours after its application.

### Rate

The rate shall include the cost of all labour and materials involved in all the above operations (including priming coat) as described above.

## 5.0 PAINTING WOOD AND METAL SURFACES

### 5.1 General Requirement :

The materials required for the execution of painting work shall be obtained directly from approved manufacturers and brought to the site in maker's drums, with seals unbroken. All paints shall conform to relevant Indian Standards as mentioned under sub-head

#### "Material".

All materials not in actual use shall be kept properly protected. Lids of containers shall be kept closed and surface of paint in open or partially open containers covered with a thin layer of turpentine to prevent formation of skin. Materials which have become stale or fat due to improper and long storage shall not be used. The paint shall be stirred thoroughly in its container before pouring into small containers. While applying also, the paint shall be continuously stirred in the smaller container. No left over paint shall be put back into stock tins. When not in use, the containers shall be kept properly closed. If for any reason thinning is necessary, in case of ready mixed paint, the brand of thinner recommended by manufacturer shall be used. Painting except the priming coat shall generally be taken in hand after all other builder's work is practically finished. The rooms shall be thoroughly swept out and the entire building cleaned up at least one day in advance of the paint work being started. The surface to be painted shall be thoroughly cleaned and dusted. All rust, dirt scales, smoke and grease shall be thoroughly removed before painting is started.

No painting on exterior or other exposed parts of the work shall be carried out in wet, humid or otherwise unfavourable weather and all the surfaces must be thoroughly dry before painting work is started.

#### Brushing of Paint:

The brushing operations are to be adjusted to the spreading capacity advised by the manufacturers of the particular paint. The painting shall be applied evenly and smoothly by means of crossing and laying off, the later in the direction of the grain of wood. The crossing and laying off consists of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternatively in the opposite directions two or three times and then finally brushing lightly in a direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat. During painting, every time after the paint has been worked out of the brush bristles or after the brush has been unloaded, the bristles of the brush. (which are drawn together due to the high surface tension) shall be opened up by striking the brush against a portion of the unpainted surface with the end of the bristles held at right angles to the surface, so that bristles thereafter will collect the correct amount of paint when dipped again into the paint container.

#### Spraying:

Where so stipulated, the painting shall be done with spray. 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. Paints used shall be brought to the requisite consistency by adding a suitable thinner. Spraying should be done only when dry conditions 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 application with the minimum wastage of paint. The air pressure shall not be kept too high as otherwise the paint will clog up and will be wasted. Spots that are inaccessible to the spray pattern shall be touched up by brush after spraying. 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. Each coat shall be allowed to dry completely and lightly rubbed with very fine grade of sand paper and loose particles brushed off before next coat is applied. Each coat shall vary slightly in shade and shall be got approved from the Engineer-in-charge before next coat is started. Each coat except the last coat, shall be lightly rubbed down with sand paper or fine pumice stone and cleaned off dust before the next coat is applied. No hair marks from the brush or clogging of paint puddles in the corner panels, angles of moulding, etc. shall be left on the works. In painting doors and windows, the putty round the glass panes shall also be painted but care shall be taken to see that no paint stains etc. are left on the glass. Tops of shutters and surfaces in similar hidden locations shall not be left out in painting. In painting steel work, special care shall be taken while painting over bolts, nuts, rivets, overlaps etc. The additional specifications for primer and other coats of paints shall be according to the detailed specifications under the respective headings.

#### Brushes and containers:

After work, the brushes shall be completely cleaned off paint and linseed oil by rinsing with turpentine. After cleaning, the brushes are wrapped in heavy paper or water proof paper for storage. It is to be used the next day, it shall be hung in a thinner or linseed oil in a container. On no account shall brushes to be made to stand on bristles. A brush in which paint has dried up is ruined and shall on no account be used for painting work. The containers, when not in use, shall be kept closed and free from air so that paint does not thicken and also shall be kept guarded from dust. When the paint has been used, the containers shall be washed with turpentine and wiped dry with soft clean cloth, before they can be used again.

#### 5.2 Wood and wood Based Materials:

##### Preparation of Surface:

All wood work shall be dry and free from any foreign matter, incidental to building operation. Nails shall be punched well below the surface to provide a firm key for stopping. Moulding shall be carefully smoothed with abrasive paper and projecting fibres shall be removed. Flat portions shall be smoothed off with abrasive paper



used across the grain prior to painting. Any knots, resinous, streaks or bluish sap wood that are large not enough to justify cutting out shall be treated with two coats of pure shellac knotting, applied thinly and extended about 25 mm beyond the actual area requiring treatment.

Plywood and Block Board:

This shall be treated as for solid wood, described above.

Hard Boards:

The surface shall be dusted off and painted with a coat of plastic emulsion paint thinned with water or with a coat of shellac varnish as specified. The surface shall then be rubbed down with fine grade abrasive paper and followed with required under coating and finishing coat as for solid wood.

Particle Board: The surface shall be filled with a thin brushable filler and finished as for solid wood.

Insulation Boards: Two thin coats of water based paints shall be applied by spraying.

Priming Coat:

The dirt or any other extraneous material shall be removed from the surface to be painted. In case the surface is already finished with primer coat but unsatisfactory, it shall be rubbed down to bare wood and surface reprimed. Primer shall be applied by brushing.

Application for transparent wood filler:

The filler shall be applied with brush or rag in such a way that it fills up all the pores and indentations and levels up the surface. It shall be allowed to dry for 24 hours and it shall then be cut and rubbed with emery paper so that the surface of the wood is laid bare, with, the filler only in the pores and crevices of the wood.

Stopping:

All holes, cracks, crevices, etc. shall be stopped carefully to true and level surface with putty before the main undercoat is applied and after the application of the priming coat, stopping shall be prepared as below:

Bees wax, resin and lac (orange in colour) in the proportion of 1: 1: 16 by weight shall be melted down together in a suitable pot using slow heat, the mix being kept well stirred.

Colouring materials to produce the required shade shall be added into molten mixture and stirred. Stopping shall on cooling be rolled into stick forms for use.

Application of Paints:

This shall conform to specifications under Para 5. 1

Applying wood preservatives:

The preservatives of specified quality shall be applied in two coats. On new wood work, it shall be applied liberally with a stout brush and not doubled with rags or cotton waste, The first coat shall be allowed at least 24 hours to soak in before the second coat is applied. The excess of preservative which does not soak into the wood shall be wiped off with a clean dry piece of cloth.

## 6.0 WHITE WASHING

General

The item refers to white-washing over old and new concrete, stone masonry brick plastered surfaces and asbestos cement sheets. White wash shall be prepared from fresh burnt white stone lime or shell lime. This lime shall be of class C type as per IS: 712. Surkhi lime or lime of equivalent quality may be used. The lime shall be dissolved in a tub with sufficient quantity of water (about 4.5 litres/Kg. of lime) and the whole shall be thoroughly mixed and stirred until it attains the consistency of thin cream. The white wash shall be taken out in small quantities and strained through a clear course cloth. Alternatively whitening for paints and putty as per IS: 63 may also be used. Clean gum dissolved in hot water shall then be added in suitable proportion of 2 gm of gum Arabic to a litre of lime or whitening to prevent the white- wash coming off easily when rubbed. Rice may be used instead of gum. For the new work, the priming coat shall be of white wash with lime or with whitening as specified in the description of the item. Two or more coats, shall then be applied on the entire surface till it represents a smooth and uniform finish. The finished dry surface shall not be powdery and shall not readily come off on the hand when rubbed.

#### Scaffolding:

This may be double or single according to requirements. If ladders are used, pieces of old gunny bags or cloth rags shall be tied on their tops to avoid damage or scratches to the wall. Proper stage scaffolding shall be created when white-washing ceiling. The contractor shall be responsible for accidents if any taken place.

#### Preparation of Surface:

The surface shall be prepared by removing all mortar dropping and foreign matter and thoroughly cleaned with wire or fibre brush or other means as may be ordered by the Engineer to produce an approved clean and even surface. All loose pieces and the scales shall be scraped off and holes stopped with mortar. In case where the surface has been previously coloured-washed, the old colour wash must be entirely removed before the white-wash is applied. In the case of surface which has once been white-washed, the old loose white-wash shall be broomed down. In case, the loose white-wash cannot be removed by brooming, the Engineer may order scraping of the surface. After cleaning the surface as specified above, the unwanted nails shall be removed and all nail holes, cracks and crevices stopped with mortar similar in composition to the surface to be stopped. The mortar should be cured.

#### Application of white-wash:

On the surface so prepared, the white-wash shall be laid. Each coat shall be laid on with a brush. The first stroke of the brush shall be from the top downwards, another from bottom upwards over the first stroke, and similarly, one stroke from the right and another from the left over the first brush before it dries. This will form one coat. Each coat must be allowed to dry and shall be subject to inspection before the next coat is applied. When dry, the surface shall show no signs of cracking. It shall present a smooth and uniform finish free from brush marks and it should not come off easily when rubbed with a finger. No portion in the surface shall be left out initially, to be patched up later on. For new work, the white washed surface shall present a smooth and uniform finish. For old work, patches and repairs shall be white washed first. Thereafter, the whole surface shall be white washed with the required number of coats. Doors, windows, floors and other articles of furniture, etc., shall be protected from being splashed upon. Splashing and droppings, if any, shall be removed and the surfaces cleaned.

Preparing the surface for white wash including the scaffolding. Applying the white wash in required number of coats as specified above and prior white washing of repaired patched.

#### Mode of Measurement:

Length and breadth shall be measured correct to cm. And shall be calculated in sqm correct to two places of decimals.

#### Rate

The rate shall include all material and labour involved in all operations described above.

### 7.0 PLASTIC EMULSION PAINTING ON WALL & CEILING

#### 7.1 General

Plastic emulsion paints are not suitable for application on external wood and iron surfaces and surfaces which are liable to heavy condensation and are to be used generally on masonry or plastered surfaces. Suitable primer as per manufacturer shall be provided.

#### 7.2 Paint

Plastic emulsion paint of approved brand and manufacture and of the required shade shall be used.

#### 7.3 Preparation of Surface

The surface shall be thoroughly cleaned of dust, old white or colour wash by washing and scrubbing. The surface shall then be allowed to dry for atleast 48 hours. It shall then be sand papered to give a smooth and even surface. Any unevenness shall be made good by applying putty, made of plaster of paris mixed with water on the entire surface including filling up the undulation and then sand papering the same after it is dry.

#### 7.4 Application

The number of coats shall be as stipulated in the item. The paint will be applied in the usual manner with brush or roller. The paint dries by evaporation of the water content and as soon as the water has evaporated the film gets hard and the next coat can be applied. The time of drying varies from one hour on absorbent surfaces to 2 to 3 hours on non-absorbent surfaces. The thinning of emulsion is to be done with water and not with turpentine. Thinning with water will be particularly required for the undercoat which is applied on the absorbent surface. The quantity of thinner to be added shall be as per manufacturer's instructions. The surface on finishing shall present a flat velvety smooth finish. If necessary more coats will be applied till the surface presents a uniform appearance.

#### 7.5 Precautions

- (a) Old brushes if they are to be used with emulsion paints, should be completely dried of turpentine or oil paints by washing in warm soap water. Brushes should be quickly washed in water immediately after use and kept immersed in water during break periods to prevent the paint from hardening on the brush.
- (b) In the preparation of walls for plastic emulsion painting, no oil base putties shall be used in filling cracks, holes etc.
- (c) Splashes on floors etc. shall be cleaned out without delay as they will be difficult to remove after hardening.
- (d) Washing of surfaces treated with emulsion paints shall not be done within 3 to 4 weeks of application.

#### 7.6 Other Details :

These shall be as per specification for "Painting" as far as they are applicable.

#### 8.0 FLAT OIL PAINT

The work shall include a priming coat of 'Distemping Primer' or 'Cement Primer' as specified in the description of the item. The primer coat shall consist of cement primer or distemper primer as directed by the Engineer in charge.. The primer and the flat oil paint shall be of approved brand and manufacturer and of the required shade. The surface shall be thoroughly cleaned of dust, old white or colour wash by washing and scrubbing. The surface shall then be allowed to dry for atleast 48 hours. It shall then be sand papered to give a smooth and even surface. Any unevenness shall be made good by applying putty, made of plaster of Paris mixed with water on entire surface including filling up the undulations and then sand papering the same after it is dry.

#### Application:

Primer Coat: The specified primer shall be painted or sprayed over the surface in an even and uniform layer.

Painting Coats: When the surface is dry, it shall be painted or sprayed or as directed by as Engineer-in-Charge with the wall paint in uniform and even layers will be done to the required number of coats. Each coat shall be allowed to dry overnight and rightly rubbed with very fine grade of sand paper and loose articles brushed off before the next coats sprayed. Spraying should be done only when dry conditions prevail. During spraying the spray gun shall be held perpendicular to the surface to be coated and shall be passed over the surface in uniform sweeping motion. Different air pressures and fan adjustment shall be tried so as to obtain the best 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 tools and tackles 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 wall paints, the surface obtained is not upto the mark, further one or more coats as required shall be given after rubbing down the surface and dusting of all loose particles to obtain a smooth and even finish. If the primer or wall paint gets thicker during the application, it shall be thinned suitably with the thinner recommended by the manufacturer. Adequate ventilation shall be provided to avoid congestion and discomfort. Fitments and floor shall be suitably protected.

#### 9.0 SYNTHETIC TEXTURED PAINT IN PLAIN / STONE OR METALLIC FINISH.

##### 9.1 General

Synthetic Textured Paint, reinforced by using fibres and shall be based on chemicals having acid and alkally resistant properties. It can be applied to any hard, plain surface both internally and externally. It does not require

any further application or treatment once it is applied on the surface. Synthetic Textured Paint is available in ready-mixed form in any desired colour and can be applied by using a trowel. The synthetic Textured Paint avoids cracks formation as well as it provides a waterproofing coating on the surface treated.

#### 9.2 Base Coat

An average 20mm thick cement plaster shall be provided as rendering coat which shall be roughened lightly with wire brush so as to form very mild keys on the rendered

surface.

The surface shall be allowed for curing for a period of minimum 14 days before the application of synthetic Textured Paint.

#### 9.3 Applications

Synthetic Textured Paint is applied in three coats :

(a) one coat of plaster by trowel and ;

(b) subsequent two coats of chemical overcoat by brush in approved colour and finished as specified (plain/stone or metallic).

#### 9.4 Measurements

The item shall be measured in square metre areas. The rate shall include erecting and removal of scaffolding, all labour, materials, equipments, plants, tools and all incidental expenses to complete the treatment to the satisfaction of Engineer-in-charge.

#### 9.5 Guarantee

The synthetic Textured Paint treatment shall be executed through an approved agency and written performance guarantee shall be submitted by the Contractor for a minimum period of Ten years through the agency. The contractor and the agency shall be jointly responsible for the performance of the treated surface until the expiry of the guarantee period.

#### 10.0 ACRYLIC PAINTING TO EXTERNAL SURFACES

Acrylic weather shield paint of approved brand shall be applied over plastered surfaces as directed by the Engineer. Other specifications including preparation of surfaces, application of paint etc. Shall conform to section 4.3 above and as directed by Engineer-In-Charge. The priming coat, anti-fungal treatment, preparation of paint etc. shall be carried out as per manufacturer's specification / as directed by Engineer-In-Charge.

#### 11.0 MEASUREMENT

Painting on plastered or concrete surface shall be measured as for plastering. Painting on wooden or metal surfaces shall not be measured separately and is deemed to be included in the respective item.

# FLOORING, SKIRTING, DADO & CLADDING

## FLOORING, SKIRTING, DADO & CLADDING CONTENTS

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### 1.0 SCOPE

These Specifications covers flooring, skirting, dado or cladding works using different types of stone/ slabs/ tiles as detailed hereunder:

### 2.0 GENERAL

The provision of the latest revisions of the following IS Codes shall form a part of this specification to the extent they are relevant.

IS: 269 Specification for ordinary, rapid hardening and low heat Portland cement.

IS: 383 Specification for coarse and fine aggregate from natural sources for concrete

IS: 657 Specification for material for use in the manufacture of magnesium oxychloride flooring compositions.

IS: 1130 Specification for marble (Blocks, slabs & Tiles).

IS: 1200 Part XI Method of measurements for Building and Civil Engg. Works, paving, floor finishes, dado & skirting.

IS: 1237 Specification for cement concrete flooring tiles.

IS: 1443 Code of practice for laying and finishing of cement concrete flooring tiles.

IS: 2541 Code of practice for use of lime concrete' in buildings.

IS: 2571 Code of practice for laying in situ cement concrete flooring

IS: 4082 Recommendation on stacking and storage of construction materials at site.

IS: 4457 Specification for Ceramic unglazed vitreous acid resistant tile.

IS: 8042 Specification for white port land cement

IS 8112 Specification for high strength ordinary portland cement IS: 10067 Material Constants in Building Work

IS: 13711 Ceramic Tiles : Sampling & basis of acceptance

IS: 13712 Ceramic Tiles : Definitions, classifications, characteristics and making

IS: 13753 Dust Pressed ceramic tiles with water absorption of  $E > 10\%$  (Group -B III)

IS: 13754 Dust Pressed ceramic tiles with water absorption of  $6\% < E < 10\%$  (Group - B IIb)

IS: 13755 Dust Pressed ceramic tiles with water absorption of  $3\% < E < 10\%$  (Group - B IIa)

IS: 13756 Dust Pressed ceramic tiles with water absorption of  $E < 3\%$  (Group - BI)

Other I.S Codes not specifically mentioned here, but pertaining to Floor Finishes form part of these specifications.

### 3.0 MATERIAL

3.1 Cement, sand, aggregate, water shall conform to the relevant BIS standards as specified in clause 2.0 above. Stone shall be hard, sound, durable and free from defects like cavities, cracks, sandholes, flaws, injurious veins, patches of loose or soft materials and weathered portions etc.

#### 4.0 SUB-BASE

4.1 Sub-base for all flooring shall be prepared and kept ready for further applications. All items shall be defined and detailed on the drawing. Measurements shall be as per the BOQ of these items. Preparation of sub-base may be carried out by excavation or back filling in plinth. Back filling shall be with the selected earth in layer of 150mm to 200mm maximum and adequately watered and well-compacted to achieve at least 90% compaction at optimum moisture content. In case of excavation, the base shall be well-dressed to the desired level and inspected. All loose spots shall be excavated till the hard surface is reached and then filled as directed by the Engineer-in-Charge. Surface shall be watered with just sufficient water and rolled and compacted with vibratory compactor.

#### 4.2 Dry Brick Flooring

##### 4.2.1 Spreading Sand:-

After the plinth has been prepared as detailed above, 225mm of sand shall be spread, evenly over the surface and well watered and the wet sand brought to a true under surface formation.

##### 4.2.2 Laying bricks:-

Over the sand, thoroughly well burnt bricks of uniform shape shall be laid on edge breaking bonds in straight lines. After laying each two or three lines of bricks, they shall be cramped together as tightly as possible. When the last line of bricks has been cramped into position no movement of the bricks should be possible and if any such exists, the flooring must be removed and railed.

##### 4.2.3 Blinding the surface:-

After the bricks are satisfactory laid, sand will be spread over the surface so as to fill all joints. This sand will be well watered and more sand and water added as necessary and until all joints are filled flush and solid.

##### 4.2.4 Pointing:-

The joints shall there after be raked out to a depth of half an inch and level pointed with cement mortar.

##### 4.2.5 Curing:-

The complete work shall be kept covered with wet straw for ten days after pointing. 4.3 Rubble soling Good quality 150mm to 230mm thick rubble soling shall be carried out depending upon the grade of soil. Rubble used shall be at least 100mm for 150mm thick soling and 150mm for 230mm thick soling. Stone shall be hand packed as close as possible and bedded firmly with the broadest face downwards and the greatest length across, voids filled with chips and small stones. These shall be hammered down to achieve packing and the complete filling of interstices. To achieve the desired levels and slopes, pegs at suitable intervals (about 12m) shall be fixed. Soling shall be watered and again packed with sand or stone dust to fill interstices created by watering. Then it shall be rolled by power driven roller of 10MT capacity wherever possible or with vibratory compactor. Filling sand or stone dust, watering and compaction shall continue till full compactness is achieved to the satisfaction of the Engineer-in-Charge.

#### 4.4 Base floor

This shall be regular reinforced concrete floor or plain cement concrete floor as specified. All specifications of concreting shall be the same as per Plain & Reinforced Concrete section of this volume.

#### 5.0 CEMENT CONCRETE FLOORING

##### 5.1 Materials

Cement concrete: The cement concrete shall generally conform to specifications for ordinary concrete. The coarse aggregates shall be carefully selected, sufficiently tough and hard stone pieces broken in a manner that will provide particles of approximately cubical shape affording good interlocking. The maximum size of coarse aggregate shall be 12 mm. The fine aggregate shall consist of properly graded particles. The proportion of mix

shall be as specified in the item description. The least amount of mixing water that will produce a workable mix and will allow finishing without excessive tro-welling shall be used. Generally a water cement ratio of 0.5 should suffice.

### 5.2 Workmanship:

The sub-grade in all cases shall be formed to proper levels and slopes, well compacted and cured. The top surface shall be kept slightly rough. The surface of the sub-grade shall be cleaned off all loose materials and moistened immediately before laying the concrete floor. The concrete flooring shall be laid in alternate bays not exceeding 3.35 sq.m (about 36 sf.ft) each. The edge of each panel into which the floor is divided should be supported by aluminium dividing strips of adequate size to prevent sticking. Their depth shall be the same as that proposed for the finished floor as mentioned in the item.

At least 48 hours shall elapse before the concreting in the adjacent bays is commenced. The concrete shall be laid immediately after mixing. While being placed the concrete shall be vigorously sliced and spaded with suitable tools to prevent formation of voids or honey comb pockets. The concrete shall be brought to the specified levels by means of a heavy straight edge resting on the side forms and drawn ahead with a sawing motion in combination with a series of lifts and drops alternating with small lateral shifts. While concreting the adjacent bays care shall be taken to ensure that the edges of previously laid bays are not broken by careless or hard tamping. Immediately after laying the concrete, the surface shall be inspected for high or low spots and any needed correction made up by adding or removing the concrete. After striking off the surfaces to the required grade concrete shall be compacted with a wooden float.

The blows shall be fairly heavy in the beginning but as consolidation takes place, light rapid strokes shall be given to complete the ramming. The floating shall be followed by steel trowelling after the concrete has hardened sufficiently to prevent excess of fine material from working to the surface, The finish shall be brought to a smooth and even surface free from defects and blemishes and tested with straight edges. No dry cement or mixture of dry cement and sand shall be sprinkled directly on the surface of the concrete to absorb moisture or to stiffen the mix. After the concrete has been thoroughly rammed and has dried sufficiently to allow rendering to be worked up, surface shall be rendered with a thin coat of 1:1 cement mortar with fine sand and uniformly floated. If so directed by the Engineer-in-Charge, approved mineral colour pigment conforming to appendix-B of IS 657 shall be added to the cement mortar to give the required colour and shade to the flooring. When the cement mortar rendering is sufficiently stiff, lines shall be marked on it with strings or by any other device to give the appearance of tiles 30 x 30 cm or of any other size laid diagonally or square as directed by the Engineer-in-Charge. The junctions of floor and walls shall be rounded off if so directed, without any extra payment. After the concrete in the bays has set, the joints of the panels shall be filled with cement cream or with suitable bitumastic compound as shown on the drawings or directed by the Engineer-in-Charge. Vertical edge of the bays shall be neatly marked on the surface of the concrete with a pointed trowel after filling the joints.

Finishing: When the rendering is somewhat stiff, neat cement may be sprinkled on sparingly through a paper pot on the surface and rubbed lightly to give smooth polished ordinary cement coloured surface. If coloured flooring is required by the Engineer-in-Charge the approved coloured cement shall be used. Surface shall be protected from direct sun when it is green.

Curing: Curing shall start on the next day after finishing and shall be continued for 14days. Curing shall not be commenced until the top layer has hardened. Covering with empty gunnies shall be avoided as the colour of the flooring is likely to be bleached due to the remnants of cement dust from the bags.

### 5.3 Measurement -

Length and breadth shall be measured before laying skirting dado or wall plaster. No deduction shall be made nor extra paid for voids not exceeding 0.20 sqm. Deductions for ends of dissimilar materials or other articles embedded shall not be made for areas not exceeding 0.10 sqm. The flooring done either with strips (in one operation) or without strips (in alternate panels) shall be treated as same and measured together.

### 5.3.1 Rate

The rate shall include the cost of all materials and labour involved in all the operations described above including application of cement slurry on RCC slab or on base concrete including roughening and cleaning the surface and including the cost of strips. Nosing of steps where provided shall be paid for separately in running metre. Nothing extra shall be paid for laying the floor at different levels in the same room or courtyard and rounding off edges of sunken floors. In case the flooring is laid in alternate panels, nothing extra shall be paid towards the cost of shuttering used for this purpose.

## 6.0 GLAZED / CERAMIC TILES IN FLOORING

### 6.1 Material

The tiles including specials shall be of the approved make and quality and shall conform to BIS Specifications in all respects. Glazed tiles / Ceramic tiles shall conform to IS : 13711- 1993, IS : 13712-1993, IS : 13753-1993, IS : 13754-1993, IS : 13755-1993, and IS : 13756-1993. Samples of tiles shall be got approved by the Engineer-in-Charge, who will keep them in his office for verification as to whether the material brought for use conform to the approved samples.

The tiles shall be square or rectangular of size as specified in the item description or as directed by the Engineer-in-charge. The thickness of the tiles shall be as specified. The length of all four sides shall be measured correct to 0.1mm and average length breadth shall not vary more than  $\pm 0.8$ mm from specified dimension. The variation of individual dimension from average value of length / breadth shall not exceed  $\pm 0.5$ mm. Tolerance in thickness shall be  $\pm 0.4$ mm. Cement Mortar 1:4 to be used along with White Cement of approved quality and make.

### 6.2 Workmanship

#### 6.2.1 Mortar Bedding

The amount of water added while preparing mortar shall be the minimum necessary to give sufficient plasticity for laying. Care shall be taken in the preparation of mortar to ensure that there are no hard lumps that would interfere with even bedding of the tiles. Before spreading the mortar bed, the base shall be cleaned of all dirt, scum or laitance and loose materials and then well wetted without forming any pools of water on the surface. The mortar shall then be evenly and smoothly spread over the base by the use of screed battens to proper level or slope. The thickness of the bedding shall not be less than 12 mm (about 1/2") or more than 20 mm (about 3/4") in any one place. The tiles shall be laid on bedding mortar when it is still plastic but has become sufficiently stiff to offer a fairly firm cushion for the tiles.

#### 6.2.2 Fixing Tiles

The tiles before laying shall be soaked in water for at least 2 hours. Tiles, which are fixed in the floor adjoining the wall, shall be so arranged that the surface of the round edge tiles shall correspond to the skirting or dado. Neat cement grout of honey like consistency shall be spread over the bedding mortar just to cover so many areas as can be tiled within half an hour. The edges of the tiles shall be smeared with neat white cement slurry and fixed in this grout one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints shall be kept as close as possible and in straight lines. The joints between the tiles shall not exceed 1.5 mm (about 1/16") wide. The joints shall be grouted with a slurry of white cement. When hairline joints are specified the same shall be followed. After fixing the tiles finally in an even plane, the flooring laid shall be kept moist and allowed to mature undisturbed for 10 days to allow the bedding and flooring to set properly.

#### 6.2.3 Cleaning

After the tiles have been laid in a room or the day's fixing work is completed, the surplus cement grout that may have come out of the joints shall be cleaned off before it sets. Once the floor has set, the floor shall be carefully washed clean and dried. When dry, the floor shall be covered with oil free dry saw dust which shall be removed only after completion of the construction work and just before the floor is occupied.



### 6.3 Measurements

Length and breadth shall be measured correct to a cm before laying skirting, dado or wall plaster and the area calculated in square metre correct to two places of decimal. Where coves are used at the junctions, the length and breadth shall be measured between the lower edges of the coves. No deduction shall be made nor extra paid for voids not exceeding 0.20 square metre. Deductions for ends of dissimilar materials or other articles embedded shall not be made for areas not exceeding 0.10 square metre. Areas, where glazed tiles or different types of decorative tiles are used will be measured separately.

### 6.4 Rate

The rate for flooring shall include the cost of all materials and labour involved in all the operations described above. Nothing extra shall be paid for the use of cut (sawn) tiles in the work.

## 7.0 GLAZED/CERAMIC TILES IN DADO/ SKIRTING

### 7.1 Materials

The tiles including specials shall be of the approved make and quality and shall conform to BIS standards in all respects. Samples of tiles shall be got approved by the Engineer-in-Charge. Materials brought for use shall conform to the approved samples.

### 7.2 Workmanship

#### 7.2.1 Plastering

Cement plaster of about 15 mm thickness shall be applied to the part of the wall where dado or skirting is to be fixed. The proportion of mortar shall be as mentioned in the item.

#### 7.2.2 Fixing of Tiles

Dado or skirting work shall be done only after fixing tiles on the floor is completed. The tiles shall be soaked in water for at least 2 hours before being used for skirting or dado work. Tiles shall be fixed when the cushioning mortar is still plastic and before it gets very stiff. The back of tiles shall be covered with a thin layer of neat cement paste and the tile shall then be pressed in the mortar and gently tapped against the wall with a wooden mallet. The fixing shall be done from the bottom of wall upwards without any hollows in the bed or joints. Each tile shall be fixed as close as possible to the one adjoining. The tiles shall be joined with white cement and matching coloured pigment slurry. Any difference in the thickness of tiles shall be evened out in cushioning mortar so that all tile faces are in one vertical plane. The joints between the tiles shall not exceed 1.5 mm in width and they shall be uniform. After fixing the dado, they shall be kept continuously wet for 14 days.

#### 7.2.3 Cleaning

After the tiles have been fixed the surplus cement grout that may have come out of the joints shall be cleaned off before it sets. After the complete curing, the dado or skirting work shall be washed thoroughly clean.

### 7.3 Measurement

Flooring shall be measured in Square Metres correct to two places of decimal while the individual dimensions shall be measured correct to one centimetre before laying skirting, dado or wall plaster. No deduction shall be made nor extra paid for any opening of area up to 0.1 sqm. Nothing extra shall be paid for use of outlines nor for fixing at different levels. Risers of steps, skirting, cladding and dado shall be measured in square metres correct to two places of decimal. Length shall be measured in centimetre along finished face of the riser, skirting, cladding or dado correct to a centimetre. Height shall be measured from the finished level of tread or floor to the top.

### 7.4 Rates

The rate shall include the cost of all material and labour involved in all the operations described above.

## 8.0 MARBLE / GRANITE STONE/KOTA STONE SLAB FLOORING

### 8.1 General

The item refers to provision of flooring of Indian Marble / Granite stone/Kota Stone slabs of approved colour / pattern and shall conform to the specification as given below :-

## 8.2 Materials

### 8.2.1 Stone Slabs

The stone slab specified in the item shall be got approved by the Engineer. At its thinnest part, no stone shall be thinner than the specified thickness. The stone slab shall be hard, sound, durable, resistant to wear, rectangular in shape or square if directed by the Engineer and of the specified width. The stone slab shall be of the type mentioned in the item and of the colour and quality approved by the Engineer. Slabs shall be hard, dense, uniform and homogenous in texture. They shall have even crystalline grain, and free from defects and cracks. The surface shall be machine polished to an even and perfectly plane surface and edges machine cut true and square. The rear face shall be rough enough to provide a key for the mortar. Uniformity of size shall generally be maintained for the stone slab used in any room. The stone shall be without any soft veins; cracks of floors and shall have a uniform colour. The edges shall be quite straight. The stone in slabs in external and internal wall veneer work shall be mirror polished where required, in the factory with silicon carbide abrasive starting from no. "00" up to no. 5 and then using buff/lead strip rolls with tin oxide for final mirror polish. For flooring and counter top the final tin oxide polish shall not be used. Samples of stone slabs to be used shall be got approved by the Engineer and the slabs to be used shall conform to the approved sample. The dimensions of the slab shall be as specified in the item.

### 8.2.2 Approval of Sample

Before starting the work, the contractor shall get samples of marble / granite slab approved by the Engineer-in-Charge. Approved samples shall be kept in the custody of the Engineer-in-Charge and the marble / granite/Kota slab supplied and used on the work shall conform to samples with regard to soundness, colour, veining and general texture.

### 8.2.3 Sampling

In any consignment of marble / granite/Kota, all the blocks / slabs / tiles of the same group, size and finish shall be grouped together to constitute a lot. Sample shall be selected and tested separately for each lot for determining its conformity or otherwise to the requirements of the specification. The number of marble / granite blocks / slabs / tiles to be selected for the samples shall depend upon the size of the lot and shall be in accordance with the Table (Sample size & Criteria for conformity) given below:

### 8.2.4 Sample size and Criteria for Conformity.

*Note: The marble / granite blocks/ slabs/ tiles/Kota stone in the sample shall be taken at random and in order to ensure to randomness of selection, random tables may be used.*

*Explanation 1:* All the marble / granite blocks / slabs / tiles/Kota Stone tiles, selected in the sample, shall be examined for dimensions workmanship and general requirements. Any block / slab / tile failing in any one or more of the above requirements shall be considered as defective. All lot shall be considered as conforming to these requirements if the number of Number of Blocks /slabs /tiles in the lot Number of blocks slabs / Tiles to be selected in sample Permissible number of defectives Sub sample size in Nos. Upto 25 3 0 2

26 to 100	5	0	2
101 to 200	8	0	3
201 to 500	13	0	4
501 to 1000	20	1	5

defectives obtained is not more than permissible no. of defectives given in Col. 3 of the Table.

*Explanation 2:* The lot of marble / granite/Kota having been found satisfactory with respect to dimensions, workmanship and general requirements shall be tested for physical properties as given below. For this purpose a sub sample of the size given in Col. 4 of table shall be selected at random. These marble / granite blocks/ slabs /

tiles in the sub sample shall be tested for moisture absorption, hardness and specified gravity. The lot shall be considered having satisfied the requirements of the physical properties if none of the marble / granite blocks / slabs / tiles tested for the requirements fails in any of these tests.

## Physical Properties

### 8.2.5 Bedding

Cement mortar for the bedding shall be of the proportions as specified in the item. The proportions will be by volume on the basis of 50 Kg. bag of cement. The mortar may be hand mixed or machine mixed. In hand mixed mortar, cement and sand in the specified proportions shall be thoroughly mixed dry on a clean impervious platform by turning over at least 3 times or more till a homogeneous mixture of uniform colour is obtained. Fresh

& clean water shall be added gradually and thoroughly mixed to form a stiff plastic mass of uniform colour so that each particle of sand shall be completely covered with a film of wet cement. The mortar so prepared shall be used within 30 minutes of adding water. Only such quantity of mortar shall be prepared as can be used within 30 minutes. The mortar remaining unused after that period or mortar which has partially hardened or is otherwise damaged shall not be re-tempered or remixed. It shall be destroyed or thrown away.

### 8.3 Construction

#### 8.3.1 Bedding

The base of cement concrete shall be laid and compacted to a reasonably true plain surface and to the required slopes and below the level of the finished floor to the extent of the thickness of the slabs and mortar bedding. Cement concrete bedding if provided shall be paid under a separate item. Cement mortar for bedding may be mixed manually or by a mechanical mixer. The amount of water added shall be the minimum necessary to give just sufficient plasticity for laying and satisfactory bedding. Care shall be taken in preparing the mortar to ensure that there are no hard lumps that would interfere with the even bedding of the stones. Before spreading the mortar, the sub-floor or base shall be cleaned of all dirt, scum or laitance and of loose material and then well wetted without forming any pools of water on the surface. In case of R.C.C. floors, the top shall be left a little rough. All points of level for the finished paving surface shall be marked out. The mortar shall then be evenly and smoothly spread over the base by the use of screed battens only over so much area as will be covered with slabs within half an hour. The

SL

NO

CHARACTERISTIC STANDARDS METHOD

OF TEST

01 02 03 04

01 Moisture absorption after 24 hrs immersion in cold water Max. 0.4% by weight IS : 1124

02 Hardness Min 3 Mohs Mohs Scale

03 Specific Gravity Min 2.5 g/cc IS : 1122

thickness of the mortar bedding shall not be less than 12mm, not more than 25mm. The required slope shall be given to the bed.

#### 8.3.2 Fixing stone slab

Before laying, the stone flags shall be thoroughly wetted with clean water. Neat cement grout of honey like consistency (white cement shall be used in the case of marble slabs) shall be spread on the mortar bed over as much area as could be covered with the slabs within half an hour. The specified type of stone slabs shall be laid on the neat cement float and shall be evenly and firmly bedded to the required level and slope in the mortar bed. Each stone slab shall be gently tapped with a wooden mallet till it is firmly and properly bedded. There shall be no hollows left. If there is a hollow sound on gentle tapping of the slabs, such slabs shall be removed and reset properly. The Mason shall make the joints of uniform thickness and in straight lines. The joints shall be filled solidly with pigmented grout for their full depth. The stone slabs shall be laid so as to give continuous parallel long joints with cross joints at right angles to them. The edges of the adjoining slabs shall be in one plane. Where

the slabs cover open edges, of floor or window sills the edges shall be neatly rounded off. This shall be included in the rate. When diamond pattern paving is provided in the item, the slabs shall be square and laid to the diamond pattern with triangular shaped slabs to make up the edges. In plain pattern stones on each course shall break joints with those in the next. The pattern joints etc. shall be as per drawings or as directed by Engineer-In-Charge, to the entire satisfaction of Engineer –In- Charge

#### 8.3.4 Curing

The flooring shall be kept well wetted with damp sand or water for fourteen days. It shall be kept undisturbed for at least seven days.

#### 8.3.5 Cleaning

All flooring shall be thoroughly cleaned and handed over clean and free from any mortar stains etc.

#### 8.4 Measurement:

The contract rate shall be per square metre of the floor area covered by the flooring of the specified type. All work shall be measured net. The length and width of the flooring shall be measured net between the faces of skirtings or dados or plastered faces of walls. Paving under the dado, skirting or plaster shall not be measured.

#### 8.5 Rate :

The rate for the item shall include the following.

- (a) All labour, materials and equipment, cleaning the sub-base, laying mortar bed and cement grout, fixing stone slabs specified above and making up the joints.
- (b) Any cutting and waste if required.
- (c) Pointing when included in the item.
- (d) Cleaning the floor from all stains, etc.
- (e) Polishing wherever required.

### 9.0 MARBLE / GRANITE STONE/KOTA TILEs IN RISERS OF STEPS AND SKIRTING

9.1 Marble Stone Slabs and Dressing of Slabs shall be as specified above in clause 10.0 of Marble / Granite Stone Slab/Kota tiles Flooring except that the thickness of slabs shall be as specified in the item description. A tolerance of + 3mm shall be allowed, unless otherwise specified in the description of the item.

#### 9.2 Preparation of Surface

It shall be as specified above in clause 10.0 of Marble / Granite Stone Slab/Kota tiles Flooring except where necessary the wall surface shall be cut uniformly to the requisite depth so that the skirting face shall have the projection from the finished face of wall as shown in drawings or as required by the Engineer-in-Charge.

9.3 The risers of steps and skirting shall be in grey or white cement admixed with or without pigment to match the shade of the stone, as specified in the description of the item, with the line of the slab at such a distance from the wall that the average width of the gap shall be 12mm and at no place the width shall be less than 10mm. The skirting or riser face shall be checked for plane and plumb and corrected. The joints shall thus be left to harden then the rear of the skirting or riser slab shall be packed with cement mortar 1:3 (1 cement: 3 coarse sand) or other mix as specified in the description of the item. The fixing hooks shall be removed after the mortar filling the gap has acquired sufficient strength. The joints shall be as fine as possible. The top line of skirting and risers shall be truly horizontal and joints truly vertical, except where otherwise indicated. The risers and skirting slab shall be matched as shown in drawings or as instructed by the Engineer-in-Charge.

#### 9.4 Curing, Polishing and Finishing

The face and top of skirting shall be polished. The stone in slabs in external and internal wall veneer work shall be mirror polished where required, in the factory with silicon carbide abrasive starting from no. "00" up to no. 5 and then using buff/lead strip rolls with tin oxide for final mirror polish. For flooring and counter top the final tin oxide polish shall not be used

#### 9.5 Measurements

Length shall be measured along the finished face of riser or skirting, correct to a cm. Height shall be measured from the finished level of tread or floor, to the top (the underside of tread, in the case of steps) correct to 1mm. The areas shall be calculated in square metre correct to two places of decimal.

#### 9.6 Rate

The rate shall include the cost of all materials and labour involved in all the operations described above.

#### 10.0 MARBLE / GRANITE STONE SLAB CLADDING

Marble / Granite tiles and slabs shall be mirror polished, flame finished or as given any other surface treatment as specified. All exposed edges shall be similarly treated. The Marble / Granite stone in slabs in external and internal wall veneer work shall be mirror polished where required, in the factory with silicon carbide abrasive starting from no. "00" up to no. 5 and then using buff/lead strip rolls with tin oxide for final mirror polish. For flooring and counter top the final tin oxide polish shall not be used Machine polishing and sizing shall be done with only water as lubricant. Sawing also shall be preferably done with water as lubricant but as a special case, oil or kerosene may be permitted subject to the oil or kerosene being thoroughly dried in ovens. Tiles / slabs with stains or patches due to the use of oil or otherwise shall be rejected. Any tiles / slabs showing patches or stains after installation shall also be rejected and replaced.

Tiles shall be transported to site well-packed in boxes. Slabs will be individually packed in cardboard paper. Tiles / slabs shall not be waxed or touched up with dyes / colours. The entire supply for each type of marble / granite, unless specifically permitted by the Consultant, shall be procured from one location in one quarry to keep variations to the minimum. The Contractor shall segregate and sort the tiles / slabs according to colour, texture and size to keep variations in the same in any one floor, wall or isolated area to the minimum. The Contractor shall, before fixing the marble / granite on floors or walls, lay whole areas of marble / granite loose on ground to select and match the marble / granite. Any tiles / slabs with a variation not acceptable to Consultant / ENGINEER shall not be used, and if used shall be removed and replaced. The Consultant's decision in this respect shall be final and binding. Tight tolerances shall be checked and maintained throughout. Maximum variations shall be as follows:-

Sides  $\pm 0.5$  mm Thickness  $\pm 0.5$  mm slabs

$\pm 0.3$  mm tiles Angularity  $\pm 0.2$  % Flatness  $\pm 2$  mm

Linear items such as treads, skirting, sills etc. shall be of uniform thickness throughout. All visible edges shall be machine polished unless otherwise specified. Marble / granite shall be laid or fixed to the highest standard by highly trained masons to the entire approval of Consultant / Engineer. Any tiles / slabs broken, stained or damaged shall be removed / replaced. External wall cladding shall be fixed with approved stainless steel 316 grade serrated cramps and dowels. Marble / granite slabs for external cladding shall be minimum 30mm thick. The Contractor shall prepare shop drawings and get them approved by the Consultant before proceeding with any work. The Contractor shall put a mock-up of typical and non-typical panels and get it approved well before he commences fixing on site. The Contractor shall coordinate his site activities with other contractors working on site through Engineer and shall take particular care, in coordination with the Engineer, in ensuring that his methods of fixing do not damage or endanger the building structure, finishes and services in any way.

The Contractor shall get his system of anchorage approved by the Consultant. No reinforcement bar in concrete shall be cut through during drilling or anchorage. The anchorage in solid concrete block work shall be specially designed taking into consideration the actual compactness and crushing strength of the blocks. 2 nos. Pullout tests in block work shall be carried out prior to commencing work to prove the strength of anchorage with ample margin of safety.

Prior to commencing work, the Contractor shall obtain approval of the Consultant for material and workmanship after submitting the following details:-

- (a) 3 representative samples for each type of marble / granite specified.
- (b) Physical characteristics:-  
Dimensional tolerances, water absorption (polished or unpolished as applicable) by weight, compression strength, Mohs hardness, unit weight.
- (c) Source of supply and availability in full quantity and uniformity of colour, tone and texture.
- (d) Company profiles of suppliers and labour sub contractor if any.
- (e) Procedure for fixing and samples of fixtures such as cramps, pins, dowels etc.

If required the Contractor shall arrange visits to the quarries and to the works carried out by the proposed Sub Contractor.

#### 10.1 Measurements:

The length and breadth shall be measured correct to a cm. In case of radially dressed or circular slabs used in the work, the dimensions of the circumscribing rectangles of the dressed stone used in the work, shall be measured & paid for. The area shall be calculated in Sqm. nearest to two places of decimal

#### 10.2 Rate:

The rate includes the cost of materials and labour required for all operations described above. The rate shall also include:

- a) Marble / Granite stone slab / tiles procured & delivered at Site, including wastage and breakage, polishing, chamfering, rounding, grooves, drip moulds and other linear works as per drawings and specifications.
- b) Stainless steel cramps, pins, dowels and other anchoring systems as per approved shop drawings and as specified.
- c) Backing mortar and pigmented cement grout where specified.
- d) Labour in transporting materials on site, fixing, carefully cutting, hand polishing, and touching up where required etc.
- e) Protecting Marble / Granite stone slab / tiles during construction until virtual completion of works.
- f) Temporary supports, templates, straight edges etc.
- g) Alignment and leveling in coordination with Engineer and Main Contractor.
- h) Joints with plastered and other surfaces.
- i) Cleaning on completion.
- j) Scaffolding / staging and safety precautions.
- k) Submissions of Samples.
- l) Mock-up (total area approx. 15 sqm.)
- m) Working to specified tolerances
- n) Shop drawings
- o) Pull out tests – 2 nos. – on anchors in blockwork.
- p) Provisions for adequate anchorage.
- q) Providing and applying protective water / stain resistant chemical coating / impregnation treatment.

### 11.0 VITRIFIED TILES FOR FLOORING

#### 11.1 Standards

##### DESCRIPTION MINIMUM REQUIREMENT

Specification for coarse and fine aggregates I.S. 383 - 1970 Tests for mortar I.S. 2250 : 1981

Method of test of aggregates in concrete I.S. 2386 - 1963

Recommendation on stacking and storage of construction materials at site. I.S. 4082 : 1996 Specification for white port land cement I.S. 8042 - 1989

#### 11.2 Materials

##### Tiles

The tiles shall be unchamfered, fully vitrified, homogeneous, unglazed, ceramic satin matt finished tiles of nominal size of premium quality. The size and thickness of tiles shall be as per the architectural requirements.

### 11.3 Workmanship

The floor tiles shall be laid to the correct slope and levels. The mix of the mortar shall be to a minimum of 1:4 consistency. Bedding for tiles in flooring Ordinary portland cement 43 grade I.S. 8112 - 1989 Water I.S. 456 : 2000 & I.S. 3025

Vitrified Tiles Shall conform to EN - 176 Group B1a and ISO 13006 stds.

Deviation in length Method of testing shall be as per EN 98

Deviation in thickness Method of testing shall be as per EN 98

Straightness of sides Method of testing shall be as per EN 98

Rectangularity Method of testing shall be as per EN 98

Surface flatness Method of testing shall be as per EN 98

Water absorption Shall not be greater than 0.05 % (Method of testing shall be as per EN 99)

Moh's hardness Shall not be less than 6 (Method of testing shall be as per EN 101)

Flexural strength Shall not be less than 27 N / sqmm. (Method of testing shall be as per EN 100)

Abrasion resistance (Method of testing shall be as per EN 102)

Skid resistance (coefficient of friction) 0.6 (Method of testing shall be as per ASTM C-1028)

Breaking strength Shall not be less than 2500 N (Method of testing shall be as per ASTM C-678)

Density Shall not be less than 2 gm / cm<sup>3</sup> (Method of testing shall be as per DIN - 51082)

Frost resistance Shall be frost proof (Method of testing shall be as per EN - 202)

Chemical resistance Shall be resistant to chemicals (Method of testing shall be as per EN - 106)

Thermal shock resistance Shall be resistant to thermal shocks (Method of testing shall be as per EN - 104)

Colour resistance No damage (Method of testing shall be as per DIN - 51094)

Thermal expansion Shall not be more than  $9 \times 10^{-6}$  (Method of testing shall be as per EN - 103)

Stain resistance Shall be stain resistant (Method of testing shall be as per ISO 10545 -14)

Glossiness Desired reflection effect as required by architect (Method of testing shall be with the use of glossometer)

The amount of water added while preparing mortar shall be the minimum necessary to give sufficient plasticity for laying. Before spreading the mortar bed, the base shall be cleaned of all dirt, scum or laitance and loose materials and then well wetted without forming any pools of water on the surface. The mortar shall then be evenly and smoothly spread over the base by the use of screed battens to proper level or slope. The thickness of the bedding shall not be less than 12 mm (about 1/2") or more than 20 mm (about 3/4") in any one place. The tiles shall be laid on bedding mortar when it is still plastic but has become sufficiently stiff to offer a fairly firm cushion for the tiles.

#### Laying of tiles

The tiles before laying shall be soaked in water for at least 2 hours. Tiles, which are fixed in the floor adjoining the wall, shall be so arranged that the surface of the round edge tiles shall correspond to the skirting or dado. Neat cement grout of honey like consistency shall be spread over the bedding mortar just to cover so many areas as can be tiled within half an hour.

The edges of the tiles shall be smeared with neat white cement slurry and fixed in this grout one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints shall be kept as close as possible and in straight lines. The joints between the tiles shall not exceed 1.5 mm wide. The joints shall be grouted with a slurry of white cement. After fixing the tiles finally in an even plane, the flooring shall be covered with wet saw dust and allowed to mature undisturbed for 14 days.

#### Cleaning

After the tiles have been laid in a room or the day's fixing work is completed, the surplus cement grout that may have come out of the joints shall be cleaned off before it sets. Once the floor has set, the floor shall be carefully washed clean and dried.

### 11.4 Testing

If any tile is found to be warped, damaged or irregular in shape and size, it shall be refitted or replaced, properly jointed. The tiling work shall be tested for plumb, line and level. The surface of the floor and wall surfaces shall be frequently checked with a straight edge. Corners of walls shall be truly at right angles. The finished work shall not sound hollow when tapped with a wooden mallet.

#### 11.5 Measurement:

The contract rate shall be per square metre of the floor area covered by the flooring of the specified type. All work shall be measured net. The length and width of the flooring shall be measured net between the faces of skirting or dados or plastered faces of walls. Paving under the dado, skirting or plaster shall not be measured.

#### 11.6 Rate :

The rate for the item shall include the following.

- (a) All labour, materials and equipment, cleaning the sub-base, laying mortar bed and cement grout, fixing tiles as specified above and making up the joints.
- (b) Any cutting and waste if required.
- (h) Pointing when included in the item.
- (c) Cleaning & protecting the floor from all stains, etc.

### 12.0 WOODEN LAMINATED FLOORING

#### 12.1 Standards

#### 12.2 Materials

##### Laminate flooring

The laminate flooring shall be of first quality and shall adhere to all the relevant international or equivalent Indian standards. It shall be of approved shade, make, design and quality and shall be laid in a pattern / layout as per the specific requirements of the architect. The flooring planks shall be hard, durable and shall require minimal maintenance.

#### 12.3 Workmanship

##### Laying of floor

The floor shall be installed at room temperature strictly as the guidelines prescribed by the manufacturer. The floor may be installed as a floating floor at the discretion of the Engineer. The sub floor shall be dry, rigid, even and clean. Care shall be taken to ensure that the floor is not laid in wet rooms or in rooms provided with floor drains. A polyethylene film of minimum 0.2 mm thickness shall be provided as a moisture barrier over the sub floor prior to laying the laminate flooring. The contractor shall ensure to provide a gap of about 12 to 15mm from all the walls and fixed objects to allow for the flooring to settle in the environment. The plank profiles shall be fixed securely into the sub floor.

An approved flexible sealant made out of acrylic or polyurethane shall be used for fixing the flooring. The entire expansion space shall not be filled. The planks shall be installed lengthwise, parallel to the side walls in small corridors and passages. The planks shall be fixed preferably in a direction towards incoming light. The top layer shall be of polyurethane type finish in order to maintain the aesthetics of the flooring.

#### 12.4 Protection & Maintenance

Whenever glue is used for fixing, the excess glue during fixing shall be removed immediately with a scraper and damp cloth. A constant indoor room climate of 40 to 60% RH, shall be ensured at the time of installation. No furniture or any other heavy object should be dragged on the floor after installation. The flooring shall be cleaned with an upright vacuum cleaner or a damp cloth and a dry broom. Steam cleaners shall not be used. The floor shall not be sanded, waxed, lacquered or treated with film forming agents or abrasive materials.

#### DESCRIPTION MINIMUM REQUIREMENT

Usage Method of test shall be as per EN 13329

Wear resistance As per EN 13329

Impact Resistance As per EN 13329



Stain resistance As per EN 13329

Cigarette burns As per EN 13329

Colour fastness As per EN 13329

Slip resistance Shall not be less than 0.60 (As per ASTM C 1028)

End joint displacement A minimum of 200mm between joints shall be maintained Indentation resistance Shall not be less than 600 kg / sqcm. (As per DIN 52185)

Electrostatic charge 0.9 kV (As per DIN 54345)

Formaldehyde emission As per EN 717 - 2

Fire resistance B1 (As per DIN 4102)

### 12.5 Testing

The testing for various properties shall conform to the various international standards as listed in standards above. The flooring after installation may be tested for straightness and evenness using a straight edge. If any undulations are noticed, the same may be rectified complete to satisfaction of the Engineer

### 12.6 Measurement:

The contract rate shall be per square metre of the floor area covered by the flooring of the specified type. All work shall be measured net. The length and width of the flooring shall be measured net between the faces of skirting or dados or plastered faces of walls. Paving under the dado, skirting or plaster shall not be measured.

### 12.7 Rate :

The rate for the item shall include the following.

- (a) All labour, materials and equipment, cleaning the sub-base, installation of the flooring including all operations as mentioned above.
- (b) Any cutting and waste if required.
- (c) Cleaning & protecting the floor from all stains, etc.

### 13.0 PAVER BLOCK FLOORING (WITH SAND BEDDING)

#### 13.1 Scope

Scope of work consisting of providing and laying of Paver block of required size, shape and colour as per the specification given below.

#### 13.2 Dimension And Tolerances:

Paver blocks shall be as per specified size, thickness, colour and quality as approved by the Architect. Maximum variation in dimension of paver block shall not be more than +2 mm.

#### 13.3 Testing & Sampling

The testing and sampling shall be carried out as directed by the Engineer-in-charge / PMC.

#### 13.4 Manufacturer's Certificate

The manufacturer shall satisfy that the paver block conform to the requirement of this specification and shall produce certificate to this effect along with each consignment.

#### 13.5 Independent Testing

If the Engineer-In-Charge / PMC desires to carry out tests pertaining to quality, size, strength etc. the same shall be carried out by selecting random sample from any batch. The manufacturer shall supply free of charge required number of paver block for testing. Cost of testing shall be borne by the manufacturer.

#### 13.6 Laying & Fixing Paver block

The base on which the blocks are to be laid shall be cleaned, wetted and mopped. The bedding for the paver block shall be with 50mm sand bed. The average thickness of the bedding mortar under the paver block shall be 50 mm and the thickness at any place under the paver block shall be not less than 50mm. The paver block shall be laid in the following manner:-

Sand of the specified thickness shall be spread under the area of each paver block roughly to the average thickness specified above. The paver block shall be washed clean before laying. They shall be laid on top, pressed, vibrated with plate vibrator and brought to level with the adjoining block. The paver block shall be lifted and laid aside. The top surface of the sand shall then be corrected by adding fresh sand at hollows. The paver block shall then be lowered gently back in position and vibrated with plate vibrator till they are properly bedded in level with and close to the adjoining blocks with as fine a joint as possible. Subsequent block shall be laid in the same manner. After each block has been laid, surplus sand on the surface of the block shall be cleaned off. The surface of the flooring as laid shall be true to levels, and, slopes as instructed by the Engineer-in-Charge / PMC.

#### 13.7 Rate

The rate shall include all labour, materials, tools and tackles required for the following tasks to carry out the item as specified above.

- i) Providing and fixing the paver block in the required pattern
- ii) Cleaning the floor before and after the paver block has been laid.

#### 13.8 Mode of Measurement

Laying of paver block shall be measured in square metres correct to two places of decimal while the individual dimensions shall be measured correct to one centimetre. No deduction shall be made nor extra paid for any opening in the floor area upto 0. 1 sq.m. Nothing extra shall be paid for use of outlines / pattern nor for laying the floor at different levels in the same area.

# FALSE CEILING

## FALSE CEILING

### CONTENTS

#### SL NO DESCRIPTION

- 1.0 Plaster of Paris False Ceiling
- 2.0 Mineral Fibre Board False Ceiling
- 3.0 Water Resistant Fibre Tile False Ceiling
- 4.0 Measurements

#### 1.0 PLASTER OF PARIS (GYPSUM ANHYDROUS) TILES CEILING

##### 1.1 INDIAN STANDARDS

(1) IS : 2095 – 1982 : Gypsum Plaster boards.

The above mentioned IS Specification and Code of Practice has been indicated for general guidance. However, this IS Specification and Code will be adopted only for those particular items in the contract where the mode of measurement or detailed technical specifications are not laid down in the Tender.

##### 1.2 PLASTER OF PARIS

Plaster of Paris shall be of the calcium sulphate. Its fineness shall be such that when sieved through a sieve of I.S. Sieve designation 3.35 mm for 5 minutes after drying the residue left on it, shall not be more than 1% by weight. Initial setting time shall not be less than 13 minutes.

##### 1.3 Preparation of Tiles.

The tiles of plaster of Paris reinforced with hessian cloth shall be prepared in suitable sizes as per drawing or as ordered by the Engineer in charge. The maximum size of tiles shall be limited to 75 cms. in each direction. Wooden forms of height equal to the thickness of the tiles shall be placed on a truly level and smooth surface such as glass sheet. The section of form sides shall be such that the edges of the tiles shall be provided with a neatly formed chamfer around of 5mm width and 8mm depth, unless the tiles are to be provided with cover fillets over joints, in which case the edges of the tiles shall be truly square. The glass sheet or the surface on which the form is kept and the form sides, shall be given a thin coat of non-staining oil to facilitate the easy removal of the tile. Plaster of Paris shall be evenly spread into the form upto about half the depth and hessian cloth weighing not less than 230 gms per square metre, shall be pressed over the Plaster of Paris layer. The ends of the hessian cloth shall be turned over at all edges to form a double layer to a width of 5 cms. The hessian cloth shall be of an open webbed texture so as to allow the plaster below and above to intermix with each other and form an integral whole. The form shall then be filled with Plaster of Paris, which shall be uniformly pressed and then wire cut to an even and smooth surface. The tile so moulded shall be allowed to set initially for an hour or so and then removed from the form and allowed to dry and harden for about a week. A good tile, after drying and hardening, shall give a ringing sound when struck. The tiles shall be true and exact to shape and size and with clean and regular chamfers. The exposed faces shall be truly plane and smooth.

##### 1.4 Frame

G.I. frame of class and section as specified in the description of relevant item for the frame or as ordered by the Engineer in charge shall be provided. The width of the scantling provided shall be sufficient to provide a proper screwing surface. The longitudinal and header scantling shall be so arranged that the tiles can be fixed to form the panel arrangement required as per drawings, or as ordered by the Engineer in charge and there is supporting scantling under each and every edge of the tiles. The framing shall be paid for separately unless specifically included in the description of the item.

##### 1.5 Plaster of Paris

Shall be as specified in item 1.2 above.

##### 1.6 Preparation of tiles

Shall be as specified in item 1.3 above.

### 1.7 Fixing

The tiles so prepared shall be fixed to the cross battens of the ceiling frame with 40 mm brass screws at spacing not exceeding 20cm centre to centre on all edges. The tiles shall be laid with their edges in just close position to the adjoining tiles without any gap in between. The line of screws shall be not less than 15mm away from the edge of the tiles. The screws shall be slightly counter sunk into the tiles. Holes for screws shall be drilled. The counter sunk heads of screws shall be covered up with plaster of paris and smooth finished. Where a surface unbroken by visible joints is required, then the joints shall be filled with plaster of paris and trowelled smooth so that the whole surface appears as one without any joints. Nothing extra shall be paid for this closing of joints.

### 1.8 G. I. PRESSED METAL SECTION FRAMEWORK FOR SUSPENDED CEILING.

The main load bearing member shall be C shape rectangular tube/ channel with two horizontal 28mm and one vertical 50mm sided and each ends of the C turned down 9mm, fabricated of 22 gauge (0.80mm) G.I. Sheet. The cross runner shall be furring channel with 50mm horizontal side, two vertical 10mm and two ends turned flat 15mm onwards, fabricated out of 24 gauge (0.63mm) G.I. sheet. Wall angle shall be 25mm x 25mm, 24 gauge (0.63mm).

The hangers or suspenders shall comprise 6mm dia. M.S bars, painted with a coat of steel primer of approved make. These will be fixed to 'L' cleats of M.S 25 mm x 25mm x 5mm and 75mm long fixed to the soffit of the of the roof slab with metallic expansion fasteners. The hanger rods of required length shall have threaded end with 2 M.S check nuts at the lower end fixed into holding clamp of size 75mm x 28mm and allowing level adjustment. The clamp will hold main runners which shall be running at not more than 1 metre centres in one direction. The cross runner with open side of the channel at top shall be placed below the main runner at right angles at distance as directed by the Engineer in charge but not exceeding 450mm centres in one direction. These will be anchored and screwed properly with main runners at every crossing with a 12 SWG, G.I. wire clip fixed diagonally around the main runner. The cross runners shall be fixed at centres not exceeding 300mm. The wall angles shall be properly secured to walls with rawl plugs and screws and the ends of main and cross runners shall be supported on wall angle.

## 2.0 MINERAL FIBRE BOARD FALSE CEILING

### 2.1 Standards

#### DESCRIPTION REFERENCE FOR CODES

In general Shall be as per B.S. or equivalent Indian standards Suspension system Exposed semi recessed suspension system

Weight Approximately 3.5 kg / sqm.

Light reflectance Shall be greater than 83%

Humidity resistance Shall be about 95% RH

Fire performance

Reaction Class 0 / Class 1 (BS 476)

Resistance One hour fire rating

Acoustical criteria

NRC (Noise reduction coefficient) 0.55

Sound Absorption 0.5

Sound Attenuation 0.32 decibels

Thermal conductivity 0.052 to 0.057 W/moK

### 2.2 Materials

#### 2.2.1 Mineral Fibre boards

The mineral fibre boards shall be of shall be of approved make, design, shade and quality. The tiles shall be of specified size and thickness. The tiles have straight and square edges and shall be free from any breakages, marks, stains or bends.

### 2.2.2 Framework

The supporting framework shall comprise of sections of specified size and weight as per the requirements of the architect. The main runner shall be appropriately spaced and fixed to soffit by approved hangers. End hangers shall be at a suitable distance from the adjacent wall. The cross tees shall be appropriately interlocked (both ways) between main runner to form a required module or grid. The wall angle shall be fixed to the wall at specified space intervals.

### 2.2.3 Workmanship

The ceiling shall be erected in a continuous sequence. All work in this section shall be performed in an efficient manner as per the instructions of the architect and as per manufacturer's recommended procedures. The assembly shall be of the semi-recessed type and shall be designed to meet the needs of performance, durability and aesthetics. The contractor shall make adequate provisions for adequate supports for lighting fittings, making cut-outs and extra framework for light fixtures, A.C. grills, speakers, trap doors, sprinklers, sensors, all detectors, etc., complete all as per lay-out / pattern as shown in drawing, as per manufacture's recommendations, as per approved shop drawings.

### 2.2.4 Protection

Prior to installation, the material shall be stored in a dry and clean area which is enclosed and protected from rain or other causes of excessive moisture and stabilised in the area for not less than 24 hours prior to installation.

### 2.3 Testing

The false ceiling system installed shall be tested for straightness and levels. The panels shall be true to shape and size as specified and shall be free from any bends, scratches or visible marks, patches etc. The framework should be carefully examined for rigidity. If there is any sag, the panels should be dismantled and re-erected complete to the satisfaction of the engineer in charge. The maximum sag permissible shall be as per that defined in relevant B.S. or equivalent Indian standards.

### 2.4 Reference vendors / manufacturers

Armstrong or approved equivalent

## 3.0 WATER RESISTANT FIBRE TILE FALSE CEILING

### 3.1 Standards

#### DESCRIPTION REFERENCE FOR CODES

In general Shall be as per B.S. or equivalent Indian standards Suspension system Exposed semi recessed suspension system

Weight Approximately 6 kg / sqm.

Light reflectance shall be greater than 85%

Humidity resistance shall be about 100% RH

Fire performance

Reaction Class 0 / Class 1 (BS 476)

Thermal conductivity 0.17 W/moK

### 3.2 Materials

#### 3.2.1 Water resistant fibre tiles

The water resistant fibre tiles shall be of approved make, design, shade and quality. The tiles shall be of specified size and thickness. The tiles have straight and square edges and shall be free from any breakages, marks, stains or bends.

#### 3.2.2 Framework

The supporting framework shall comprise of sections of specified size and weight as per the specific requirements. The main runner shall be appropriately spaced and fixed to soffit by approved hangers. End hangers shall be at a suitable distance from the adjacent wall. The cross tees shall be appropriately interlocked

(both ways) between main runner to form a required module or grid. The wall angle shall be fixed to the wall at specified space intervals.

### 3.2.3 Workmanship

The ceiling shall be erected in a continuous sequence. All work in this section shall be performed in an efficient manner as per the instructions of the architect and as per manufacturer's recommended procedures. The assembly shall be of the semi-recessed type and shall be designed to meet the needs of performance, durability and aesthetics. The contractor shall make adequate provisions for supports for lighting fittings, making cut-outs and extra framework for light fixtures, A.C. grills, speakers, trap doors, sprinklers, sensors, all detectors, etc., complete all as per lay-out / pattern as shown in drawing and as per manufacture's recommendations.

### 3.2.4 Protection

Prior to installation, the material shall be stored in a dry and clean area which is enclosed and the material shall be allowed to stabilise in the area for not less than 24 hours prior to installation. Also care should be taken such that the material does not bear the weight of any unauthorised loads.

### 3.3 Testing

The false ceiling system installed shall be tested for straightness and levels. The panels shall be true to shape and size as specified and shall be free from any bends, scratches or visible marks, patches etc. The framework should be carefully examined for rigidity. If there is any sag, the panels should be dismantled and re-erected complete to the satisfaction of the engineer in charge. The maximum sag permissible shall be as per that defined in relevant B.S. or equivalent Indian standards.

## 4.0 MEASUREMENTS

### 4.1 Measurements

Length and Breadth of superficial area of the finished work shall be measured correct to a cm. Area shall be calculated in square metre correct to two places of decimal. No deduction shall be made for openings of areas up to 40 dm<sup>2</sup>, nor shall extra payment be made either for any extra materials or labour involved in forming such openings. For opening exceeding 40 dm<sup>2</sup> in area deduction in measurements shall be made, but extra will be payable for any extra material or labour involved in making such openings. Curved surfaces shall be measured and paid for separately from flat surfaces. The work shall be deemed to comprise of flat surfaces only unless specifically stated otherwise in the description of the item.

Any sunk or raised mouldings in the plaster shall be measured and paid for separately, deduction being made from plastering on ceiling only if the width exceeds 15 cm. Ceiling at a height greater than 5 metres shall be so described and measured separately stating the height.

### 4.2 Rate

The rate shall include the cost of all materials and labour involved in all the operations described above including all scaffolding, staging, etc. The frame work supporting the ceiling will be paid for separately unless otherwise stipulated in the description of the item. The rate does not include for any raised or sunk mouldings or for any patterned finishing of the surface, which will be measured and paid for extra over the plaster work.

# WOOD WORK & JOINERY INCLUDING DOORS & WINDOWS

## WOOD WORK & JOINERY INCLUDING DOORS AND WINDOWS

### CONTENTS

#### SL NO DESCRIPTION

- 1.0 Scope
- 2.0 General
- 3.0 Materials
- 4.0 Workmanship
- 5.0 Measurements
- 6.0 Flush Doors & Shutters

#### 1.0 SCOPE

The specifications refer to wood work in general including carpentry and joinery work in the building.

#### 2.0 GENERAL

The provision of the latest revisions of the following I.S. codes shall form a part of these specifications. IS 205

Specifications for non-ferrous metal butt hinges

IS 287 Recommendation for maximum permissible moisture content of timber used for different purposes.

IS 303 Specification for plywood for general purpose.

IS 362 Specification for parliamentary hinges

IS 419 Specification for putty for the use on window frames

IS 883 Code of practice for design of structural timber in building.

IS 1003 Specification for Timber panelled and glazed shutters Part II - Window and ventilator shutters.

IS1200 Method of measurement of building and Civil Part XXI Engineering Works - Wood Work and Joinery.

IS:1341 Specification for steel butt hinges

IS:1658 Specification for Fibre Hard Boards

IS: 1761 Specification for transparent sheet glass for glazing and framing purposes.

IS: 3087 Specification for wood particle boards (medium density for structural timber in building)

Other I.S. codes not specifically mentioned here, but pertaining to wood work and joinery form part of these specifications.

#### 3.0 MATERIALS

##### 3.1 Sawn Timber

Teak wood / hardwood of good quality and class as specified in the item shall be used. The timber shall be of high quality and well seasoned. It shall have uniform colour free from defects such as cracks, dead knots, shakes, sapwood etc. No individual hard and wound knot shall be more than 6 Sq.cm in size and the aggregate area of such knots shall not be more than 1% of the area of the piece. The timber shall be close grained having not less than 2 growth rings per cm. width in cross section. The maximum permissible percentage of moisture content for well seasoned timber used in building work shall be as specified in the IS : 287.

##### 3.2 Glazing materials

###### Glass Panels:

Unless otherwise specified, glass panes used in glazed or panelled and glazed shutters, shall be of good quality glass of thickness not less than 2 mm for panes upto 0.1 sq.m in area not less than 3 mm for glass panes of area larger than 0.1 sq.m with a tolerance of 0.2 mm in both cases.

The glass shall be free from flaws such as specks, bubbles, smoke waves, air holes, etc. and shall conform to the relevant IS : 1761. Unless otherwise specified, glass panes used in shutters of bath room and lavatories shall be frosted and of thickness as mentioned above and shall be free from any flaws.

Where so specified, special quality glass such as plate glass, pin heads glass, wired glass, float glass etc. shall be used. They shall conform to relevant IS standards as regards quality. Putty for glazing in wooden frames of doors and windows Putty shall be prepared by mixing one part of white lead with three parts of finely powdered chalk and then adding boiled linseed oil and mixing the whole thing into a homogeneous stiff paste. It shall be free from impurities like dust, grit, etc. and shall conform to IS : 419.

### 3.3 Fittings

The item of wood work of joinery generally includes fittings such as hinges and screws for fixing of door shutters and is explicitly so mentioned in the item. Hinges – Hinges shall be of iron, brass, aluminium or any other material as specified. They shall present a neat appearance and shall operate smoothly. All hinges shall be of steel and their riveted heads shall be well formed and smooth. Hinges shall be of the type specified and shall conform to the relevant Indian Standard Specifications.

## 4.0 WORKMANSHIP

### 4.1 Wood Work, Wrought, Framed and Fixed

#### General:

The work shall be carried out as per detailed drawings and/or as directed by the Engineer in charge. The wooden members of the frame shall be planed smooth and accurate to the full dimensions. Rebates, rounding, mouldings, etc. as shown in the drawing shall be done before the members are joined into frames. Where wood work is not exposed to view as in the case of frames for false ceiling, however, no planning is required to be done unless specified expressly as rough timber work.

Note: The work wrought shall mean 'planned'. Jointing in timber frames must be made carefully and accurately. They shall be strong, neat and shall fit without edging or filling. The joints shall be pinned with hard wood or bamboo pins of 10 to 15 - dia after the members of the frame are pressed together in a suitable vice-mechanism The door and window frame shall have rebate to house the shutters and the depth of such rebate shall be 1.25 cm.

Wood work shall be painted, oiled, polished or otherwise treated as specified. All portions of timber abutting against masonry or concrete portion of building shall be coated with boiling coal tar or other type of approved wood preservatives primer, before placing them in final position. Before any surface treatment is applied in the wood work shall be got approved by the Engineer-in-Charge.

#### Fixing in Position:

The frames shall be fixed only after acceptance by the Engineer-in-Charge. In case of door frames without sills, the vertical members shall be buried in floor for the full thickness of the floor and the door frame shall be temporarily braced at the sill level so as to prevent warping or distortion of frame during construction.

### 4.2 Panelled, Glazed or Panelled and Glazed Shutters:

#### General

The work shall be carried out as per detailed drawing. The wooden members shall be planed smooth and accurate. They shall be cut to the exact shape and sizes without patching or plugging of any kind. Mouldings, rebates, rounding, etc. shall be done, as shown in the drawing, before the pieces are assembled into the shutter. Joinery work:

The thickness of the styles and rails shall be as specified in the item of work. The minimum thickness of panels shall normally be 15 mm where the clear width of panel is not more than 300 mm and 20 mm where the clear width of the panel is more than 300 mm. However, where the Engineer-in-Charge so considers lesser thickness upto 12 mm and 15 mm respectively may be allowed by him instead of 15 mm and 20 mm specified above. Solid wood panel for door and window shutters shall be made out of one or more strips of timber planks of not less than 125 mm width. it is preferable to use strips of not more than 200 mm width to reduce chances of warping, splitting or other defects. The timber strips shall be joined together with continuous tongued and grooved joints,



glued together and reinforced with metal dowels. The grooving of the solid panel shall normally run along the longer dimensions of the panel unless otherwise directed. The corners and edges of panels shall be finished as shown in the drawing and these shall be feather tongued into styles and rails. Sash bars shall have mitres joints with the styles. Styles and rails of shutters shall be made out of single piece. Lock and intermediate rails exceeding 200 mm in width if permitted by the Engineer-in-charge may be made out of one or more pieces of timber but the width of each pieces shall not be less than 125 mm. Where more than one piece of timber is used, they shall be joined with a continuous tongued and grooved joint glued together and reinforced with metal dowels (rust proof) at regular intervals of 20 cm or pinned with not less than three 40 mm rust proof pins of the lost head type. The tenons shall pass clear through styles. The styles and rails shall have a 12 mm groove to receive the panel. In case the double shutters the rebate at the closing junction of the two shutters shall be of depth not less than 2 cm. Shutters shall not be painted or otherwise treated before these are passed by the Engineer-in- Charge and fixed in position.

#### 4.3 Glazing:

The glazing work shall be done in accordance with the specification given separately elsewhere.

#### 4.4 Hold Fast

Hold fasts used for fixing doors and window frames shall be made of 40 x 3 mm flat iron and 40 cm long. It shall have two holes on one end for fixing to frame with long screws, and at the other end, the flat iron shall be split and bent at right angles in the opposite direction. The hold fast shall be tightly fixed to the frame by means of bolts, the bolt hole in frame being plugged suitably and finished neat. The hold fast shall be embedded into masonry by concrete block of 200 x 250 x 400 mm size.

### 5.0 MEASUREMENTS

Woodwork and joinery work shall be measured in square meters. Length and width of unfinished opening shall be measured to the nearest 0.01 m. Areas shall be worked out correct upto 3rd place of decimal of a sq.m. All work shall be measured net as fixed, that is, no extra allowance in measurement shall be made for shape, joints, etc. However, where the dimensions as fixed exceeds the specified dimension (as per drawing, etc.) only the specified dimensions(s) shall be measured and where one or more dimension of the piece as fixed is less than the fixed dimension the actual dimension shall be measured, without prejudice to the right of the Engineer-in-Charge to reject the piece and order replacement of such pieces.

It shall include:

- i) Supply of specified species of timber sawn to requisite sizes without any defect, wrought, framed and fixed in position with the required standard of workmanship including supply-and-fixing of fixtures, straps, bolts, hold-fasts, spikes, nails, screws, etc. applying contractors glue or other jointing materials, coal tarring embedded parts, glazing and supplying and fixing of all specified fittings.
- ii) All material, labour, scaffolding, use of equipment etc. for framing, fixing and completing the item as specified.

### 6.0 FLUSH DOOR SHUTTERS

#### 6.1 General

The door shall be of flush type solid core with single or double shutter as the case may be.

#### 6.2 Shutters

The shutters shall be decorative or non-decorative type of the exterior or interior grade as described in the item and as shown in the drawings. It shall conform to the relevant specifications for the type and grade given in I.S. 2202/1983, Specifications for Wooden Flush door shutters (solid core type). The finished thickness shall be as mentioned in the item. Face veneers used shall be of the pattern and colour approved by the Engineer.

#### 6.3 Fixtures and Fastenings

These shall be as shown in a table on the drawings or as indicated in the specifications. Where it is not specified they shall be of oxidised brass and shall be of good workmanship. All fixtures and fastenings shall be sound and strong. They shall be sectional and of the best quality. The size, shape, design and finish shall be as shown on

drawings and approved by the Engineer. Unless otherwise specified each leaf shall be hung with three brass parliamentary hinges to suit the locations for back flap with brass screws. Each door shall be furnished with aldrop and latch, brass flush bolts, etc. The fixtures shall comply with the relevant Indian Standards. Samples of all fixtures and fastening shall be got approved by the Engineer and deposited in his office for reference. All the fixtures shall be fixed to the joinery in a secure and efficient manner. Metal sockets shall be provided to all bolts where the shoots enter, stone, concrete, etc.

#### 6.4 Measurement

Flush door shutters shall be measured in square metres. Length and width of unfinished opening shall be measured to the nearest 0.01 m. For further details of measurement of flush door shutters see clause 5.0.

# **STRUCTURAL GLAZING & CLADDING SYSTEMS/UPVC DOORS & WINDOWS**

## **STRUCTURAL GLAZING & CLADDING SYSTEMS UPVC DOORS & WINDOWS**

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### **1. SCOPE OF WORKS**

The scope of works under this contract includes design, supply, installation, protection, guarantees, testing and maintenance upto the defects liability period for Structural Glazing, Curtain Wall, Aluminium Cladding, Stainless Steel Sheet Cladding, Sun shading device / Sun-breaker assembly, Doors, Sky-light, Windows, Louvres etc. The work under this section includes all Labour, materials, equipment and services as required for the complete design, engineering, testing, fabrication, assembly, delivery, anchorage, installation, protection and waterproofing of the aluminium curtain wall / structural glazing system, cladding, aluminium doors, Sky-light, aluminium windows & louvres and all in accordance with the true intent and meaning of the specifications and drawings taken together, regardless of whether the same may or may not be particularly shown on the drawings or described in the specification provided that the same can be reasonably inferred there from. Anchorage includes all primary and secondary anchor assemblies and supportive structural framing as required to secure aluminium structural glazing system, cladding, Sky-light and louvers to the building structure.

The detailed scope of works consists of :-

1. The aluminium structural glazing system, cladding, Sky-light, Sun shading device / Sun-breaker assembly, aluminium doors, aluminium windows & louvres described hereafter shall include but will not necessarily be limited to the following:-
  - a. Frames, vision panels, spandrels, doors and ventilators.

- b. Openable panels where indicated, inclusive of all accessories, fittings etc.
- c. Copings, soffit trimmers, and external metal cladding panels for both the wall cladding and the curtain walling system.
- d. Aluminium doors, aluminium windows, aluminium fix glazing, louvres etc. Wherever indicated.
- e. All caulking, sealing and flashing including sealing at junctions with roof waterproofing and exterior wall, flashing at doorway, raised kerbs and in window surrounds.
- f. Sealant within and around the perimeter of all work under this section.
- g. Separators, neoprene / EPDM / silicon gaskets, trims etc.
- h. All steel structural framing and beam supports, anchors and attachments as required for the complete installation of the whole system, wherever specified.
- i. Inserts in concrete, anchor fasteners etc. for the anchorage of all work under this section to the approval of Architect.
- j. Isolation of all dissimilar metal surfaces as well as moving surfaces similar or dissimilar.
- k. Fire-stops, Flashings, Sealing of all interfaces with buildings etc.
- l. Protection during storage and construction until handing over.
- m. Engineering proposals, drawings and data.
- n. Shop drawings, engineering data and structural calculations of all systems including framing, fasteners and cladding.
- o. Scheduling and monitoring of the work.
- p. All samples, mock-ups and test units.
- q. Co-ordination with work of Civil Works and other agencies / contractors employed on site.
- r. All final exterior and interior cleaning of the aluminium structural glazing system, cladding, doors louvres and window etc.
- s. Hoisting, staging, scaffolding and temporary services.
- t. Specified tests, inclusive of necessary reports.
- u. Maintenance manuals.
- v. Design and Performance guarantees.
- w. Periodic inspection, supervision and advice by Contractor's Senior Personnel of the System Principal as well as guarantee in approved Proforma for the quality and performance of works.
- x. Construction monitoring for regular quality control and technical inspection to ensure the work conforms to the shop drawing details (including any modification made during testing) and acceptable standards of quality.

## 2. REFERENCES AND STANDARDS

- 2.1 The provisions not restricted to the latest Standards listed below and mentioned in subsequent Para's. ANSI Z97.1.84 Safety Glazing materials used in Buildings ASTM C 1036-90 Specification for float glass
- ASTM C 1048-90 Specification for Heat treated Float Glass ASTM E 774 –88 Specification for sealed Insulating Glass Units ASTM C 1172- 91 Specification for Laminated Architectural Glass ASTM C 864 – 90 Specification for compression Seal Gaskets ASTM C 1115-89 Specification for Silicon Rubber Gaskets ASTM C 920-87 Specification for Sealants ASTM C 509-90 Specification for sealing material
- CPSC 16 CFR 1201 Specification for Safety of glass
- GTA Specification Specification for environment durability for heat NO 89-1-6 strengthened Spandrel Glass with Applied pacifiers. BSCP 118 Structural use of Aluminium ASTM E 283 Air Infiltration test
- ASTM E 331 Static water penetration test
- ASTM E330 Positive and negative Test
- AAMA 501.1 Dynamic Water Penetration Test-600Pa equivalent wind speed by propeller engine.
- AAMA 501.4 At 100% Of the specified lateral displacement.
- AS N25 4284 Seismic test
- IS 875 1987 Part 3 Code of practice for design Loads (other than Earthquake) Wind Load

2828 : 2001 Plastic — Vocabulary (first revision)

3346 : 1980 Method for the determination of thermal conductivity of thermal insulation materials (two slab guarded hot plate method) (first revision)

4020 (Parts 1 Door shutters — Methods of tests to 16) : 1998 (third revision)

4021 : 1995 Timber, door window and ventilator frames — Specification (third revision)

4669 : 1968 Methods of test for polyvinyl chloride resins

4905 : 1968 Methods for random sampling

4923 : 1997 Hollow steel sections for structural use (second revision)

8543 (Part 4/ Methods of testing plastics: Part 4 Sec 1) : 1984 Short-term, mechanical properties, Section 1 Determination of tensile properties

10148 : 1982 Positive list of constituents of polyvinyl chloride resins and its copolymers for safe use in contact with foodstuffs, pharmaceuticals and drinking water.

10151 : 1982 Specification for polyvinyl chloride (PVC) and its copolymers for its safe use in contact with food stuffs, pharmaceuticals and drinking water.

10428 : 1983 Glossary of terms relating to doors

11239 (Part 3) : Methods of test for rigid cellular 1985 thermal insulation materials: Part 3 Dimensional stability.

13360 Plastics — Methods of testing: (Part 3/Sec 1) : Physical and dimensional properties, 1995 Section 1 Determination of density and relative density of non-cellular plastics.

(Part 5/Sec 5) : Mechanical properties, Section 5 1995 Determination of Charpy impact strength

(Part 5/Sec 7) : Mechanical properties, Section 7 1996 Determination of flexural properties

14182 : 1994 Solvent cement for use with unplasticized polyvinyl chloride plastic pipes and fittings In general the Contractor may follow any International Standards subject to his satisfying the Architect/ Employer that these specifications are equivalent to latest specifications issued by ASTM, ISO, AAMA, BSS & SSIR. Copies of all standards & codes proposed to be followed for design, materials, installation and testing shall be submitted to the Architect within 2 weeks of issue of Works Order.

## 2.2 Building Regulations

Design of the aluminium structural glazing system shall comply with all Government codes and regulations. For wind design, all calculations shall comply with the requirements of the relevant National Building Code and Indian Standard Code, unless specified otherwise.

## 3.0 GUARANTEE

The Contractor shall be fully responsible for and shall guarantee proper design and performance of his installed system for a period of 10 years from handing over of works. The design and installation shall be to the best international standards and shall specially take account of wind and seismic loads, storms, air pollution, thermal stresses, building movements and the like In addition specific 10 year guarantees (to be furnished in non-judicial stamp paper of value Rs.100/-) in approved Proforma shall be given for performance of glass, glazed units, anodizing, PVDF coating to cladding sheets and sealants. All the Guarantees shall be submitted before Final payment and shall not in any way limit any other rights to correction which the Employer may have under the Contract.

## 4.0 CONTRACTOR'S RESPONSIBILITIES

4.1 The Contractor's responsibilities include but are not necessarily limited to the following items:

a) The Contractor shall provide and install all supplementary parts necessary to complete all items generally implied in the drawings and in the specifications though not specifically shown or mentioned. This shall include the design and sizing of all sections and anchor assemblies to meet the performance and design requirements, furnishing and installation of all inserts, fasteners, clips, bracing and framework as required for the proper anchorage of the structural glazing system elements to the structure, unless otherwise noted or specified to be furnished / installed by another contractor. Alternate anchorage proposals will be considered, if, in the opinion of the Architect the general design and intent of the drawings and specifications are maintained. The Contractor's system therefore must perform satisfactorily as a whole.

b) Design Responsibility:

Drawings and specifications indicate the required basic dimensions, profiles and performance criteria. The Contractor shall have the option of modification and addition of details provided the visual concept and performance requirements are fulfilled. Proposed modifications shall be clearly shown on shop drawings as "Design Modifications" and acceptance of the same will not relieve the Contractor from sole responsibility for performance of the aluminium structural glazing system and cladding. The Contractor shall be solely and fully responsible for due performance of his installation based on his own design and details.

c) In-plant and job site inspection: The Contractor shall allow the Employer, Architect / PMC or their authorised agent full access to plants, shops and assembly points to view and inspect the processes and methods employed in the fabrication, assembly and finishing of the aluminium structural glazing system and cladding for this project.

The Architect / PMC will have the right to reject any and all aluminium structural curtain wall / structural glazing system and cladding components and assemblies during assembly and erection if the workmanship and intent are not in strict conformity with the approved shop drawings, structural calculations, documentation, certifications, samples and mock-up.

d) Glass, sealants and other items or materials procured by purchase shall be back to back guaranteed by the manufacturer.

## 5.0 SHOP DRAWINGS

5.1 The contractor shall prepare necessary shop drawings based on the preliminary drawings and two (2) copies of all shop drawings shall be submitted to the Architect for review and approval. The Architect's review of all shop drawings will be limited to their conformity to the design concept & specifications. Architect's approval of the shop drawings will not relieve the contractor from any of the responsibilities and requirements as stated drawings and all other related submissions, documentation, certifications, samples and the mock-up for that work have been reviewed and approved by the Architect. On approval of the drawings by Architect, the Contractor shall submit six (6) copies of all drawings to PMC for release to execution / site.

5.2 Shop drawings shall incorporate scaled and dimensioned plans, elevations, sections and full size details for all work in this section. Shop drawings shall indicate the desired dimensional profiles and modules, function, design and performance standards and, in general, delineate the scope of work. The contractor shall verify and co-ordinate these items with all applicable and/or related trades, contract drawings and specifications. Since the dimensions and modular references shown on the drawings are for specific and/or typical detail, the shop drawings shall include a full complete layout of all modular and referenced dimensions for all the aluminium structural glazing, cladding, doors, windows and louvres and their related elements. All dimensions / modules, etc., shall be field checked as required.

The full size details shall show and specify all metal sections, types of finishes; areas to be sealed and sealant materials; gaskets; direction and magnitude of thermal expansion; direction and magnitude of all applicable construction including fasteners and welds; all anchorage assemblies and components; the fabrication and erection tolerances for the work and applicable related works adjoining, attached to or in some way related to the work covered by these specifications. The location of all static and dynamic anchor assemblies, the direction of thermal and other applicable building movements, coordination with concrete works and the sequence of installation shall be designated on the applicable plans, elevations and / or sections. All details shall be subject to Architect's approval.

5.3 Shop drawings shall indicate the desired profiles, dimensions, details of metal finish and in general delineate the scope of the work. Profile adjustments in the interest of economy, fabrication, erection, weather-ability or ability to satisfy the performance requirements may be made only with the written approval of the Architect, provided that the general design and intent of the drawings and specifications are maintained.

5.4 Shop drawings to be vetted by the Principal of the Structural Glazing & Cladding System. Six (6) copies each of all final approved shop drawings shall be submitted to Architect / PMC.

## 6.0 STRUCTURAL CALCULATIONS

6.1 The Contractor shall guarantee that his design will ensure the structural safety and integrity of the curtain wall, cladding and glass panels against all natural forces, superimposed loads, environment and consequent movements. For that purpose the contractor shall employ a competent design engineer to design his systems and components. During the design stage, the Contractor shall interact actively with the Architect concerning all aspects of design and shall obtain all the information from them concerning the structure, probable deflections and other building movements etc. The Contractor shall take full account of all possible building movements as well as the movements of his curtain wall and cladding systems in his design. The Contractor shall submit his detailed structural calculations for the systems and each of their components and shall guarantee that his design will ensure the structural safety and integrity of the curtain wall, cladding and glass panels against all natural forces, superimposed loads, and environment and consequent movements.

The structure and functional design must be vetted and approved by the Principals of the curtain wall system.. The Contractor shall obtain the Architect's approval to his design calculations and to the provisions made in his design for all the building movements, and shall be responsible for the correctness of the fixing and interaction of the curtain wall with the structure so as to ensure that all the movements envisaged between the structure and the curtain wall area are fully taken care of. The Contractor shall be responsible for the workmanship of fabrication and installation and shall indemnify the Employer against all claims due to defects or non-performance during the specified 10 year Guarantee period. The provisions of this clause shall not in any way limit the Employer's rights under other clauses of the Contract.

6.2 The R.C.C. in the building structure is Grade M 30. The Contractor shall design anchorages for this grade of concrete with adequate safety factor.

6.3 Three (3) sets of approved design calculations which is compatible with R.C.C. and steel structure shall be submitted to Architect.

## 7.0 DOCUMENTATION AND CERTIFICATION

### 7.1 Glass and Glazing Documentation:

The applicable glass manufacturer(s) shall submit written certification for Architect's review and approval stating that all glass and glazing requirements as detailed and specified on the shop drawings have been reviewed and approved for use relative to their specific application and / or design parameters, compatibility to adjacent materials and in conformity with all requirements as detailed and specified in the Contract Documents. Certification shall further state that the proposed glass and glazing materials are most appropriately suited for the use or uses intended and recommended for the specific use or the selection of the glass and the glazing materials including, but not limited to, gaskets, setting blocks, sealant, the design and dimensional parameters of the glass pockets and the compatibility of materials. Test Certificate from approved laboratories for U-values and shading factor claimed by the Manufacturer shall be submitted.

### 7.2 Sealants Documents:

All sealant applications must be clearly designated on the applicable shop drawing details and referenced to a master sealant schedule specifying materials, special instructions and application procedures. The applicable sealant manufacturer(s) shall submit in writing that all sealant requirements as detailed and specified on the shop drawings have been reviewed and approved for use relative to their specific application and / or design intent, compatibility to adjacent materials and in conformity with all the requirements as detailed and specified in the contract documents. The manufacturer's certification shall specify the optimum life expectancy, in years, for the proposed sealant materials as detailed and specified on the shop drawings and/or master sealant schedule and shall further state that the proposed materials are most appropriately suited for the use or uses intended and recommended for the specific use or uses.

### 7.3 Quality Control Documentation:

In-plant and job site quality control procedures shall be documented in writing for Architect's review and approval to ensure the design integrity and performance of the as built product. Documentation shall include schedule,

details, isometric and/or schematic explanatory sketches cross-references to the shop drawings, data sheets, etc., all as required to intelligently witness and assess methods and materials; and to ensure that both the fabrication and installation are in accord with the contract documents. The Employer / Architect / PMC shall, if required, be given free access to the plant to inspect fabrication procedures. No fabrication or assembly of job site materials shall commence until the first production unit is inspected and approved by Architect / PMC.

a) The in-plant quality control procedures shall include but not necessarily be limited to the following items: Fabrication : Tolerances, Joinery, Sleeves, etc.

Finish Match : Approved finish controls required for matching the exposed surfaces.

Assembly : Welds, fastener, sealants, gaskets, separators, glazing etc.

Protection : Handling, protection, shipping etc.

b) The job site quality control procedures shall include, but not necessarily be limited to the following items: Anchorage : Lines, grades and related building tolerances

Installation : Tolerances, finish, match, joinery, sleeves, flashing, welds, fasteners, sealants, etc.

Sealing : As recommended by the applicable sealant manufacturer(s)

Protection & Cleaning : As recommended by the applicable sealant manufacturer(s)

## 8.0 SAMPLES AND MANUALS:

8.1 The following samples of actual job site materials together with detailed technical data / catalogues shall be submitted in duplicate, unless otherwise noted, and in the sizes noted, for Architect's review and approval. Any omission of an item, or items which require the Contractor's compliance with these documents does not relieve him from such responsibility.

(a) Aluminium sheet panel: Each type and thickness; 600 x 600 mm of the specified thickness.

(b) Aluminium extrusions; one only of each section ; 300 mm long of specified thickness.

(c) Glass; Each type and kind, 300 x 250 mm of specified thickness and including frame.

(d) Glazing gaskets, tapes, separators, glass setting blocks, etc. each section or unit, 300 mm long or unit.

(e) Fasteners and connections devices: Each type and size.

(f) Finish samples: After approval of the final finish coating the Architect / PMC is to be provided with six (6) approved samples.

(g) Window and door ironmongery and accessories, as applicable.

(h) Flashings and finish samples.

(i) Cladding.

(j) Samples submitted should be also include assembly of various components forming a typical fixing and details complete with flat sheets, glazing, extrusion, fastener, sealants etc.

## 8.2 Mock - Up

Before the fabrication and site installation is taken up, the Contractor shall put up a mock up of his proposed curtain wall / structural glazing system & aluminium cladding system at least 4.00 m high and 3 modules wide incorporating all types of in-fill panels, fire-stop, flashing, shadowbox, bracket, hardware and fixtures. A mock-up of 4 panels of cladding shall also be put up. The mock-up are essential for final approval of all materials and installation details by the Architect. The Contractor shall submit samples and catalogues of door / window elements for approval, as applicable.

## 8.3 Maintenance Manual:

Submit Maintenance Manuals approved by Architect / PMC in three (3) copies each indicating the detailed procedures for the periodical inspection maintenance and cleaning of all the structural glazing, cladding, doors, windows and louver elements, finishes etc.

## 9.0 WORK SCHEDULE:

9.1 Immediately on receipt of the Work Order the Contractor shall submit the final programme of work schedule for the completion of the whole of the works including submittals, approvals, fabrication, supply at site & installation. The time schedule shall be got approved from the PMC.



9.2 The time schedule shall be prepared in consultation with PMC to suit the overall project schedule and shall be updated from time to time to suit prevailing conditions and coordination with other Contractors employed on site.

#### 10.0 INSPECTION OF COMPONENTS:

10.1 The Contractor shall submit a schedule of material specification and procedure for inspection of the quality of components of the metal wall cladding / curtain walling the fabrication in the plant.

10.2 The Contractor shall submit fortnightly report on the results of the inspection of the components, in a format approved by the PMC.

10.3 The Contractor shall submit a description of the procedure of delivery, hoisting, storage, handling, fixing, scaffolding, temporary working stage or gondola, protection and cleaning.

#### 11.0 STORAGE, PROTECTION AND PROGRAMME

11.1. The Contractor shall submit a schedule on the procedure for inspection during installation so as to maintain quality control on the job site.

11.2. The Contractor shall submit a detailed method statement for the protection of the surface of the aluminium structural glazing & cladding members during delivery and erection, with description as to when the protection can be removed.

11.3. The Contractor shall submit weekly reports on the inspection of erection and installation as direction by the PMC.

11.4. Delivery and Storage and Materials: All materials delivered to site shall be stored in allocated spaces where the stored materials will not be exposed to rainwater, moisture or damage, and shall permit easy access to and handling of the materials. Materials shall be stored neatly and properly stacked.

- a) Aluminium wall cladding / Factory made structural glazing units and / or their components shall be transported, handled and stored in a manner to preclude damage of any nature.
- b) Accessory materials, required for erection at the site shall be delivered to the site in labelled containers by the manufacturer.
- c) Remove all units or components which are cracked, bent, chipped, scratched or otherwise unsuitable for installation and replace them promptly.

#### 12.0 PERFORMANCE REQUIREMENTS

All components, assemblies and completed work included in or permit to the work of this section shall conform to or exceed the following performance standards and comply with all applicable and governing building codes and regulations.

12.1. Thermal Movement: Provide for noiseless contraction and expansion of component materials for an ambient temperature range of +10 C to 70 C and a material temperature range of 100 C without buckling, opening joints, glass breakage, undue stress on fasteners, or other detrimental effects. Make allowance for vertical and horizontal expansion. For fabrication, assembly and erection, procedures shall take into account the ambient temperature range at the time of respective operations.

12.2. Building Movement and Related Building tolerance. The design and installation of the structural glazing system shall accommodate all inherent building movements and/ or deflections and the fabrication and installation tolerances of all related work not involved in this section without the loss of, or any detrimental effect to, the performance requirements herein specified. The Contractor shall verify and co-ordinate all such

movements and / or tolerances with the Architect and the Architect before designing all the components of structural glazing and aluminium cladding so that movements and deflections in the structure do not at any time affect the integrity and safety of curtain wall and aluminium cladding and vice versa.

#### 12.3. Thermal property:

All insulation materials, fire-stops and smoke seals shall comply with the current requirements of the Local Chief Fire Officer, Fire Brigade and other authorities.

#### 12.4. Structural Properties:

- a) The design of curtain wall / structural glazing system and aluminium cladding and all related components shall comply with the requirements of National Building Code I.S.875 and Indian Standard Code I.S.456.
- b) No curtain wall / structural glazing system and aluminium cladding elements including sealants and sealed joints shall sustain permanent deformation or failure under loading equivalent to 1.5 times the design wind pressure herein specified.
- c) Deflections: The specified deflections must be reduced if they are in any way detrimental to the aluminium structural glazing and cladding elements and sealants. (Refer to clause 27.0 on page TS- Structural Clad-56.)

#### 12.5. General

- 1) All braces, supports and connections for the aluminium curtain wall / structural glazing and cladding shall be designed, provided and installed complete as required.
- 2) Anchors for curtain wall shall be located within a maximum distance of 500 mm above or below the R.C.C. floor slab unless specifically approved otherwise by the Architect.
- 3) Variations from schematic layouts indicated on the drawings may be permitted but only if a proposed revision does not, in the Architect's opinion, deviate from the design intent, cause excessive stress in the structure, cause excessive deflection, inhibit thermal and building movement or conflict with other requirements.
- 4) Member shapes and / or profiles if schematically shown on the Architect's drawings are not necessarily the exact shapes required or best suited for the particular condition. Final shapes and locations shall be as designed by the contractor and are subject to the Architect's review and approval.
- 5) The height-from the finished floor level to the top of the window sill shall not be less than as shown in the drawing. The horizontal or lateral load on such transom / railing (where not backed by an R.C.C. parapet) shall be designed in accordance with the following criteria i.e. a horizontal UDL at 0.74 KN/m run, UDL supplied to the infill of 1.0 KN/m<sup>2</sup> and a point load applied to part of the infill at 0.5 KN.
- 6) No holes shall be burned, filed or drilled in any structural steel members unless approved by the Architect in writing.
- 7) The contractor shall provide detailed layouts, alignment jigs etc. for the proper and exact placement of all welded anchor studs, anchorage components, embedded anchor assemblies etc.
- 8) All metal structural glazing and cladding elements and their applicable anchorage assemblies shall be designed to accommodate all thermal and building movements without any harmful effect to the structural glazing and cladding.
- 9) No field forming, cutting and/or alterations of primary wall elements will be allowed. All framing members shall be shop fabricated and finish coated. No unfinished surfaces will be permitted on exposed surfaces.

#### 12.6. Concrete Tolerances:

- a) The contractor shall take into account tolerance in concrete and masonry surfaces to which the structural and glazing framework is fixed.
- b) In general, the construction tolerances in the building shall be as follows.
  - Surface level of floor slab, sills and lintels 10 mm
  - Plumb in a storey height 10 mm
  - Plumb in full height of building 14 mm
  - Cross – diagonal distortion between columns 14 mm
  - Max. displacement of any point on External Fascia from its true location 14 mm

#### 12.7. Lightning protection

The whole of the curtain wall when having insufficient clearance from the lightning protection system shall be bonded as directly as possible to the lightning protection system.

At each end of each continuous length of curtain wall, cladding or louvres, provision shall be made at top and bottom for bonding by the electrical contractor engaged by the Employer. The exact locations and details of the bonding points shall be as determined by the Architect.

#### 12.8. Fire-stop and Interface with building.

Joints in the curtain wall / structural glazing system between successive floors shall have the required fire resistance of at least 2 hours and shall comply with requirements of C.F.O. A fire-stop-cum-smoke seal shall be provided at each window-head level. In addition the Contractor shall provide an aluminium flashing to approved design at the window sill level and on 2 sides of vision panels. All interfaces with building structure, and other elements shall be sealed / flashed / provided with expandable gaskets to Architect's approval.

#### 12.9. Sound Control

Provisions shall be made (e.g. capping of all ends of mullions) to prevent sound transmission through the system. Provisions shall also be made to prevent metal to metal rubbing noise due to thermal changes and wind pressure. Desired sound levels should be 35 - 45 dB and shall not be more than 45 Db

### MATERIALS

#### 13.0 GENERAL:

13.1. Materials and components used shall be of the best quality and suitable for the purpose to Architect's approval and shall have been tried and tested in similar environments.

13.2. Aluminium panels shall be of a minimum thickness of 2 mm and of max. 3 mm (except Para 14.5) for solid sheets, and 4 mm for insulated composite units.

13.3. All materials shall be free from any defect that may impair the strength, functioning or appearance of the glazing and cladding system or adjacent construction.

13.4. Testing by independent testing laboratories or review of data by the Architect shall not relieve the Contractor's responsibility to verify for himself that the work conforms to the intent of the contract documents.

#### 14.0 METALS

14.1. In general, metals shall comply with relevant Indian and International Standards.

#### 14.2. Aluminium Wall Cladding

The aluminium cladding shall be fabricated with a minimum of 4 mm thick aluminium composite panel of approved make comprising of a thermoplastic resin core sandwiched between two skins of aluminium alloy. The panels shall be PVDF coated to minimum 35 micron thickness in approved metallic colour. The resin content of the PVDF shall be minimum 75%. The back of the panel shall be chromatised minimum 3 micron thick or otherwise protected to Architect's approval. The insulation in-fill of the composite panel shall be non-toxic on burning. The panels shall be acceptable to the Chief Fire Officer.

14.3. Fasteners: The type, size, alloy, quantity and spacing of all fasteners and / or anchorage devices shall be as required for the specified performance standards.

a) Bolts, anchors and other fastening devices shall be of approved types as required for the strength of the connections, shall be self-locking, unless otherwise noted, shall be suitable for the conditions encountered, and shall be torque tightened, where required, to achieve the maximum torque tension relationship in the fasteners. Washers, nuts and all accessory items shall be of the same material as fasteners.

- b) Fastening devices between aluminium and aluminium shall be Grade 304 of AISI nonmagnetic stainless steel unless otherwise approved.
- c) Fastening devices between aluminium and dissimilar materials shall be Grade 304 of AISI non-magnetic stainless steel unless otherwise approved.
- d) Exposed fasteners are subject to Architect's approval and shall be M.S. epoxy coated.
- e) Self-locking fasteners shall be stainless steel of grade 304 with nylon inserts or patches.

#### 14.4. Extrusions:

All aluminium extrusions shall conform to the system principal's specification for tolerances which shall, in any case, be better than DIN standards. Any section not conforming to the tolerances shall be rejected. In general aluminium alloy for extrusions shall be 6063 T5 or T6 as per B.S.1474. However, the grade and tempering specifications shall be as recommended by the supplier for each application and shall be approved by the system principal. All aluminium sections shall be either anodised in approved colour to a minimum thickness of 35 microns or coated with PVDF as specified in clause 19.0 except for sections concealed from view behind cladding which may be mill-finished. All surfaces abutting the parent sections and designed to receive sealants shall have adequate sealant contact and adhesion. They shall be finished to match parent sections.

#### 14.5. Aluminium Flashing

Flashings concealed from view shall be made from mill-finished aluminium sheets 1.5 mm thick. Visible flashings (e.g. on periphery of vision panels) shall be 2 mm thick aluminium sheets anodised in approved colour.

#### 14.6. Capping

Top capping shall be from 3 mm stretch-levelled aluminium sheets coated with 35 micron PVDF in approved colour.

#### 14.7. Soffits and Suspended Ceiling System

Soffits and suspended ceiling system if required shall be of similar metal of the aluminium wall cladding with a similar finish. Colour and shape shall be selected by the Architect.

#### 14.8. Fire stops – cum – smoke seals.

Fire stops – cum – smoke seals shall be provided at successive floor levels, and shall be two hour fire resistant. Metals sections shall be in galvanised steel sections minimum 1.5 mm thick. All details shall be approved by the Architect.

#### 14.9. Protection:

Materials used as permanent or temporary protection for metals shall conform with relevant Indian / International Standards.

#### 14.10 Brackets:

Brackets shall be of chromotised Aluminum of grade 6161-T6 or 6005-T6 conforming to ASTM 6511/A and approved by Architect. Slots in brackets shall be pre-drilled /punched and not flame-cut.

#### 14.11 Hardware and Fittings:

All hardware and fittings such as patch fittings, handles, locks, stay-arms, floor springs etc. for doors windows and openable panels shall be stainless steel to best International standards and to Architect's approval. Hinges for openable panel shall be stainless steel friction hinges / stays selected for specified wind load and dead loads or specifically extruded in-built hinges. All fittings and locks shall be approved by the Architect.

#### 15.0 SEALANTS & GASKETS

15.1 All sealant applications must be clearly designated on the applicable shop drawings details and reference to a master sealant schedule specifying materials, special instructions and application procedures. Provide documentation as per Clause 7.2.

15.2 The compatibility and sequence of installation for all sealants must be carefully considered in all proposals in order to ensure the required cure and optimum performance. Sealants must not degrade and / or fail under all design conditions including, but not limited to thermal movement, water, ultraviolet exposure and / or other adverse environmental conditions. The following sealant materials are specified for performance standards only. All proposals must be equal to or better than the materials herein specified. The designation of sealant types noted on the drawings is intended for general design guidance. Final selection by the contractor for the sealant types shall be based on their conformity with the Performance Requirements herein specified and meets with the Architect's approval. Maximum precautions shall be taken to prevent failure of sealant.

15.3 Structural sealant: Structural sealant shall be Dow Corning Silicone sealant 995, GE ultraglaze 4000, or approved equivalent recommended by manufacturer. All exposed and concealed metal to metal (including tight or butt type metal to metal assembly prior to assembly), perimeter metal to concrete joints shall be silicone base sealant, preferably 2 component, in approved colour, conforming to the manufacturer's recommendations for the specific uses and performance criteria. The manufacturer shall conduct laboratory test for adhesion for each lot of aluminium sections and glass. Laboratory reports shall be submitted to the Architect.

15.4 Weather Sealant: The grades of sealants for concealed metal to metal and metal to concrete joints such as embedment and lapping of flashings elements to be installed or embedded in a full bed sealant shall be the best recommended by the manufacturer for the application. (Dow Corning, GE or equivalent).

15.5 Joint fillers and back-up materials shall be non-gaseous polyethylene foam, sponge neoprene as per written recommendations from the applicable sealant manufactures for each specific application. Shape, size, hardness, compatibility and bond breaking requirements are all factors to be considered.

15.6 All sealant must be non-staining and compatible with adjoining sealants, backup materials, substrate materials and their respective finishes and / or applied colour coatings.

15.7 Exposed assembly sealant will not be permitted at any wall area.

15.8 All sealants shall be given 10 years Guarantee for materials, workmanship and performance from the date of completion of Contract.

15.9 Caulking compound: Dow Corning 991 or approved equivalent, one part gun grade consistency, colour to match adjacent material or approved by Architect for use around frame or between frame and floor slab.

#### 15.10 GASKETS:

A) SILICON GASKET : All Gaskets and seals shall be SILICON of approved quality, compatible with substrates, finishes and other components they are in contact with.

#### 16.0 SEPARATORS

16.1 Separators between steel and aluminium members and wherever required shall be rigid type, high impact, smooth both side Teflon with a minimum thickness of 0.8 mm or other non-conducting materials as approved by the Architect.

#### 17.0 GLASS

17.1 All glass and glazing materials shall be verified and co-ordinated with the applicable performance requirements.

17.2 Finish and install glass and glazing work as indicated on the drawings and as specified herein. All glass shall be cut to required sizes and ready for glazing. Any pane which does not fit any section of the curtain wall and shop front will be rejected and a replacement made at the Contractor's expense. All glass shall be of accurate sizes with clear undamaged edges and surfaces which are not disfigured.

- 17.3 Glass shall conform to the quality, thickness and dimensional requirements specified in US Federal specification DD- G 0451 C.
- 17.4 Heat strengthened glass shall not deviate in surface flatness by more than 0.23 mm within 260 mm of leading or trailing edge, or 0.076 mm in centre. Direction of ripples shall be consistent and extent shall be acceptable to Architect. Distortion of glass shall be controlled as much as possible during heat strengthening. Sag distortion shall be unidirectional as per Architect's option. Surface compression stress of heat strengthened glass shall be within 320 – 450 Kg/cm<sup>2</sup>
- 17.5 Permanent identification marking on glass shall be accomplished by a technique selected by the manufacturer. The location of the marking shall be proposed by the Manufacturer and approved by the Architect. All glass shall be delivered to site with the manufacturer's label of identification attached.
- 17.6 Submit for Architect's approval a complete list of materials to be used, including the sealants proposed and such samples as the Architect may require. All glass and glazing methods and materials including the design and profile dimensions of glazing pockets shall be as approved and recommended in writing by the applicable glass and sealant manufacturers. A sealant substrate test report shall be submitted for each type of sealant for adhesion and compatibility.
- 17.7 Sealants in factory-glazed panels shall be fully cured prior to shipment to projects site and installation.
- 17.8 All glass breakage caused by the Contractor or his sub-contractor because of the installation of faulty work by him shall be replaced by the Contractor at his own expense without delay to the project completion.
- 17.9 The Contractor shall be responsible to deliver to the Employer without charge replacement for any unit of glass and glazing that fails within the Guarantee period of Ten (10) years from date of completion of Contract.
- 17.10 The glass glazed panels / structural glazing frames for the structural glazing system shall be designed to withstand lateral imposed loads and comply with requirements of local building codes.
- 17.11 Glass thickness should be selected in accordance with AS 1228 – 1989 "Glass in Buildings Selection and Installation" to satisfy design performance requirements and local design codes.
- 17.12 Glass shall be free from defects or impurities detrimental to its performance. Defects such as bubbles, waves, spots, scratches, spalls, discolouration, visibly imperfect coating, chipping, and bubbles or delamination of pacifier film shall be limited in accordance with the Manufacturer's / trade guidelines. The glass is to be produced in such a way that the rollers will be parallel to what will be the horizontal position of the glass. Glass shall be consistent in colour.
- 17.13 Manufacturer's glazing instructions regarding installation, clearance, dimensional tolerance, bite edge clearance etc. shall be followed.
- 17.14 All solar control glass panels shall be stored with particular care and protected against abrasion, sun and moisture prior to installation.
- 17.15 Precautions specified by glass manufacturers to minimise thermal stress must be followed. A thermal stress analysis shall be obtained from glass manufacturer prior to fabrication and their recommendations shall be followed. Allowance shall be made for thermal movements due to an air temperature range of 60 C (+100C-700C) and a material temperature range of 100 C.
- 17.16 Glass panels shall be selected / rejected on the basis of product quality standards specified by the manufacturer concerning scratches, pinholes, clusters, distortion, colour variations, flaws in coating and other defects.

17.17 Each type of glass shall be obtained from only one manufacturer and one lot. Adequate spare quantity shall be ordered to cover for breakage and for replacement during maintenance period.

17.18 Setting blocks for glass shall be extruded neoprene with minimum 80 durometer hardness.

17.19 VISION GLASS PANELS;

Characteristics of each type of glass are given elsewhere.

17.20 SPANDREL GLASS PANELS

Characteristics of each type of glass are given elsewhere.

18.0 GLAZING COMPOUNDS;

18.1 Provide documentation as per Item 7.1. All neoprene materials shall be extruded high quality ozone resistant, cured, elastomeric, virgin neoprene compounds with durometer hardness, profiles and design parameters, lengths and locations all as required and recommended in writing by the applicable glass manufacturer (s). All neoprene glazing materials shall have smooth neat exposed surfaces, all flashings and burrs removed and in profiles, including integral locking projections to engage into the parent drawings. Furnish certified test reports to establish conformity with the specified standards.

18.2 Setting blocks used to support the dead load of the glass shall be extruded in silicone material conforming to the design criteria, all as recommended by the glass manufacture.

18.3 Jamb shims used to centre and station the glass shall be extruded in silicone material conforming to the design

18.4 Fixed compression and roll-in glazing gaskets shall be extruded in silicone material as recommended by the glass manufacturer. Gaskets for any one light shall be one piece with injection moulded corners free of all flashings and burrs.

19.0 METAL COATINGS:

19.1 All Aluminium extrusions shall be PVDF coated to minimum 35 microns of shade approved by the Architect.

19.2 Coatings to aluminium sections and cladding where specified shall be fluoropolymer formulated and will consist of a 3 coat system comprising primer, colour coat and clear anti abrasion top coat. The coating system shall meet or exceed all the requirements of AAMA 605 - Voluntary specification for high performance organic coatings on Architectural extrusions and panels. The total dry film thickness shall be 35 microns.

19.3 After selection of colour by the Architect, the Contractor shall prepare two (2) sets of two (2) samples of each which shall define the colour and gloss range and submit them for approval.

19.4 All samples shall be identified and have a full laboratory report attached.

19.5 The coating system, including materials and application shall conform to the requirements and recommendations of the paint manufacturer.

19.6 Testing and Sampling Procedures In-process testing shall be performed on test specimens of equal metal thickness pre-treated and finished along with the production metal, specimen shall exhibit a test of at least 75 mm x 300 mm to permit instrument readings. In addition to running in-process tests to assure high quality production, additional finished extrusions or panels are to be submitted to the coating manufacturer's laboratory for extended exposure testing. All test samples shall be properly identified with date, batch number and shift indicated. The following tests shall be conducted at least once per production shift and submitted to the Employer when required.

- (i) Dry Film Thickness – evaluated with a Permascope, Isoscope or Dermatron instruction.
- (ii) Film Hardness.
- (iii) Dry Cross batch Adhesion
- (iv) Boiling Water Adhesion Test.
- (v) Gloss Measurement
- (vi) Colour Examination Against Standard
- (vii) General Appearance – Smoothness, free of blisters, sags, pinholes and other surface imperfections. Testing reports shall be certified by the testing agency, manufacturer and the Contractor

#### 19.7 Process

- (i) Dry Film Hardness – The coating shall have a hardness of H minimum when tested with “Eagle Turquoise Pencil”
- (ii) Film Adhesion – The coating system shall withstand the following adhesion tests: DRY: Make ten (10) parallel cuts 1.25 mm apart through film and ten (10) more cuts 90 degrees and crossing first ten cuts. Apply Scotch Transparent #710 Tape, 18m wide, over area of cuts, pressing down firmly against coating. Pull tape off sharply.  
WET: Make ten (10) parallel cuts as above. Immerse samples in boiling water for 5 minutes. Remove sample, dry, cool and tape-test the cross-hatched area as above.
- (iii) Gloss Measurement – Measure gloss at various locations on painted metal with a 60-"Glossmeter".
- (iv) Colour Uniformity – Check random samples of painted production metal under a uniform light source, such as natural North daylight against standard panels approved by the Employer.
- (v) Test for cure of coating using 100 double rubs with several thickness of cheesecloth wet with MEK solvent. Slight dulling of the film is considered normal, but softening shall not be permitted.

#### Performance Requirements:

Salt Spray resistance – withstand a minimum of 3000 hours exposure to 5% salt solution at 95%.R.H., 37.5 degrees C with no more than 1.25 mm creepage or loss of adhesion from scribed line or cut edges.

Humidity Resistance – Withstand a minimum of 3000 hours exposure to 100% R.H. 37.5 degrees C with no more than a few blisters, size No. 8 (ASTM D 714 – 56).

Abrasion Resistance – Withstand abrasion of sand with an abrasion coefficient value of 65 minimum when evaluated as per ASTM D 968-51 test method.

Mortar Resistance – Withstand wet mortar, 24 hour part test at 100% RH without gaining adhesion or any visual effect on the painted surface of solid colours.

Detergent Resistance – Withstand immersion in 3% synthetic detergent solution for 72 hours at 37.5 degrees C with no loss of adhesion no blistering and no visible change.

Colour Retention – Withstand maximum chalk rating of No. 8 for colours and No. 6 for white per test method ASTM D659-44 (1970).

Field Touch-up and Repair – The contractor and coating manufacturer shall supply materials for air dry touch up for spray or brush application as per instruction of manufacturer. Touch up shall be held to an absolute minimum to Architect's approval. Furnish to Owner a written guarantee warranting all work in connection with organic coating system to be free from defects in materials and workmanship for a period of Ten (10) years from date of completion and to correct promptly any defect free of cost. The following are considered as defects without being limited thereto:

- i) Peeling
- ii) Cracking
- iii) Checking
- iv) Blistering
- v) Chalking in excess #8 Chalk rating when measured in accordance with ASTM D659-44 (1965).
- vi) Fading or colour change in excess of 5 NBS unit when calculated from measurement on a spectrophotometer or colour meter capable of colour measurement by reflectance reading in accordance with ASTM D244-68.

#### 20.0 STRUCTURAL GLAZING AND CLADDING SYSTEMS

20.1 The method of assembly, reinforcing and anchorage of the aluminium structural glazing / cladding system, where indicated, is schematic. Locations and method of providing same shall be the Contractor's responsibility,



who shall design the assembly, reinforcing and anchorage to suit each specified conditions in an acceptable manner complying with the requirements specified herein after.

20.2 Visible joints shall be as shown in the Architect's drawings.

20.3 All parts shall be secured by concealed means wherever possible and where exposed to view, screw positions are to be indicated on the preliminary drawings. Exposed screws shall be of the countersunk type coloured in same finish as of aluminium or non magnetic stainless steel and shall be evenly and neatly located in an approved manner.

20.4 All components shall be assembled, secured anchored, reinforced, sealed and made weather-tight in a manner not restricting thermal or wind movements of the structural glazing. Sealants shall be concealed wherever possible.

20.5 All fastening into or through aluminium shall be SS-306 as approved by Architect.

20.6 Free and noiseless movement of all the components of the Curtain Walling system due to thermal effect, structural effect, wind pressure, seismic forces, erection or dead loads, shall be achieved without strain to the glass, without buckling of any components and without excessive stress to any members or assemblies.

20.7 Aluminium surfaces in contact with mortar, concrete, plaster, masonry, wet application of fire-proofing and absorptive materials shall be coated with an anti-galvanic, moisture barrier material.

20.8 Waterproofing:

a) A complete drainage system must be incorporated into the structural glazing frame work. Water leakage and condensation shall be drained or discharged to exterior face of the wall and all internal spaces vented by acceptable means to ensure air pressure equalization wherever possible.

b) Drainage system will be sealed off at every floor to prevent infiltrated water from leaking to lower floors.

c) Movement of water behind and on exposed surfaces must be controlled to ensure that water is not retained and that elements will not be damaged or corroded by water and to avoid the potential for algae and fungus growth as a result of standing or trapped water.

d) The junction of bracket connecting S.S. Screen with reflector system & structural Glazing system shall be fully protected against ingress of water by providing suitable water proofing systems as approved by Architect.

20.9 Anchorage System and Building Frame

Each glazed unit shall be fixed to the structural slab at each floor level. All fasteners shall be SS-304 of AISI as approved by Architect. The contractor shall also make necessary modifications to the anchor fasteners to suit existing site conditions of steel reinforcement without additional charge.

20.10 Mullions and Transoms

a) The sections of mullions and transoms shall be designed to restrict deflection under wind pressure as specified and shall be rigid enough to support and retain the glass spandrel under all conditions. The mullions shall be designed if required, to act as guide tracks for gondolas to permit its free movement in vertical direction for window washing and to sustain concentrated loading by the gondola cage. The mullions & transoms shall also to be designed to cater for the loading of S.S Screen with reflector.

b) Reinforcing members, where used, shall be completely enclosed and if fabricated from steel shall be galvanised and protected with primer and two coats of zinc chromate.

20.11 Window units (Vision Panels)

All windows shall be glazed from inside where possible. All cladding as well as internal glazing beads, if any (unless otherwise specified) shall be in anodised aluminium.

20.12 Spandrel Units

a) Spandrel shall be of glass having equal colour matching with vision areas with pacifier coating.

- b) Structural spandrel beam, structural glazing fasteners and other construction shall not be seen through the glass from the exterior and shall be fully concealed behind shadow box.
- c) A shadow box shall be provided a distance behind the spandrel glass panel. It shall consist of 50 mm semi-rigid fibre glass insulation of minimum density of 48 Kg/cum., and 0.8 mm galvanised sheet steel tray natural finished. The periphery shall be properly sealed. Surface #1 shall be adequately protected against damage until spandrel glazing is done.
- d) Two hour rating fire stops-cum-smoke seals shall be constructed continuously at the spandrel to the approval of the Chief Fire Officer and other authorities.

#### 20.13 Ventilators, Openable Windows and Doors

- a) Ventilators, windows and doors shall be provided at positions as shown on the drawings. The ventilators when in closed position shall remain watertight under all weather conditions and pass the water tightness tests as specified.
- b) All hardware and accessories shall be supplied by the contractor and when exposed shall be of stainless steel or approved aluminium alloys in approved finish.
- c) Minimum aggregate openable area of the ventilator shall be as given in the Architect's drawings.
- d) The detailed system of the ventilators and doors must be proposed by the tenderer keeping the position as shown on the drawings.

#### 20.14 Coping and Soffit Trimmer

- a) All coping and soffit panels shall have suitably designed frame reinforcement and be fixed rigidly to the structure.
- b) All joints between coping / soffit panels and between coping / soffit panels to structural glazing frame and other sections of the work shall be tightly sealed up. Effective drainage system shall be provided to drain out the water that may penetrate through the joints.

#### 20.15 CLADDING

Cladding shall be non-toxic composite aluminium panels of adequate strength with approved aluminium details. The panels shall be 4 mm thick composite units finished with PVDF coating minimum 35 micron thick of approved metallic colour. The resin content of the PVDF coating shall be minimum 75%. The back of the panel shall be chromatised minimum 3 micron thick, compatible with adhesives for stiffeners if any or given a polymer coating. The insulation fill of the composite panel shall be non-toxic on burning and panel shall be acceptable to CFO. The fabrication and installation of the cladding systems shall be carried out as per manufacturer's instructions with invisible / concealed fastenings, aluminium sub-structure, silicon sealants properly tooled etc.

All cladding panels of one kind shall be obtained in one lot from the manufacturers. Each panel shall be guaranteed for a minimum flatness of 1 mm from the true face after installation under no-wind conditions. Deviations from the true alignment of adjoining panels shall not be cumulative. Full load deflections shall be kept to the minimum possible. Each panel shall be capable of withstanding wind pressure without any permanent deformation. (Refer clause 27.0 on page TS-Str. Glazing -53.) The cladding system shall be adequately ventilated. The air gap between the cladding panels and the concrete / block wall shall be at least 50 mm to allow proper ventilation of the rainscreen system. The cavity shall be closed by a perforated bird / vermin-proof closer at bottom and by a flashing at top. The fabrication processes including cutting, grooving, benching, folding, joining, rout-in as well as installation shall be performed as per manufacturer's instructions. The panels shall be backed by approved aluminium supporting framework, fixed to walls with aluminium brackets.

#### 21.0 LOUVERED PANELS

21.1 Louvered panels shall be provided at positions as shown on the drawings.

21.2 Louvres shall be of 35 micron PVDF coated of approved shade aluminium fins of Aerofoil shaped blades of Min 1.5 mm thickness with an assumed efficiency of 50% unless otherwise specified and shall be complete with stainless steel bird-proof wire mesh ( 18 gauge) fixed internally.

21.3 All hardware and accessories shall be, when exposed, of non-magnetic stainless steel and / or coloured aluminium to match that of structural glazing / cladding wherever possible.

## 22.0 FABRICATION

22.1 General: All assemblies shall be fabricated and assembled in accordance with the drawings and the requirements of these specifications. Deviations of any nature, without approval of the Architect /PMC shall not be permitted.

22.2 Tolerances: Furnish a schedule of fabrication tolerances for all major wall cladding components. In addition to the fabrication tolerances, provide for and schedule thermal movement including assembly and installation tolerances for all major and/or applicable wall cladding components and/or assemblies.

### 22.3 Workmanship

1) All work shall be performed by skilled workmen, specially trained and experienced in the applicable trades and in full conformity with the applicable provisions of the listed References and Standards and/or otherwise noted on the drawings or as specified herein.

2) All work shall be carefully fabricated and assembled with proper and approved provisions for thermal expansion and contraction, fabrication and installation tolerances and design criteria.

3) All forming and welding operations shall be done prior to finishing. Unless otherwise noted.

4) All work shall be true to detail with sharp, clean profiles, straight and free from defects, dents, marks, waves or flaws of any nature impairing strength or appearances; fitted with proper joints and intersections and with specified finishes.

5) All work shall be erected true to plumb, level, square to line, securely anchored, in proper alignment and relationship to work of other trades and free from waves, sags or other defects.

### 22.4 Joints in Metal Work

1) All exposed work shall be carefully matched to produce continuity of line, design and finish. Joints in exposed work, unless otherwise shown or required for thermal movement, shall be accurately fitted, rigidly secured with hairline contacts and sealed watertight.

2) Where two or more sections or metals are used in building up members, the surface in contact shall be brought to a smooth, true and even surface and secured together so that the joints shall be absolutely tight without the use of any point materials. Extrusions shall be finished to eliminate any edge projection or misalignment at joints.

3) Furnish physical samples of all joinery elements as for comparative appraisal and approval of the production materials. Physical samples of all typical wall intersection assemblies shall be colour coded on surfaces and/or areas to receive sealants.

### 22.5 Shop Assembly

As far as practicable, all fitting and assembly of the work shall be done in the shop. Work that cannot be permanently shop assembled shall be temporarily assembled in the shop and marked with the approval of Architect, before disassembly to ensure proper assembly later in the building.

### 22.6 Sleeves

Unless otherwise noted, all aluminum sleeves shall be extruded sections designed to accurately interlock with adjacent sections and incorporate serrated surfaces for the secure bedding of sealant between the parent metal and the sleeve.

### 22.7 Fasteners

1) All fasteners shall be of SS-304 of AISI stainless steel with self locking devices, unless otherwise specified, and of sufficient size and strength to withstand the applicable design wind load and dead load forces with safety allowance factors as required for the specific materials. The spacing and quantities of fasteners shall be as required to develop the maximum strength of the member they secure or support. Washers and/or other

accessory items shall be of the same material as the fastener. Torque tightens all assembly fasteners to achieve the maximum torque tension relationship in the fastener.

2) All fasteners shall be concealed unless otherwise shown or approved. The head style for all exposed fasteners shall be countersunk oval head unless otherwise specified on the drawings. Exposed fasteners shall be finished to match surrounding metal finish.

3) All fasteners including washers and accessory items shall be scheduled and designated on the shop drawings so that anyone can witness and assess the assembled units to ensure that all fasteners conform to the designated and approved type, size, material, spacing, etc. When certain items are not readily apparent, such as material and alloy or torque tightening requirements, special instructions for the identification and appraisal of such items shall be issued.

## 22.8 Protection of Metals

1) Protection against galvanic action shall be provided wherever dissimilar metals are in contact.

2) Aluminium which is to be in contact with cured concrete, mortar or plaster shall have the contact surfaces protected wherever crevices between the contact surfaces may entrap moisture and corrosive elements. All metals, except stainless steel, which are to be in contact with fresh concrete, mortar or plaster, shall have the contact surfaces protected with epoxy paint.

3) Furnish a schedule of all protective coatings and related items including the designation of area and/or specific locations, materials used, special instruction, specification data sheets, etc.

## 22.9 Welding

1) All welding in aluminum work shall be done by the inert gas shielded arc or fluxless resistant techniques and with electrodes and/or by methods recommended by the suppliers of the metals being welded. Type, size and spacing of welds, shall be as shown on approved shop drawings.

2) Welds in galvanized metal shall be touched up with zinc rich paint.

3) Welds behind finished aluminum surfaces shall be so done as to eliminate distortion and/or discoloration on the finished side. When required, weld spatter and welding oxides on finished surfaces shall be removed by de-scaling and / or grinding. Provide low heat filled welds using chill bar on finished side to eliminate dimpling, distortion and / or discoloration on the finished or exposed surface. Plug, puddle or spot-welding are not permitted. If weld beads are shown on exposed finished surfaces, the surfaces shall be ground and polished to match and blend with finish on adjacent parent metal.

4) Structural welds shall be made by certified welders and shall conform to the general recommendations and regulations of AWS Specification D1.0-46.

- Dirt grease, lubricant, or other organic material shall be removed by vapour degreasing or suitable solvent.
- Joints rejected because of welding defects may be repaired only by re-welding. Defective welds shall be removed by chipping or machining. Flame cutting shall not be used.

5) Wherever welding is done in proximity to glass or finished surfaces, such surfaces shall be protected from damage due to weld sparks, spatter or tramp metal.

6) All welds shall be scheduled and designated on the shop drawings so that anyone can witness and assess the assembled units to ensure that all welds conform to the designated and approved type, size, spacing etc.

## 22.10 Soldering

All soldering and/or brazing shall be done as recommended by the suppliers of the metals involved.

## 22.11 Shop painting of Carbon Steel

Item of carbon steel, unless galvanised or scheduled for other finish, shall be thoroughly cleaned of all loose scale, filings, dirt and other foreign matter and shall be painted with zinc chromate primer.

## 22.12 Factory Application

As much work as possible shall be carried out in the factory. All glazing shall be done in the factory. Gaskets shall be pre-positioned and welded in the factory as far as possible. Site work shall be kept to a minimum.

## 23.0 GENERAL EXECUTION

23.1 The drawings supplied by the Architect shall be considered essentially schematic, except of profiles of exposed surfaces which shall be as indicated. If, in the opinion of the contractor, a change of profile is required in order to meet the specifications, he shall consult the Architect for a review of the conditions.

23.2 The method of assembling, reinforcing and anchorage of the aluminum structural cladding system, were indicated is schematic. Location and method of providing same shall be the Contractor's responsibility, who shall design, assemble, reinforce and anchor to suit each specified condition in an acceptable manner complying with main building structure. Site work shall be coordinated with the Overall programme.

23.3 Visible joints shall be as shown on the Architect's drawings.

23.4 All parts shall be secured by concealed means and screws exposed to view shall not be allowed.

23.5 All components shall be assembled, secured, anchored, reinforced, sealed and made weather tight in manner not restricting thermal or wind movement of the metal wall cladding /curtain walling system. Where possible, sealants shall be concealed.

23.6 Free and noiseless movement of all components of aluminum structural glazing and cladding system due to thermal, structural, wind pressure, or dead loads shall be achieved without strain to glass, without buckling of any components and without excessive stress to any members or assemblies.

23.7 The entire aluminum structural glazing and cladding system shall be assembled and installed so that all leakage and condensation shall be drained and discharged to the exterior face of the wall.

23.8 Movement of water behind and on exposed surfaces shall be controlled to ensure that water is not retained and that elements will not be damaged or corroded by water and to minimize the potential for algae and fungus growth as a result of standing or trapping water.

### 23.9 Measurements:

The measurements given on Architect's drawings shall not be used by the Contractor for preparing his shop drawings and for executing the work. All dimensions shall be actually measured on site and in case of any discrepancy between measurements on site and in drawings, modules shall be decided in consultation with the Architect.

## 24.0 PRE-CONSTRUCTION LABORATORY PERFORMANCE TESTING.

### 24.1 General

Specification 24.1 to 24.7 shall apply and the Contractor is required to carry out performance tests in laboratory condition at one of the approved test laboratories at his own cost if specifically mentioned in the Bill of Quantities. The performance mock-up are full-size representative portion of the proposed exterior wall system built to study construction details, test for the whole system meeting the performance specification for weather , structural load and movements. The Contractor shall carry out on site water penetration test at locations as specified in clause 24.8 at his own cost. The contractor shall produce Mock-up Elevation, construction detail drawings and structural calculations for the structural glazed curtain wall mock-up test units and submit to Architects office for the final approval. The Contractor shall forward the copies of approved mockup elevation and shop drawings and test parameters to the Test Laboratory prior to installation of the test units. These drawings shall include:

- Test elevation and sections showing bracket spanning.
- Full scale typical details of unitized panels (intersections of members).
- Typical support details and spanning.
- Extent & type of sealants: weather and structural sealants.
- Pressure equalization and Drainage system in each panel with size.
- Blanking off details and spandrel panel pressure release .

- Openable vent details with multipoint locking positions.
- Method of installation.

Any deviations from the drawings shall be agreed upon before commencement and recorded in the final test report. Contractor shall install the mock-up in line with the approved drawings and with the same supervision and installation work force.

#### 24.2 Test Units

- 1) The test units shall comprise of components and full size representative portion of the proposed exterior wall system under examination. The width of the test sample shall be not less than three typical elements / units. The height of the test sample shall be not less than 2 storey high and must contain full height modules of the proposed structural glazing system. Vertical and horizontal movement joints shall be included in the test sample.
- 2) Critical details of the building facade which differ from those in the representative test sample, such critical inward and outward building corners, overhangs, coping seal at roof level and similar, supplementary on site test for water tightness shall be performed on such part of the facade.
- 3) The materials and components of the test sample (glass thickness, size and strength, aluminum profiles, bracket spanning, sealant, gaskets, accessories etc.) shall be of the same, type and size and have the same details, methods of construction, flashing and anchorage as that of proposed on the building facade.
- 4) The cost of entire testing shall be borne by the Contractor.
- 5) The test sample shall be mounted and sealed into a simulated building frame in the manner and by the same fixing which are intended to attach the facade to the building structure. The support frame if not same but shall be of equivalent stiffness to that supporting the building to prevent unrealistic deflection of the prototype sample.
- 6) Simulated floor slabs and spandrel shall be to actual depth as of site condition with the air seal connected to the slab. The air seal of the test sample shall be continued to the air seal of the test chamber.
- 7) All Unitized mock-up panels in the facade shall be sealed at the test chamber boundaries. This is to minimize the effects that the surrounding construction will have on the test performance of the sample. All pressure equalization and drainage slots or holes in the test sample shall be left open.
- 8) Transparent viewing panels shall be provided so that the performance of the façade in areas that are not readily seen can be determined.

#### 24.3 Inspection of test units

- 1) The Contractor shall allow for the PMC's / Architect's / Employer's representative to inspect the test sample during erection. At this stage the adequacy and stiffness of the support structure shall be assessed. When the installation of the test sample is complete, the PMC's / Architect's / Employer's representative shall inspect the test sample and if satisfied, shall approve its completeness in writing.
- 2) Testing shall commence only after obtaining the written approval as referred above.
- 3) Full time supervision of the contractor shall be provided for the erection of the test unit and all thru testing of the test units.

#### 24.4 TEST SEQUENCE- TEST PRESSURES

Prior to testing, unlock, fully open, close and lock operable windows, doors in the mock-up for minimum of 5 cycles. If any repairs or corrections are made, repeat the above cycle for 5 times.

- 1) Air Infiltration Test (ASTM E-283) Method :

The test shall be conducted at 300 Pa pressure. The test chamber leakages shall be calculated by attaching air tight seal of polythene sheet to the face of the curtain wall with the tape and seal all around and applying Positive, negative pressures of 300 Pa to measure the air infiltration rate through the test apparatus by calibrated flow meter placed in the test chamber air line. Now sealing film or tape shall be removed from the test sample and the total air infiltration through the test sample and the chamber shall be recorded. The difference between the total leakages and the chamber leakage shall be the leakage of test sample. Evaluation : Permissible air leakage shall be: 0.25 m<sup>3</sup>/hr/m<sup>2</sup> for fix area and 1.0 m<sup>3</sup>/hr/mtr crack length of operable panel.

#### 2) Test Water tightness (Static pressure) Method :

The differential air pressure for the test shall be 600 Pa. Water shall be sprinkled on the test unit at 3.4 L/m<sup>2</sup>-Min apply the air pressure differential within 15 seconds - negative pressure of 600 Pa shall be maintained continuously for 15 minutes before the pressure is turned to zero and stop the water spray.

#### Observation :

All water leakage and drainage system at the joints and ventilators of the Curtain Walling System shall be observed from the inside of the chamber. Evaluation : If water observed in the operable vent drainage path and the same is drained thru drain slots after the spray is stopped it shall be considered as pass. Any uncontrolled water in excess of 15 ml or more on the top surface of any exposed interior shall be considered as leakage. In case of leakage the remedy needs to be carried out and the retest shall be conducted.

#### 3) Test of Water tightness (Dynamic pressure) Method :

This test shall be performed upon completion of the test for water penetration by static pressure.

The Dynamic water penetration test should not commence within thirty (30) minutes of the static water penetration test. Maintaining the wind flow with the help of wind generating device, wind speed shall be adjusted to 31.28 m/sec, water shall be sprayed on the complete face of the test specimen at the rate of 3.4 Ltr/m<sup>2</sup>-Min. The spray shall be maintained for a period of not less than 15 min.

#### Observation :

Observation of the internal face of the facade shall be carried out during the water spray operation and for five (5) minutes after the water spray has stopped and there is zero air pressure different on the facade. Any water appearing on the inside face of the facade shall be recorded, with the extent and, if possible, the source of leakage indicated.

#### Evaluation :

There shall be no leaks at the peak pressure equal to 600 Pa static positive pressure. A leak is considered to occur when:

- a) Water appears on the inside face of the facade and is visible from an occupied space in excess of 15 ml of water or
- b) Uncontrolled water appears on the inside face of the facade and is likely to damage insulation or other Architectural fixtures.
- c) Uncontrolled water is defined as any leakage that is not contained and drained away within the test duration (including the five (5) minutes observation period) in excess of 15 ml of water.

#### 4) Test of Wind Resistance under static pressure

#### Method :

The equivalent load for wind pressure or wind suction shall be given to the test unit as increasing and decreasing the inside pressure of the "Pressure Chamber" at which the test unit is fixed.

Static Wind Pressure : The static pressure shall be increased to a maximum of + 215 Kg/sq.m. in steps. Observation : Deflection on each observational point of the test unit shall be observed and recorded under the static pressure as described above.

Evaluation : No damage or harmful permanent deformation on any parts shall be found at the maximum design wind pressure as defined in item 24.4. The deflection of the main structural members in this condition shall be as follows:

- a) Mullions less than  $L/175$  in case of single glass and  $L/240$  in case of double glass ( $L$  = length between support) or less than 15 mm whichever is least.
- b) Transoms Less than  $L/300$  ( $L$  = length between support) or less than 15 mm whichever is least. No damage or harmful permanent deformation of any parts excepts sealing materials shall be found at the maximum testing pressure. The maximum deflection / span ratio of glass shall not exceed 1: 90. The residual displacement of a member shall not exceed  $L/1000$ . The slippage at supports and fixing shall not exceed 1.0 mm.

#### 5) Seismic Racking test

Method : The floor beam shall be subjected to 3 cycles of Lateral Displacement up to the value of 0.4% of floor height with no time restrictions. First the beam will be jacked To one direction to the maximum limit of the Displacement and released to allow the system to come Back to its original position. The beam is than jacked to Other direction to the maximum limit and released. Like Wise 3 cycles are repeated.

Observation : The observation team is placed inside and outside The specimen to watch for any sudden effects of Jacking.

Evaluation : No glass breakage or fall out is allowed. Any damage shall be easily repairable without any part replacements required. No wall component fallout is allowed.

6) Repeat Air test : Same as described under air infiltration test with static pressure.

7) Repeat Water test static : Repeat the water penetration test under static pressure.

#### 8) Proof test

Method : The test sample shall be subjected to proof tests. The applied positive and negative pressure shall be 1.5 times the designed wind pressure. Each proof test pressure shall be maintained on the test sample for a period of 10 seconds at peak pressure and released to zero.

Evaluation : Under proof test there shall be no collapse shall mean any one or any combination of the followings:

- a) Dislodgment of any glass.
- b) Dislodgment of any frame, panel or any thereof
- c) Failure of any fixings that connect the façade to the building structure, such that the test sample is unstable.
- d) Failure of any stop, locking device, fastener or support which would allow an opening light to come open.
- e) The permanent deformation in framing members in excess of  $L/1000$  is not permissible and considered as failure.

### 24.5 Form of Report

Details of the test sample (including an outline of the simulated building frame) and the test apparatus, instrumentation and method shall be clearly given in a report. The report shall include the following:

- a) An identification and general description of the facade and Certificate of Identity from the contractor.
- b) Drawings of the actual test sample showing modifications, if any.
- c) Test sequence with pressure used in all tests.
- d) Location of all transducers for the structural performance test.
- e) Displacements, span/deflection ratios and air infiltration rates.
- f) Other pertinent observations.

### 24.6 Record Drawings

1) The testing laboratory shall keep a copy of approved test unit, shop drawings and calculations at testing laboratory accurately and neatly recorded on the above mentioned shop drawings all changes, revisions, modifications, etc. made to test unit, which shall become the record drawings.

2) On completion of testing and after approval of test reports, the testing laboratory shall submit the marked up record drawings to the Project Consultant.



#### 24.7 Cost of Performance Testing

The cost of testing at the approved lab shall be payable as per relevant item as indicated in the Bill /Schedule of Quantities. Testing shall include for the test chamber, support structure for the test, cost of fabrication, erection, corrections to and the demolition of the test unit. If the test unit fails to pass the initial testing, the Contractor shall make the necessary corrections to the test unit and shall have the Test unit re-tested by the Testing laboratory until it passes the test. The rate shall also include for cost of correction to the test unit and cost of re-testing and no additional cost shall be payable in this regard.

#### 24.8 Site Tests

The Contractor shall carry out site tests at his own cost to determine resistance to water leakage as per recommendations given in AAMA 501.2-94 and relevant Bureau of Indian standards for "Field Check of Metal Storefronts, Curtain Walls and Sloped Glazing Systems for Water Leakage". The test areas shall be selected by the Architect, one for every 600 sq.m. approx. of installed curtain wall and glazing system. Testing will normally be ordered on Lower floors but the Architect may at his discretion order tests to be carried out on any upper floor. In case of any test failing, the Architect shall order more tests to be conducted at the Contractor's cost. Each test area shall be:

- a) 10 sqm. minimum or
- b) 25 m. Run of perimeter of vision and spandrel units
- c) 4 entire panels of standard types, whichever is the least.

#### 25.0 INSTALLATION

25.1 Quality Control : See clause 7.3

#### 25.2 Qualification of workmanship

All work shall be performed by skilled workmen, especially trained and experienced in the applicable trades employed and in full conformity with applicable provisions of the listed References and Standards and/or as otherwise noted on the Architect's drawings or as specified herein. The qualification of the Contractor's installation workmen shall first be filled with and approved by the PMC / Architect.

#### 25.3 Setting out

Bench marks for elevations and building line offset marks for alignment shall be established on each floor level by the contractor. Should any error be found in their location, the Contractor shall notify the PMC in writing and installation work shall not proceed in the affected area until the errors have been corrected. The Contractor shall submit the structural glazing anchorage plan for endorsement by the PMC and approval by the Architect. The Contractor shall coordinate his system of anchorage with PMC according to site conditions.

#### 25.4 Prior Inspection of the Structure

After the setting out has been established and before beginning installation in any area, the Contractor shall examine all parts of the structure on which the curtain walling system/metal wall cladding are to be placed in that area. Should any conditions be found which, in his opinion, will prevent the proper execution of his work or endanger its permanency, he shall report such conditions in writing to the PMC. Installation work shall not proceed in that area until such conditions are corrected or adjusted to the satisfaction of the PMC.

#### 25.5 Workmanship

All parts of the aluminum structural glazing and cladding system shall be erected true to plumb and in proper alignment and relation to establish setting out, as shown on approved shop drawings.

#### 25.6 Erection Tolerances

The installed metal wall cladding/curtain walling system components shall conform to the following erection tolerances under no-wind conditions:

- a) Amount of total deviation and/or misalignment in any direction for vertical members: 3 mm maximum in a height of 4 m (non-cumulative) and maximum 7 mm in full-height of cladding/curtain walling.

- b) Amount of total deviation and/or misalignment in any direction for horizontal members : 3 mm max. in a length of 7 m. 5 mm in full length
- c) Maximum offset from true alignment between two abutting members shall be 1 mm. No edge projection or misalignment will be permitted.
- d) Maximum joints, gaps or openings between removable glazing stop and adjacent member shall be 1mm and/or a maximum 1 mm cumulative opening at both ends of removable members (0.5 mm each end).
- e) Deviation in spacing of brackets + 3 mm.
- f) Allowances for the cumulative effect of all tolerances (fabrication, assembly, thermal and erection) must be made to ensure a workmanlike installation. The documentation and distribution of this information to all applicable installation and inspection personnel is essential in order to ensure the standard of quality and workmanship required.

25.7 Installation within and/or adjacent to concrete: Where work is to be installed within and/or adjacent to concrete, no aluminum structural glazing and cladding system components other than built in anchor devices shall be put in place until the concrete work is completed, including the removal of all forms, shoring, etc.

25.8 Anchorage : See clause 12.5 (2) and 20.9.

a) Anchorage of the aluminum structural glazing and cladding system to the structure shall be by approved methods and in strict accordance with approved shop drawings. After the aluminum structural glazing and cladding system are properly positioned, all connections so designated on approved shop drawings shall be rigidly fixed by welding or other positive means.

b) All anchorage assemblies and their related components shall be thoroughly scheduled and described on the shop drawings so that anyone can evaluate an installation and ensure its compliance with the contract documents. Designate trades responsible for furnishing and/or installing materials if other than the Sub-Contractor. Descriptive items shall include the access removal movement and tolerances of related building and the aluminum structural glazing and cladding system direction and magnitude of thermal expansion, materials, sizes, quantities and any special instruction as may be required. All primary aluminum structural glazing and cladding, anchorage assemblies inclusive of frame/structural mullion shall receive a 100% inspection.

#### 25.9 Welding

All welding shall be done by skilled mechanics qualified or licensed in accordance with local building regulations. Welds and adjoining burnt area in prime coated surfaces shall be thoroughly cleaned and painted with one coat of primer. Welds in galvanised steel shall be coated with one coat of zinc rich paint. Special care shall be taken to protect glass and other furnished surfaces from damage and to prevent causing fires.

#### 25.10 Use of sealing materials

a) Sealing materials shall be used in strict accordance with the Manufacturer's printed instructions and shall be applied only by workmen specially trained or experienced in their use. Before applying sealant, all mortar, dirt, dust, moisture and other foreign matter shall be completely removed from surfaces it will contact. Adjoining surfaces shall be masked when required to maintain a clean and neat appearance. Sealing compounds shall be tooled to fill the joint and provide a smooth finished surface.

b) The manufacturer(s) of the applicable materials shall, when required render technical assistance prior to the application of any sealant and witness the first applications as well as periodic site inspections thereafter. The contractor shall witness and document all inspections performed by the sealant manufacturer and provide close supervision of all workmen used to apply the sealant.

#### 25.11 Coping and soffit trimmer

Installation of coping and soffit panels and field sealing between the copings and other trades shall be performed by the Contractor.

#### 25.12 Tensioning of Bolts

All bolts shall be correctly tensioned. The tension shall be specified on shop drawings. At least 10% of bolts shall be mechanically checked for corrected tension.

#### 5.13 Sequence of Installation

If so directed by the PMC, installation of the aluminum structural glazing and cladding shall be postponed in areas as designated by the PMC for a specified period of time so as to facilitate moving materials/equipment into and out of the building and installation of M&E (Mechanical & Electrical) fittings during construction. The Contractor's work is to proceed along guidelines and schedule as directed by the PMC.

#### 25.14 Removal of Debris

All debris caused by or incidental to the installation work shall be promptly removed from the job site as the work progresses. Weep holes and drainage channels shall be unobstructed and free of dirt, rubbish and sealant.

#### 25.15 Protection and Cleaning

a) The Contractor shall adequately protect all aluminum sections, glazing, cladding sheets, components and accessories from damage during shipment, storage, erection and after completion of the work by use of protective film/foil of approved non-staining quality,

b) At such time as may be directed by the PMC, the Contractor shall remove all protective coverings and/or coatings and clean surfaces free of all soil and discoloration. Only those cleaning agents that are acceptable to the applicable aluminum, glass and coating manufacturers shall be used and where doubt exists, spot tests shall be made to satisfy the PMC.

# **WATER SUPPLY & DRAINAGE SYSTEMS**

## **WATER SUPPLY & DRAINAGE SYSTEMS CONTENTS**

SL NO DESCRIPTION

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- 13.0 CIVIL & STRUCTURAL WORK

### **1.0 SCOPE**

The scope of this section covers guidelines for the contractor on the specification and schedule of material and the general requirements. These shall be read in conjunction with the general conditions, technical specifications and bill of material.

#### **1.1 SCOPE OF CONTRACT**

The scope of work under this contract covers equipment, material, accessories and labour required for the specified works and to carry out the erection as specified and shown on the drawing and schedule of material. Safety, good workmanship and quality are the prime requisites of the work covered under this contract. All the equipments, material and the work carried out shall meet the relevant codes, specification and the intents of specifications and the proper functioning of the systems and installation and shall be in correct lines, levels etc.

#### **2.0 DIVISION OF WORK**

The division of work/scope between the contractor and client or other agencies shall be as indicated in-section 2102 – Division of work.

#### **2.1 STANDARDS & REGULATIONS**

Each section indicates the Indian/International Standard Specification to be followed. It is the responsibility of the contractor to meet the statutory regulation, local codes and other relevant standards and specifications connected to his work being carried out as may be in force at the time of execution and/or addition of new requirement.

#### **2.2 SPECIFICATION**

The technical specification attached herewith gives general guidelines and minimum standards for equipments material and workmanship. However it is the responsibility of the contractor to meet the statutory provision and IS/local codes as may be applicable at the time of execution.

#### **2.3 DEVIATIONS**

Should the tenderer wish to deviate from the provision of specification and drawings, the same shall be indicated separately at the time of tender submission. In the absence of any deviation it is deemed that the tenderer is fully satisfied with the intents of specification and drawings and their compliance with the statutory provisions and codes. However, the offer shall be strictly on the basis of tender specification and schedule of material. The offer for the deviated items shall be furnished separately against respective item in tender. The deviation shall include the following to access the merit of such deviations.

- a) Necessity for such deviation and its merit
- b) Technical details along with literature
- c) Commercial implication along with supporting calculation.

## 2.4 MATERIAL

The equipments and material shall meet the specifications and requirements indicated in the technical specifications covered under specific section and the relevant equipment data. The equipments wherever indicated shall be BMS compliant/compatible. The makes of material shall be one of the recommended makes covered under Section makes of material.

## 2.5 WORKMANSHIP

Safety good engineering and workmanship, neat appearance etc. are the prime requirements of the contract to achieve the same. The contractor shall co-ordinate with the main contractor and other agencies during the progress of work and later adequate care before carrying out the work. Necessary approval shall be obtained from the site in charge before incorporating modifications, changes or deviation from the drawing approved for execution. Such deviations shall be immediately incorporated/recorded along with the approval of site in charge.

## 2.6 SCHEDULE OF WORK AND CONTRACT VALUE

The schedule of work broadly indicates the scope and quantity of work to be carried out based on the information made available and the quantities estimated from the reference drawings. The contractor shall estimate the exact quantities through site measurements and from drawings issued before ordering the materials and update them during the progress of work.

The above quantities and the scope of work shall be subject to variation during the progress of work due to site condition, additional requirements or any other reasons. Also deletion or replacement of items and additional items may arise during the progress of work for augmentation or betterment of installation and change in the basic planning of the project. The above changes can result in the variation in contracted quantities. Such variations shall not alter the unit rates accepted, subject to the impact on the total contract value is within 25%. Addition work, if required, shall be carried out during the progress of work, the rate for the same shall be derived from tendered item or total cost to the contractor plus 20% against overhead and profit.

## 3.0 REFERENCE DRAWINGS

The drawings issued with the tender are basic diagrammatic drawings and are part of the tender document. Based on this contractor shall prepare correct technical drawings and submit for Consultant's approval. Contractor shall preserve one set of this drawing in good condition incorporating all modifications carried out from time to time during the erection period at the site and shall incorporate them and submit to the Consultants/Clients after completion of the work.

### 3.1 WORKING DRAWINGS/SHOP DRAWING

Contractor shall submit the following details within 15 days of award of contract.

- a) List of equipments and the power requirement
- b) Technical literature and catalogues of all equipments and material
- c) Foundation drawings and structural support details for equipment to be carried out by the Civil contractor/others.
- d) General arrangement, schematic power and control diagrams of electrically operated equipments and appliances along with control scheme write-up.
- e) Detailed CPM/Pert chart indicating the supply and erection of equipments and material based on the construction schedule along with the probable date of supply of material by clients/work of other agencies.
- f) List of activities that are expected to be completed by client/others.

The contractor shall prepare execution drawings and get them approved prior to taking up of execution work. The execution drawings shall cover but not limited to the following.

- a) Layout drawings duly co-ordinated with other services indication dimensions, sizes, weights and co-ordinates.

- a) Detailed section drawings indicating levels and profiles, suspension arrangements, etc.
- b) Engineering details fit for execution duty certified for structural safety by competent/qualified person.
- c) Details and spacing of equipment mounting, equipment connections, supports and hangers.
- e) Statutory clearances required, isolation and dismantling accessories to be provided at the equipments for easy operation and maintenance.
- f) Material specifications
- g) Shop drawings of equipments, ancillaries and control panels and switchgears etc. including physical dimensions, schematic distribution, control wiring etc. The approval of drawings does not relieve the contractor of their responsibility of meeting the intents and requirements of the specification and statutory requirements. He should also ensure suitable technical feasibility of all such works as per required standards.

### 3.2 AS INSTALLED DRAWINGS

The contractor shall prepare as installed drawing on completion of the work incorporating all modification, changes and deviations carried out on the execution drawings. The contractor shall submit 4 sets of hard copies and 2 sets of Autocad soft copies in CD at the time of commissioning and handing over. The final payment against commissioning shall be effective only after submission of the as installed drawings.

### 4.0 MEASUREMENTS AND PAYMENTS

The mode of measurement and payment shall be strictly indicated under Section measurements and payments. This indicates the mode of measurement, items to be included and items excluded etc. in a broad basis. However, it is the responsibility of the contractor to meet the intents of the specification and total installation on the works contract/turnkey basis.

#### 4.1 INSPECTION

The Consultants/Clients shall have the right to inspect the equipments, material and the workmanship during various stages of manufacturing storage and erection. The contractor shall at their cost, make necessary arrangements for such inspection. Also the Consultants/Clients shall have access to the store of the contractor for such inspection. The Consultants/Clients shall reject the material if found substandard or not meeting the specification and statutory requirements.

#### 4.2 TESTING & COMMISSIONING

The contractor shall carry out in house, inspection, testing and commissioning of the equipments and the entire installation at various stage and submit the report for the scrutiny of the Consultants. The contractor shall provide necessary instruments, appliances, loads and manpower required for the testing and demonstration of the performance of equipment and installation at site, manufacturer's work or elsewhere at various stages of manufacturing, pre-installation or post installation as required by the Consultants. These instruments and appliances shall be got tested and calibrated for their accuracy and performance by competent authorities. The contractor shall, in the presence of clients, carry out pre commissioning, testing and balancing of the system and incorporate necessary rectification before the installation is offered for taking over. Four sets of test reading shall be submitted for the scrutiny of the Consultants. The installation shall be taken over after the final testing and commissioning of the equipment and entire installation in the presence of Consultants/Clients. The Consultant/Client shall have the right to witness the testing of the equipments at the manufacturer's work and pre shipment inspection. The contractor, at their cost, shall arrange such inspection.

The inspection and testing carried out by the Consultants/Clients or third party does not relieve the contractor of their responsibility of carrying out routine inspection and testing during each stage of procurement, manufacture and installation and also meeting the intents and requirement of the specification and statutory requirements.

#### 4.3 STATUTORY INSPECTION

The contractor shall be fully responsible for meeting all the statutory obligations and local inspectorates pertaining to the works carried out by them. It shall be contractor's responsibility to liaison with the concerned authorities for obtaining supply of connections/permissions, all documentations as well as statutory visit by authorities before commencement/during construction and should be embodied in the tender price.

#### 4.4 HANDING OVER

The installation shall be handed over after a satisfactory testing & demonstrating post installation. Contractor to bring all equipments/appliances/electrical load and engineer to demonstrate all readings for all items for the specs. before execution including stress testing along with the following documentation.

- a) 4 sets of prints of the as installed drawings along with tracings/CDs
- b) 4 sets of test reading and certificate of local authorities duly certified.
- c) 4 sets of detailed equipment data and operation and maintenance manuals including one original
- d) Manufacturers warranty
- e) List of recommended spares
- f) Performance guarantee in the prescribed form including financial - 2 years warranty full replacement.

The final acceptance shall be effective only after the submission of the above documents.

#### 4.5 PERFORMANCE GUARANTEE

All equipment and the entire installation shall be guaranteed to yield the specified ratings and design conditions plus/minus 3% tolerance for a period of 5 years from the date of handing over. Any equipment found short of the specified ratings by readings shall be rejected.

#### 4.6 COMPENSATION FOR SHORTFALL IN CONTRACT RATINGS

The ratings/capacities of the plant offered at the time of tender are subject to realization during the performance tests. In case, the capacity rating of the chiller packaging established during the performance tests fall below 3% of the contract capacity/ratings, the Employer shall recover for such shortfall in capacity as given hereunder:

- i) Shortfall of every percentage or part thereof, 10% of the cost of package, cost include supply, installation, testing and commissioning inclusive of all taxes, duties, levies etc. and consumables.
- ii) If the shortfall is more than 5% (excluding the tolerance of 3% mentioned above) the Employer reserved the right to insist on replacement of the machine.

#### 4.7 COMPENSATION FOR EXCESS POWER CONSUMPTION

The tenderer shall substantiate power consumption rating furnished in the tender by means of T - , PH diagram and other theoretical calculations. The same will be scrutinized and accepted, if found reasonably correct. However, the same shall be realized during actual performance tests at site (subject to tolerance of +3% of the contracted 1kW/TR). If the power consumption exceeds the contracted ratings, compensation for not meeting the contract rating shall be recovered by the Employer from the contractors bill.

#### 4.8 OPERATION AND MAINTENANCE

The contractor, if required, shall submit their offer for annual operation and maintenance of the plant and installation based on lumpsum or manpower basis. The rates shall be for 8 hour shift and shall include all charges viz. material, manpower, transportation, handing charges, taxes and duties. The annual maintenance charges shall be applicable only after the defects liability. The breakdown time shall be limited to 2 hours for minor fault and 24 hours for major fault. Necessary extension shall be provided for special cases if found necessary. Penalty, if any, shall be applicable for delay in breakdown calls as indicated in the General / Commercial conditions.

#### 4.9 DIVISION OF WORK

Scope under this section the division of work between the contractor and others on a broad basis, both supply of material and installation. The details of material to be included in the supply items as well as installation, testing and commissioning of the system are covered under respective section and measurements and payments. The scope of work of the contractor for installation of equipments and material supplied by the clients covers:

- a) Taking delivery of material, storage and safe custody till handing over.
- b) Transportation to the site of erection.
- c) Supply of all fixing material, supports and accessories.
- d) Supply of consumables for testing and commissioning.

- e) Maintaining register of material received and utilised.
- f) Hand over excess material.

## 5.0 EQUIPMENTS

The scope under this section shall cover the specification and details of equipments.

The equipment shall conform to the relevant standards and specifications indicated under each section.

### 5.1 STANDARDS

The following standard specifications shall be applicable.

- a) IS : 1520 Horizontal centrifugal pumps for clear cold fresh water
- b) IS : 1710 Vertical turbine pumps for clear cold fresh water
- c) IS : 5659 Pumps for process water
- d) IS : 9137 Code for acceptance test for centrifugal, mixed flow and axial pumps-class C.
- e) IS : 10981 Code for acceptance test for centrifugal, mixed flow and axial pumps- class C
- f) IS : 10596 COP for selection, installation, operation and maintenance of pumps for industrial applications.
- g) IS : 9542 Horizontal centrifugal monoset pumps for clear, cold, fresh water
- h) IS : 8034 Submersible pumps

### 5.2 GENERAL REQUIREMENTS

The pumps assembly shall be direct driven suitable for clear fresh water of temperature range 5C to 80C and shall be complete with pumps, motors, shafts, seals, coupling, glands, mounting frame fixing accessories etc. and shall conform to equipment data.

The pumps shall be single suction mono-block or double suction horizontal split case as indicated in the equipment data and bill of material. The pump shall deliver the required water quantity at the pressure head indicated. The capacity of motor indicated is only a guideline and shall meet the duty specified. The pump selection shall be done to achieve lowest power consumption based on the QH chart of different models. The velocity of suction pipe should not exceed 1.5 m/s.

## 6.0 SANITARY APPLIANCES & FITTINGS

### 6.1 SCOPE

The scope under this section shall cover the specification and details of sanitary appliances and fittings. All sanitary appliances and fittings shall be new, of best quality and one of the recommended make and model specified. All appliances and fittings shall be with ISI approval mark and without any defects. All ceramic appliances and accessories shall be vitreous glazed china wears of white colour unless otherwise specified. All appliances shall be complete with all accessories and fixing materials. All sanitary fittings shall be heavy duty brass with chromium plating on exposed surfaces. The fittings shall be complete with all accessories, wall flanges etc.

### 6.2 STANDARD SPECIFICATIONS

The standard specifications shall be as follows :

- a) IS : 2556 Specifications for vitreous sanitary appliances (vitreous china) Part 1 General requirements  
Part 2 Specific requirements of wash-down water closets. Part 3 Specific requirements of squatting pans  
Part 4 Specific requirements of wash-basins Part 5 Specific requirements of laboratory sinks Part 6 Specific requirements of urinals  
Part 6/sec 1) Bowl type  
Part 6/sec 2) Half stall urinals Part 6/sec 3) Squatting plates Part 6/sec 4) Partition slabs Part 6/sec 5) Waste fittings  
Part 6/sec 6) Waster spreaders for half stall urinals



Part 7 Specific requirements of half round channel

Part 8 Specific requirement of siphonic wash-down water-closets

Part 9 Specific requirements of bidets

Part 10 Specific requirements of foot rest

Part 11 Specific requirements for shower rose

Part 12 Specific requirements for floor traps

Part 13 Specific requirements of traps for squatting pans

Part 14 Specific requirements of integrated squatting pans

Part 15 Specific requirements of universal water-closet

IS : 771 Specification for glazed fire clay sanitary appliances Part 1 General requirements

Part 2 Specific requirements for kitchen and laboratory sinks

IS : 2548 Specification for plastic seat and covers for water closets

Part 1 thermostat seats and covers

Part 2 Thermoplastic seats on covers

IS : 2326 Specification for automatic flushing cisterns for urinals

IS : 774 Specification for flushing cisterns for water closets and urinals (other than plastic cisterns)

IS : 7231 Specification for plastic flushing cisterns for water closets and urinals

### 6.3 INDIAN WATER CLOSETS

The Indian water closets shall be Orissa pattern squatting pans conforming to IS : 2556 part 14 shall have a minimum size of 580x440 mm. The WC shall be complete with self draining flushing rim of box with adequate number of discharge holes, supply horn, weep hole, anti stip foot rust etc. The pans shall be preferably with integral P-trap. The exterior surface of the outlet shall be rough, non glazed to achieve proper bonding between the WC outlet and pipe.

### 6.4 WASH DOWN (EUROPEAN WATER CLOSET)

The European water closet shall be sitting pan of one piece construction with S or P trap conforming to IS : 2556 Part 3, and having a minimum size of 550x345x390 mm. The European WC shall be with or without flushing tanks and shall be with inlet horn, self draining flushing rim of box with adequate discharge holes, weep holes, anti syphonage ven horn etc, The European WC shall be floor mounted or wall hung as indicated in the drawing and schedule of material. The wall hung European WC's shall include CIsupporting chairs. The European WC's shall be with hinged plastic seats and cover.

### 6.5 URINALS

a)Lipped Front Urinal : The urinal shall be of flat back lipped front basin of required dimensions of white vitreous chinaware of an approved make as specified . It shall be fixed in position by using rawl plugs embedded in the wall with screws of proper size or fixed as per approved Manufacturer's specification. Each urinal shall be connected to a 32 mm N.B. PVC waste pipe with clamps which shall discharge into a channel or floor trap, or as specified.

b.Painting : The inside of the invisible portions of the fittings and brackets connected with urinal basin shall be painted with approved bituminous paint and outside of the brackets, etc. shall be painted with a priming coat of red oxide to give an even shade to match the colour of surrounding walls. The cost of such painting shall be included in the rate quoted for the concerned tender items. The urinals shall be of bowl/flat back one piece construction conforming to IS : 2556 Part with integral flushing box rim adequate discharge holes, inlet and outlet horns.

### 6.6 SQUATTING PLATE

The squatting plate shall be of single construction conforming into IS:2556 Part 6 having a minimum size of 450x350x100 mm with integral long individual flushing pipe, non-steel foot rest, 3 nos. 13 mm drain holes etc.

### 6.7 SEATS & COVERS

The WC seats and covers shall be of plastic conforming to IS : 2548 having a minimum of 3 mm thickness at the thinnest point. The seats shall be closed type with minimum 3 nos. rubber or plastic buffers of 25x40x10 mm. The cover shall be with equal no. of buffers placed right over the seat buffers. The seat and covers shall be smooth non-absorptive and inert to household cleaners.

#### 6.8 WC FLUSHING APPARATUS

The WC cisterns or flushing tanks shall be low level or high level plastic or vitreous china ware of minimum 15 litres capacity conforming to IS : 774 and IS : 7231. The flushing cistern shall be with siphonic apparatus, ball valve, over flow etc. The outlet size shall be 32 mm for low level and 40 mm for high level cistern. The lead pipe for the cistern shall be with PVC of sufficient length with necessary fittings, operating chain/lever etc.

#### 6.9 URINAL FLUSHING APPARATUS

The urinal cisterns or flushing tanks shall be high level plastic or vitreous chinaware automatic self acting type conforming to IS : 2326 the capacity of the cistern shall be based on the no. of urinals served at 2.5 litres per urinal at intervals of not less than 10 minutes and not more than 20 minutes.

#### 6.10 WASH BASIN

- a) Wash Hand Basin : The basins shall be of white vitreous china of approved pattern. The size of the basin shall be as specified. The basins shall be of approved quality and make and conforming to IS : 2556 part 4.
- b) Fittings : Each wash hand basin shall be provided with pillar tap as specified, having a centered tap hole with C.P. protruded nose pillar cock heavy type. This must be included with 32 mm dia C.P. basin waste, C.P. Bottle trap & concealed G.I. waste pipes (Or heavy PVC waster pipe of required length with C.P. brass couplings) as stated in the respective Schedule of items.
- c) Fixing : The circular basins shall be supported on counter top and the rectangular basins shall be supported on a pair of C.I. concealed type brackets embedded in wall or fixed in position by means of wooden cleats and screws as required.
- d) The waste pipes shall discharge into the floor trap inlet or as specified

#### 6.11 LABORATORY SINKS

- a) Sinks : The sink with drain board shall be of best quality stainless steel, make of approved quality & brand . The size of the sink shall be as specified. The sink shall be of approved quality and confirming to IS:771 or IS:2556 Part 5
- b) Fixing : The sink shall be supported on M.S. fabricated on C.I. cantilever bracket to match with sink profile. Embedded or fixed into position by means of wooden cleats and screws or embedded in wall with concrete as per sitecondition. The brackets shall be painted with approved shade and colour to match with the surrounding finish.
- c) The G.I. waste pipe shall discharge into floor trap inlet or as specified.

#### 6.12 TOILET REQUISITES

- a) Mirrors : The piece glass mirrors shall of approved make glass as specified. The size and shape of the mirror shall be as specified. It shall be mounted on the asbestos sheet and shall be fixed in position by means of C.P. brass dome shaped screws over rubber washers and rawl plug firmly embedded in wall .The plate glass mirrors of suitable shapes & size as per detailed drawings shall be provided with accessories for round counter type basins.
- b) Water connection : water connection to flushing cistern, wash hand basins shall be by means of white PVC connector or C.P. connector with stop cock as specified in the respective items.
- c) Shelf : Unless otherwise specified the shelf shall be of porcelain of approved quality & design. The size of the shelf shall be as specified. The brackets shall be fixed to the wall with C.P. brass screw to wooden plug firmly embedded in the wall.

d) Urinal Partition : Unless otherwise specified partition for urinal shall be shape out of 20mm thick x 900 mm white marble. Fixing shall be done by inserting the portion approx 75mm inside wall & grouting the same in cement concrete (1:3:6). All the exposed surfaces & edges shall be properly ground to shape and polished. Joint with wall to be finished with white cement.

e) Towel Rail : The towel rails with bracket of brass C.P. or anodized aluminum as stated in Schedule of Items shall be of approved shape and design. The size of the rail shall be of approved shape and design. The size of rail shall be of approved shape and design. The size of the rail shall be as specified. The brackets shall be fixed by means of C.P. brass screws or Rawl plug firmly embedded in wall.

f) Paper Holder :- The paper holder shall be for white vitreous chinaware of recessed type & the rate shall include chase cutting of walls, setting in cement sand mortar & making good the all round joint with white cement.

#### 6.13 BRASS OR C.P. ON BRASS WATER FITTINGS (AS SPECIFIED IN RESPECTIVE SCHEDULE OF ITEMS)

All fittings shall be of standard Manufacture and shall in all respect comply with the Indian standard specifications. The brass fittings shall be fixed in pipe line in workman like manner . Care must be taken to see that joints between fittings are made leak proof . The fittings and joints shall be tested to a pressure of 7 kg. Per 80cm unless otherwise specified. The defective fittings and the joints shall be repaired, redone or replaced at the contractor's expenses.

6.13.1 Bib cock : The bib cock shall be of horizontal inlet & free outlet of specified quality of screw down a pattern of the size as specified. The closing device shall work by means of disc carrying a renewable non-metallic washer which shuts against water pressure on a seating at right angles to the axis of threaded spindle which operates it. The handle (Head) shall be of approved design & shape. The cock shall open in anti-clockwise direction. The cock shall be polished bright (For brass ) and chrome plated on brass (For C.P.) . Minimum weight shall be 0.40 kg. For 15mm size bib cock.

6.13.2 Stop Cock : The stop cock shall be plain or angular type as per it's place of installation & of specified quality opening anti clockwise & of screw down pattern of the size as specified. Other specifications shall be as per the specification of Bib cock above.

### 7.0 INSTALLATION OF SANITARY APPLIANCES AND FITTINGS

#### 7.1 SCOPE

The scope under this section shall cover installation of sanitary appliances, fittings and ancillaries. The following standard specification and codes shall be applicable.

- a) SP : 35 (S & T) - Hand book on water supply and drainage
- b) IS : 2064 - COP for selection and maintenance of sanitary appliances

#### 7.2 GENERAL REQUIREMENTS

The appliances, accessories and fittings shall be installed as indicated on the drawing and perfectly matching the interior and the tile pattern, heights and properly levelled. The piping and pipe connections shall be done such that minimum length of the piping/pipe connections are exposed. Sufficient care shall be taken to avoid breakage and damage to the appliances, fittings and the buildings, tiling, interior works etc. carried out by other agencies. Also care shall be taken while fixing the appliances and fittings to achieve rigidity and to avoid movements of appliances and fittings which can result in damage to the water supply and drainage connections/joints.

The screws shall be fixed to the wall by providing wooden rawl plugs or anchor fasteners in wall depending upon the weight. All exposed screws, nuts and bolts shall be of heavy quality CP brass with CP brass washers. All brackets shall be finished with two coats of synthetic enamelled paints of colour matching the interior/tiles. The water supply and drainage connection to the fittings and assemblies shall be made by means of approved leak proof joints.

All pipe connections and drain connection made to the appliances shall be leak proof and with minimum length of exposed pipes. The WC, urinals and the bath tub drain connection shall be through P or S traps and the traps shall be connected to anti siphon ventilation pipes.

#### 7.2.1 WATER CLOSETS & BIDET

The Indian and Orissa WC shall be set in brickbat concrete 1:2:4. The wall hung European WC shall be supported by CI floor mounted chairs. The joints between WC and flush pipe shall be made with a putty of white lead and linseed oil and caulked well or with an approved rubber joints. The joint between WC and trap shall be made with leak proof 1:1 cement mortar. The foot rests for the Indian WC shall be fixed at proper distance with 1:2 cement mortar with edge finished in white cement.

#### 7.2.2 URINALS

The urinals shall be fixed to wall by CI bracket and two CI wall clips. Cistern shall be fixed to the wall with R.S or C.I brackets. Partitions to be grouted to the wall with screws and M.S clips. The wash basins and sinks shall be fixed with R.S or C.I brackets and clips and securely fixed to the wall. The semicircular channels shall be laid in perfect slope in 20 mm thick 1:2 cement mortar with white cement paste joints.

#### 7.2.3 WASHBASIN

Wall mounted wash basin shall be fixed to the wall using CI brackets. The counter top wash basin shall be mounted on to the counter after cutting the counter to the exact size to achieve tight fixing. The counter shall be fixed to the wall using GI brackets. The cut edges of the platform/counter shall be ground to achieve proper shape and smooth surface.

#### 7.2.4 WASH ROOM ANCILLARIES

The concealed soap tray, toilet paper holder etc. shall be fixed flush with the tile by cutting the wall and set in 1:2 cement mortar surface mounted units shall be screwed to the wall. The towel rod, towel ring, towel rack, shower curtain rod, retractable cloth lines, coat hooks, bottle opener etc. shall be fixed to the wall/door in lines and levels to match the tiling pattern and as indicated on the interior drawings.

#### 7.3 SANITARY FITTINGS & ACCESSORIES

The WC flush assembly shall consist of 32/40 mm flush valve, regulating valve and flushing pipe assembly. The flush valve shall be concealed or exposed type. The bidet water supply assembly shall be single/3 hole and shall consists of hot and cold mixer ascending spray, directing valve pair or stop cock and flexible pipes etc. the waste assembly shall be 32 mm waste with pop-up. The wash basin water supply assembly shall be single/3 hole and shall consists of pillar tap with hot and cold mixer, pair of stop-cock with flexible pipe.

The waste water assembly shall consist of 32 mm waste with pop-up, bottle trap with extension pipe and wall flange etc. The single water supply assembly shall be wall or sink mounted with swan neck spout, hot and cold mixed, pair of angle valve with flexible pipe incase of sink mounted assembly. The waste assembly shall consist of 40 mm waste with pop-up bottle trap with extension pipe and wall flange.

The bath tub water supply assembly shall consists of single wall/bath tub mounted spout with hot and cold mixer, diverter, riser pipe with clamps, 150 mm swivel type shower rose etc. The waste assembly shall consists of 40 mm waste, 40/50 mm P or S trap with cleaning eye, access door etc. The bath and shower water supply assembly shall consists of single wall spout, hot and cold mixer assembly with diverter, riser pipe, 150mm swivel type shower rose etc.

#### 8.0 THERMOPLASTIC PIPES

The thermoplastic pipe shall be of Polyvinyl chloride (PVC), Polypropylene (PP) or Polyethylene (PE) as indicated on the drawing and schedule of materials.

The thermoplastic pipes and fittings shall conform to the following standards and codes.

- a) IS : 4984 High Density PE (HDPE) pipes for water supply.
- b) IS : 4985 Unplasticised PVC (UPVC) pipes for potable water supply.

- c) IS : 10124 Fabricated PVC fittings for portable water supply
- d) IS : 5382 Rubber sealing rings or gas mains, water mains and sewers
- e) ASTM-D1785 Threaded UPVC pipes
- f) DIN : 8076 Fittings with metal inserts
- g) DIN : 8077 Polypropylene pipes
- h) DIN : 8078 Polypropylene pipe type 3 quantity requirement test
- i) DIN : 16962 Joints and fittings for PP pressure pipes
- j) ISO : R288 Fittings with threaded metal inserts
- k) DVS : 2208 Welding of thermoplastic materials.

8.1 The PVC pipes shall be unplasterised (UPVC) or chrominated (CPVC) suitable for solvent joints conforming to IS : 4985 . The fittings shall be injection moulded. Composite fittings conforming to ISO – R288 having combination of PVC and gunmetal ends shall be provided at connection to equipments valves and outlets PVC pipes with threaded joints wherever required shall conform to ASTM-D-1785.

8.2 The polyethylene pipes shall be of HDPE UV stabilized suitable for electro fusion welding. The connection to equipments, valves and outlets shall be through combination flanged joints having flanges of HDPE and metal.

8.3 The polypropylene pipes shall be of Homopolymer (PP-H) or Random copolymer (PP-R) conforming to DIN .8077 suitable for electro fusion joints. The fittings shall conform to DIN 16962 for fusion welding. Fittings for connection toequipments, valves and outlets shall be with composite fittings conforming the ISO R288. The polybutylene (PB) pipes shall be suitable for electro fusion or socket fusion welding.

#### 9.0 THERMOPLASTIC PIPES

The thermoplastic pipe shall be of Polyvinyl chloride (PVC), Polypropylene (PP) or Polyethylene (PE) as indicated on the drawing and schedule of materials. The PVC pipes and fittings shall conform the following standard specification.

- a) IS : 13592 Specification for unplasticized PVC pipes for SWR discharge system inside buildings including Ventilation and Rain water system
- b) IS : 14735 Specification for UPVC pipe fittings for SWR discharge system inside buildings including Ventilation and Rain water system
- c) IS : 4984 High Density PE (HDPE) pipes for water supply
- d) IS : 4985 Unplasticised PVC (UPVC) pipes for potable water supply
- e) IS : 5382 Rubber sealing rings or gas mains, water mains and sewers.

9.1 The PVC pipes and fittings for the drainage system shall be unplasticised SWR quality and conforming to IS:13592 class B for pipe dimensions and wall thickness. The fittings shall be injection moulded and the dimensions shall conform to IS : 14735 . The fittings shall be suitable for the application and shall be with adequate inspection windows. Pipes smaller than 75 mm required for equipment drain connection shall be of conforming to IS : 4984 and 4985.

#### 10.0 VALVES

##### 10.1 SCOPE

The scope under this section shall cover requirements, details and specification of valves and other control accessories in water circuit.

##### 10.2 STANDARDS

The following standards shall be applicable:

- a) IS : 778 Gate, globe and check valves, copper alloy for water supply works purposes.
- b) IS : 780 Sluice valves for water works purposes (50 to 300 mm sizes)
- c) IS : 1703 Ball valve (horizontal plunges type) including floats for water supply purposes.
- d) IS : 3004 Plug cocks for water supply purposes

- e) IS : 4928 Check valves, quip closing for centrifugal pump outlets.
- f) IS : 9739 Pressure reducing valves for domestic water supply systems
- g) IS : 9896 Ball valves, general purposes
- h) IS : 779 Watermeter domestic type

The valves for the control of steam shall meet the requirements of IBR and approved by them.

### 10.3 GENERAL REQUIREMENTS

The valves shall be of reputed make with ISI mark, suitable for the specified duty such as

- a) Medium to be handled
- b) System pressure
- c) System temperature

The material and type of construction shall be as indicated in section 2101 systems and materials, schedule of materials and shall be suitable for the duty specified. The valves upto 50 mm shall be screwed type and 65 mm and above flanged type unless otherwise specified. The valves shall be with non rising spindle and the flanges drilled to BS : 10 table E or to match the flanges incorporated in the piping work.

The valves installed in steam fuel oil LPG etc. requiring the approval of local authorities shall be one of the recommended makes of the concerned authority. The valves shall be rated for a test pressure of minimum 20 kg/sq.cm.

### 10.4 VALVES FOR VARIOUS SYSTEMS

The valves for various sizes shall be as indicated below :

- a. UPTO 50 mm Ball Gun metal Bronze
- b. 65mm & above Butterfly Cast Iron SS 316 / SG iron

### 10.5 STOP VALVES

The stop valves shall be gate or butterfly as indicated in the drawing and schedule of material conforming to IS:778 & IS:780. The stop valves shall be capable of complete stoppage of flow of the medium handled with solid wedge, split wedge or parallel double disc type. The butterfly valves shall be with circular or lense shaped disc pivoted in the body by two unions. The operating handle shall be provided with locking facility and shall have flow indication.

### 10.6 CONTROL VALVES

The flow control valves shall be ball type with spherical gate to control the flow the medium. The valves shall be capable of complete stoppage of flow of the medium handle to enable them to use for stop valves.

### 10.7 CHECK VALVES

The check valves/non return valves shall be unidirectional flow allowing the normal flow in one direction and completely stop the flow in reverse direction. The check valves or reflex valves shall be suitable for horizontal as well as vertical installation and shall be with circular disc hinged at one end.

### 11.0 PVC/UPVC PIPE ASSEMBLY

The UPVC pipe assembly shall be carried out by means of solvent cement and rubber ring. The pipe assembly and fabrication shall be generally as per the recommendation of the manufacturer. The cur end of the pipe shall made smooth by filling before the carrying out of the assembly. Space provision of minimum 10 mm shall be kept inside the socket for expansion. UPVC piping with threaded assembly shall generally be as indicated in GI pipe assembly. The pipe shall be supported as per the recommendations of the manufacturer to avoid sagging and stress on the joints. The support interval shall, at any case, not exceed 1500 mm.

### 11.1 POLYPROPELENE /POLYBUTYLENE PIPING

The PP-R and PB piping shall be through fusion welding as recommended by the manufacturer. The pipe ends are to be smoothed and cleaned thoroughly before making the joint. The pipes end to be welded shall be

heated to the adequate temperature and duration to achieve proper joint. The poly fusion welding duration shall be as per DVS 2207 norms furnished below.

## 11.2 CLEANING

The pipe shall be thoroughly cleaned internally and externally during the fabrication, assembling and completion, of the entire piping work using compressed air, clean water etc. Necessary detergents shall be used while cleaning and flushing the piping system and in-line instruments, traps etc. shall be isolated. All field fabricated piping shall be cleaned at the completion of fabrication. Care shall be taken to see that all burrs, welding icicles and weld spatter are removed by reaming, chipping, filing sanding or other suitable means. All foreign material such as cement, motor sand, heavy oil and loose scale shall be removed from the interior of pipe by thoroughly flushing with water. To avoid large size foreign material being washed into smaller diameter branch blind from a larger diameter header line, special precautions should be taken to disconnect at branched or to selectively blank them off.

Pipe size

(mm)

Heating time

(Sec.)

Working time

(Sec.)

Cooling time

(Sec.).

16432

20542

25742

32864

401264

Pipe size

(mm)

Heating time

(Sec.)

Working time

(Sec.)

Cooling time

(Sec.).

501864

632486

753086

904086

110 50 10 8

A record shall be kept of cleaning of each line or section of erected piping. Cleaned lines shall be tagged. Proper temporary drainage for flushing water shall be provided so that no damage is done to permanent facilities. Valves shall be cleaned when received. All possible precautions shall be taken to prevent contamination and valves shall be inspected immediately prior to installation. If a valve is found to be contaminated in any way, it shall be cleaned as follows: Removed all foreign particulars by wiping with clean lint less cloth. Wipe interior of valve with clean lint less clothes moistened with clean trichloroethylene. If contamination is excessive in metallic valves, suspend the valve in a degreasing tank with hand wheel uppermost. Direct stream of liquid trichloroethylene into the rim of the valve, through both ends and against all inside surfaces. Flush thoroughly to remove all foreign matter.

## 12.0 DRAINAGE ANCILLARIES

### 12.1 SCOPE

The scope under this section shall cover miscellaneous items and ancillary structures for drainage system such as floor trap, floor gratings, manholes, drop connections etc.

## 12.2 STANDARDS

The following standard specification and codes shall be applicable.

- a) IS : 35 (S&T) Handbook on water supply & drainage
- b) IS : 5961 Specification for CI gratings for drainage purposes
- c) IS : 4111 COP for ancillary structure system
- d) IS : 1726 Specification for CI manhole covers and frames
- e) IS : 5455 Specification for CI steps for manholes

## 12.3 FLOOR TRAPS

Floor traps of CI inlet hopper with necessary inlet socket shall be provided wherever indicated or required the joint hopper inlet sockets and waste line shall be lead caulked. The hopper connection with P or S trap shall be with minimum 50 mm seal. The floor trap and inlet hoppers shall be set in 1:2:4 concrete.

## 12.4 FLOOR GRATINGS

The floor and urinal traps shall be provided with 100 or 150 mm square or round CP or SS grating of minimum thickness of 5 mm with approved sizes. The floor grating in kitchen shall be 150 mm square 20 mm thick cast aluminum supported by 25 x 25 x 6 aluminum angles.

## 12.5 MANHOLES & INSPECTION CHAMBERS

Manholes and inspection chambers shall be provided as shown on the drawings, additional requirements if any, due to site condition or modification in the design during the progress of work shall be carried out. The manhole flooring shall be of 1:2:4 concrete with drain channels. The channels shall be semicircular bottom, of dia same as the pipe with side walls of height equal to the radius of the pipe. The channels shall follow the same slope as the mains. The branch channels shall also follow the same slope and construction. A minimum fall of 40 mm shall be given at the junction of branch channels meeting the main channel the fall shall be suitably curved to direct the fall suit the flow in the main channel. The channels and the flow shall be given smooth finish with 1:2 cement plaster. The manhole walls shall be of brick or rubble masonry with both sides plastered with 1:2 cement plaster and required water tight. Relieving arches shall be provided on the wall to prevent load on the pipe embedded inside the wall.

Inlet and outlet of the mains shall be encased in the wall such that the slope of the piping is continued. In case of increase in the outlet pipe, the crown of the inlet and outlet pipes are maintained the same and the slope of the channel is increased or maintained at the center line of pipes in case crown level cannot be maintained the same. teps shall be provided inside the manhole of depth 750 mm and by grouting two vertical columns of staggered CI rungs of not less than 3 kg. each. The rungs shall be spaced at 400 mm horizontally and 400 mm vertically with the lowest rung not more than 300 mm from the benching and highest 450 mm from the manhole cover.

The manhole covers and frames shall be of CI double sealed pattern conforming to IS:1726. The covers shall be best foundry gray metal, tough and close grained and provided with two coats of black bituminasitic paint. The frame shall be embedded in 1:2:4 cement concrete to correct levels and alignment and made water tight.

### 12.5.1 MANHOLES, GULLY CHAMBERS ETC

a) Size of Manhole : The size specified shall be the internal size of the manhole. The work shall be done strictly as per drawing and specification. The following specifications shall be adopted.

b) Excavation : The manhole shall be excavated true to dimensions and levels shown on he plan or as directed by the Architect/Owner.



c) Brick work : The brick work shall be with bricks having crushing strength 75/sq. cm brick in cement mortar 1:4 . It shall be 250 mm thick or as instructed by the architect/ Employer.

d) All angles shall be rounded 7.5 cm radius and all rendered internal surfaces should be hard impervious finish obtained by using a steel trowel. The external toe joints of the masonry shall be finished smooth.

e.) In wt ground 20mm thick cement plaster of the above specifications shall be done on the outside surface of the walls also this plaster shall be water proofed with addition of 1 kg. of acco proof to 50 kg (1 bag) of cement or with addition to any other equal and approved waterproofing compound. The plastering shall be done up to 30cm above the set soil lines.

f) Channel and Benching : Channels shall be semi-circular in the bottom half and of diameter equal to the sewer. Above the horizontal diameter, the sides shall be extended vertically to the same level as the crown of the outgoing pipe and the top edge shall be suitable rounded off. The branch channels shall also be similarly constructed with respect to the benching but at their junction with the main channel on appropriate single suitably rounded off in the direction of flow in the main channel.

The channel and benching shall be done in cement concrete (1:2:4) rising at a slope of 1 in 6 from the edges of channel. The channels at the bottom of the chamber shall be plastered with cement mortar 1:4 ( 1 cement :4 coarse sand) and steel trowelled smooth.

g) R.C.C. Work : R.C.C. work for slabs etc. shall be in cement concrete 1:2:4 with steel reinforcement as per detail drawings.

h) Plain Concrete : If used for fixing manhole covers, shall be of the above specifications.

i) Foot Rests : These shall be of M.S. square rods 22 mm or as specified and shall be galvanized or painted with coal tap these shall be embedded in cement concrete (1:2:4) at least (9) 23 cm. while the brick work is in progress. These shall be fixed 30 cm, apart vertically and staggered laterally and shall not project more than 11 cm from the wall.

j) Manhole covers and frames: All covers shall be of heavy type. these shall be non-locking or locking type as specified and capable of easy opening and closing . These shall ordinarily be gas and water tight, These shall be soluble water seal type manhole cover and frame. the covers as specified in schedule of Quantities, C.I. Surface box for air valves, sluice valves, peet valves etc. Shall be of sufficient dimensions to suit the sizes of these fittings and shall be of heavy pattern when fitted in level to heavy traffic and shall be of standard design or as directed by the Architect/Employer.

k) The frame of manhole cover shall be embedded firmly in the R.C.C. slab or plain concrete as the case may be on the top of the masonry.

l) When the manhole is built on the foot path , this shall be provided with 45cm internal diameter or as specified heavy type C.I. cover, or 56cm internal dia R.C.C. covers as specified. When it is built the metalled width of the road under traffic, it shall be provided with approx 22" (560mm) internal diameter heavy type C.I. cover.

m) Painting : All C. I. / M.S. fittings like Manhole covers & frames, gratings, footrests etc, shall be painted with two or more coats of Bitumastic paint & it's rate shall be included in the rate of the Manholes, Gully chambers etc.

#### 12.5.2 TYPES OF MANHOLES

Manhole up to 0.75 Meter Depth: This shall be 0.9M x 0.8 M size (Internal dimension) unless otherwise shown in drawings instructed per site conditions.

a) Thickness of brick wall-250mm

b) Cement brick work - (1:4)

c) Plaster : Plaster on inside surface of walls, bottom & part of outside surface of walls and on RCC cover slabs shall be done as per drawings and directions.

d) Bed concrete (1:4:8)-150 mm thick with stone chips.

e) Brick flat soling - 75mm thick.

Depth of Manhole above 0.75 M up to 1.5 M : This shall be of 1.2 M x 0.9 M (internal ) size unless otherwise shown in drawings or instructed as per site conditions.

Details same as that in item No 28.1 above.

Depth of Manhole above 1.5 M : This shall be of 1.2 M x 0.9 M (Internal) size or as specified. Thickness of brick wall

i) 250 mm up to 1.5 M from finished G.L.

ii) 375 mm below 1.5 M from finished G.L.

Cement brick work plastering and Brick Flat soling same as in earlier. Thickness of bed concrete (1:4:8)- 225 mm with stone chips.

12.5.3 Prior approval of Sample Materials /Works : Samples and all materials & works shall be approved by the Architects/Employer before the contractor undertakes any major procurement of materials or proceeds with the works concerned. The quantum of materials/works for approval of samples shall be decided by the Architect/Employer & no extra payment shall be made to the contractor for sample materials procurement/or works & replacement of materials altering or redoing of works as required and instructed by the Architects/Employer. The typical approved sample material for each work shall be kept in the office of the Employer/Architects at site until the satisfactory completion of the works. The materials supplied and installed at site shall be of the same quality & size as of the approved samples, otherwise they shall be rejected.

The decision of the Owner/Architects or their authorized representatives of whether a materials compares well with the approved sample shall be final and binding on contractor. The same principal shall be applicable to sample work approved & further works done at site.

12.5.4 Cleaning & disinfections of the supply system, water storage tanks and down take distribution pipes : All water mains , communication pipes, service and distribution pipes used for water for domestic purpose should be thoroughly and efficiently disinfected before being taken into use and allows after every major repair. The method and disinfections shall be subject to the approval or the Owner/Architects.

The water storage tanks (underground and Overhead) & pipes shall first be filled with water & thoroughly flushed out. The storage tanks shall then be filled with water again and disinfecting chemical containing chlorine added gradually while the tanks are being filled, to ensure thorough mixing, sufficient chemical shall be used to five water a dose of 50 parts of chlorine to one million parts of water. If power to 1000 Liter of water . The power shall be mixed with water to a creamy consistency before being added to the water in the storage tank. If proprietary brand of chemical is used, the proportions shall be as specified by the markers, When the storage tank is full, the supply shall be topped and all the taps on the distribution pipes opened successively , working progressively away from the storage tank. Each tap shall be closed when the water discharge begins to smell of chlorine. The storage tank shall then be topped up with water from the supply pipe and with more disinfecting chemical in the recommended proportions. The storage tank & pipes shall then remain charged at least for three hours. Finally, the tank and pipes shall be thoroughly flushed out before any water is used for domestic purpose.

#### 12.6 GULLY PIT :

To be the standard size 1.06 m x 0.63 m and to be built in cement mortar 1:3 or 3:1 as specified in strict accordance with drawings. The internal sides and floor are to be finished with 12mm cement plaster to be fitted with a 150 mm C.I. overflow pipe with hinged cover and handle 0.90x 45 C.I. Gully grid of the standard weight 15 cm syphone. The gully grid and frame are to be of 166 kg.

#### 12.7 S.W. GULLY TRAP :

S.W. Gully trap of specified sizes and quality shall be fixed 15 cm thick cement concrete 1:3:6 bedding and the gully outlet to the branch drain shall be jointed similar to joining of S.W. pipes. A brick masonry chamber 30cm x 30 cm internal shall be constructed in half brick masonry with (1:6) cement mortar and the space between the trap and the wall filled up with cement (1:6) cement concrete (1:4:8) and the upper portion of the chamber

finished internally with (1:3) cement mortar and finished with neat cement. The corners and bottom with neat cement. The corner and bottom of the chamber shall be rounded off so as to slope towards the addition the chamber shall have a C.I. grating with frame 30cm x 30cm (inside ) with machined rating faces , fixed on the top of the brick with cement concrete 1:2:4 and rendered smooth. The weight of grating shall not be less than 4.53 kgs & that at the frame 2.72 kgs.

#### 12.8 CAST IRON MANHOLE COVERS AND FRAMES :

Unless otherwise mentioned the covers and frames shall be conform to I.S. specifications and obtained from the approved manufacturer's and shall be of following grades and type generally manufactured by M/s D.N. Singh & Co., M/s R.M. Chatterjee & Foundry of M/s Thakuradas surekha or equivalent brand. Heavy duty covers etc., under heavy vehicular traffic condition & cable of bearing while loads up to 11.25 tones are to be used medium duty under light type wheel traffic load. Light duty for domestic premises use or other places where they are not subjected of wheel traffic loads.

Covers and frames shall be cleanly cast, double water soil type and they shall be free from air sand holes, cold shuts and wrapping which are likely to impair the utility of the casting. All casting shall be free from voids. The cover shall be gas tight and water tight with proper seal arrangement, but can be easily opened and it shall be fitted in the frame in workmanship like manner . The cover used for sewer line should be sewer ingrained on top of casting. Similarly for storm line it shall be marked storm. Size and dimensions are given below with weight. Covers shall have raised chequered design to provide an adequate non slip grip. The covers and frame shall be coated with a material having tar base or with black bituminous composition. The coating shall be smooth and tenacious. It shall be not flow when exposed to a temperature of 60 degree centigrade and shall not be so brittle as to chip off at temperature of 0 degree centigrade. The frame of manhole cover shall be firmly embedded to concrete alignment and levels in R.C.C. slab or plain concrete as the case may be.

Grade Type Overhead

size in cm

Clear opening in cm

Weight of cover in Kg

Weight of frame in Kg

Test load in Ton

HD Double

Triangular

76x76 50

56

118

140

111

115

35

35

HD Circular 76 dia 50 dia 118 111 35

81 dia 50 dia 140 115 35

HD Circular 81 dia 50 dia 58 58 5

#### 12.9 DROP CONNECTIONS

Drop connection of required size and length shall be provided for the main sewer in step grounds and inside manholes when the difference in invert level of the pipes exceeds 450 mm. The drop connections from gully traps to manholes shall be inside manholes using HCI special outdoor bend at the top and heel rest bend at the bottom assembled with 25 mm deep lead caulked joints. The pipes shall be adequately supported by holder bat clamps. The drop connection from branch to main shall be outside the manhole with glazed stoneware pipe with tee at the top and bend at the bottom. The pipe and fittings shall be embedded in 1:2:4 cement concrete of minimum 150 mm all around the pipe and extending the tee and the concrete upto the surface with 300 x 300 mm hinged CI cover and frame.

### 13.0 CIVIL & STRUCTURAL WORK

#### 13.1 SCOPE

The scope under this section covers, civil structural and allied work such as Earth work and trenches Concrete work Masonry walls and plastering Chasing and opening structures Structural steel work Protective coating and painting

#### 13.2 GENERAL REQUIREMENTS

All civil and structural work connected to the work specified shall be the responsibility of the contractor. Necessary care shall be taken to avoid damages of existing underground services such as water and drain lines, electrical and telecommunication line etc. and existing surface drainage system, such as channels, culverts bridges etc. Necessary diversion and supports to the existing services and surface drain etc. And retain them in their original conditions, care shall be taken to avoid damages to the building and other structures and least interference to pedestrian vehicular traffic. Proper safety precautions and provision shall be made to avoid accidents and injuries to the workmen employed and other agencies at site. Proper lighting, fencing, road barriers and diversion of traffic, temporary drains, bridging platform on excavation trenches etc. shall be provided. Care shall be taken to avoid obstruction to the traffic by occupying and stacking the material and excavated soil on the road. The civil contractor shall be suitable for

76 dia 56 dia 64 64 5

HD Rectangular 84x68.5 61x45.5 80 64 5

HD Rectangular 75x56 45.5x61 29 23

HD Circular 76 dia 45.5 dia 29 23

variation of 300 mm in the existing ground and finished ground level. The contractor shall ascertain the soil bearing capacity and the maximum subsoil water level before submitting the offer. In the absence of the above data the offers shall be based on soil bearing capacity of 15 MT/sq.m and water table of 1000 mm. On award of the work the contractor shall carry out necessary test ascertain the above details or obtain the same from the site in-charge before taking up the work. Necessary modification required in the design and the construction shall be intimated to the site in-charge along with the financial implication before carrying out the work.

#### 13.3 EARTH WORK

The earth work shall include the excavation, back filling and dispose of surplus of soil, filling up and raising the surface level of low areas etc. required for the water supply and sanitation. Excavation shall be carried out in open cutting and shall include in soft soil or hard murrum and rocks depending upon the strata of the ground. The excavation shall be taken up in the section after getting the approval of the Consultants/Owner to suit the progress of work at site after taking all precautionary measures. The Consultants shall decide the classification of soil and rocks.

The trenches shall be done to widths, depths, lines and levels as shown on the drawing or instructed at site. The bottom and sides shall be trimmed to required levels and profiles etc. watered and thoroughly The excavation in rocks shall be carried out by chiseling. Where blasting has to be resorted the same shall be carried out after taking all precautionary measures. Permission from all concerned public authorities, paying royalties and other levies, special insurance for the blasting hazards etc. the work shall be taken up at the contractor's entire risk cost and responsibility.

Necessary shoring shall be provided for the side walls for excavation/trenches in soft soil to retain the soil. Similar strutting shall be provided for buildings and structures, the stability of which is liable to be endangered due to proximity of the excavation being carried out/already carried out. Water accumulation in excavation shall be bailed or pumped out without causing injury to public, public health or structures and properties. Care shall be taken to avoid flow of sand below subsoil water level endangering building and other structures. Any settlements occurring to road, structures and other areas shall be rectified. The night soil, filth and other debris shall be taken out of the excavations and carted away. Back filling to be done after laying and testing for pressure, slope and water tightness of pipes, manholes etc. backfilling shall be done using good quality soft and hard murrum in

layers not exceeding 300 mm and each layer watered and adequately compacted. Care shall be to avoid damages to pipes etc. the surface of the filling shall be finished to lines and levels indicated. Surplus soil shall be used for filling low laying areas or carted away. Additional soil required for back filling shall be of good quality soft or hard murrum and shall be supplied by the contractor. The width of trench shall not exceed 300 to 350 mm beyond the outer surface of the pipes and the excavation for the manhole junction chambers etc. shall not exceed 300 mm all sides for the edge of the foundation. The depth of excavation shall be upto the invert levels of pipes and other items. Excavation beyond required shall be filled up with cement, concrete 50 m at no extra cost.

#### 13.4 CONCRETE WORKS

The concrete work shall conform to IS : 456 for normal structures and 3370 for water retaining structures. The and the mix shall be based on the strength and proportion indicated on the drawing and specification but not less than M20 for normal structures and M25 per water retaining structures.

The cement shall be ordinary Portland cement conforming to IS : 269 and of the best normal setting quality. The sand fine aggregated shall conform to IS : 383 and shall be natural sand crushing gravel sand or crushed stone sand shall be clean sharp angular grit type. Use of sea sand prohibited. The coarse aggregate shall be hard, clean and washed and shall be stacked according to the gradation after proper sieve analysis. The water used for the concrete work shall be clean, free from deleterious matters and shall be potable quality. All batching shall be volume and mixing shall be done in mixing machine till uniform distribution of mix and uniform colour consistency is achieved and for a duration of not less than 2 minutes. The mixture shall be filled in iron pans and immediately poured into the work spot and avoid segregation of aggregates. Concrete shall be compacted by means of suitable vibrating equipment and the concreting shall be continuous without interruption. Concreting over already set concrete shall be carried out only after the surface of the set concrete is roughened, set clean, moistures and treated with cement slurry.

The concrete shall be kept wet for a minimum of 15 days using gunny bags kept consistently wet by pouring water. The surface shall be plastered and given smooth finish and made water proof. The concrete shall be cast only after completing properly designed form work with necessary supports to withstand the weight of concrete and compacting. The form work shall be accurately fitted and water tight. The surface of form work in contact with the concrete shall be plain, smooth and treated with form emulsion. The form work shall be removed as per IS : 456 and without shock or vibration.

The minimum thickness of the RCC structures shall be as shown below Footings for brick wall 150 mm

Lean concrete below water retaining slabs 150 mm

Lean concrete below other structures 100 mm

Water retaining structures 200 mm

Minimum depth of foundation 500 mm

Water bars of minimum 150 mm wide shall be provided at the construction joints of water holding structures. The water bars shall be of 20 guage GI sheet. Also pressure release valves, if required, shall be provided for water storage tanks to avoid upliftment.

Water storage tanks shall be totally closed with roof slab with adequate manholes unless otherwise specified. Rung ladders shall be provided for storage tank having depth more than 1500 mm. All concrete surfaces shall be plastered as indicated under plastering.

#### 13.5 BRICK MASONARY

The bricks shall be table moulded, hard, sound and well burned with sharp edges, uniform size and shape and shall be free from cracks, stone floats, module of lime or their defects. The bricks shall have a minimum compressive strength of 150 Kg/sq.cm and the weight shall not increase beyond 20% when immersed and taken out of water for 24 hours. Bricks soaked in water till bubbling disappears shall be used for masonry work and shall be raised uniformly all around and accurately plumb or as shown on drawing. The masonry shall not be raised more than 10 courses in a day and no part shall be raised more than 1000 mm above another at any time. The joints in brick work shall in 1:4 cement mortar not more than 10 mm thick with bricks properly bedded and joints completely filled to the full depth. The surface of the brick work shall be cleaned down and watered properly

before the mortar sets. The brick work shall be watered thrice a day for a minimum of 10 days. No broken brick ware to be used except as closures. All brick masonry walls shall be 230 mm thick and shall be plastered on both surface as specified in plastering.

### 13.6 PLASTERING

The plastering shall be in cement mortar of 1:4 and shall proceed from top to bottom in one operation. The masonry surface shall be thoroughly cleaned, joints raked out to not less than 12 mm, washed and kept wet for 24 hours before plastering. The surface shall be rubbed with mortar to cover all irregularities and scored to provide key. The cement plaster of 15 to 20 mm shall be applied over the surface when the filling coat is still raw. The mortar which falls on the ground shall not be reused.

Plastering on the following surfaces shall be carried out after mixing adequate quantity of water proofing compound.

All exposed surfaces

All underground surfaces

All water holding surfaces

### 13.7 CHASING & OPENINGS

The chasing and opening in masonry and concrete work shall be carried out carefully and using proper tools. The openings shall be minimum to accommodate the pipes or fittings and no damage is caused to the structures or works carried out by others. Care shall be taken to avoid chasing walls on both side at same levels and routing. The opening and chasing shall be closed after laying and fixing the pipe using cement mortar and GI wire mesh.

### 13.8 STRUCTURAL STEEL WORK

The structural steel work for support of equipments, pipes and tanks shall be included in the scope. The steel and the fabrication shall conform to the following.

- a) IS : 800 COP for use of structural steel in general building construction.
- b) IS : 805 COP for use of steel in gravity water tanks
- c) IS : 401 COP for steel tubular scaffolding
- d) IS : 7205 Safety code for erection of structural steel works.

The base frame for the equipments shall be fabricated out of ISMC 75 or as shown on the drawing. The structural work shall be in MS with sections as shown on the drawing or subject to the pressure and load of the items supported. All structural steel work shall be in welded construction using 3 mm welding rod of reputed make. The structural supports for pipes shall be as shown unless otherwise specified or shown on the drawing. GI pipes upto 65 mm running at ceiling Channels/angle irons members suspended from ceiling by means of 10 mm rod or 40 x 3 mm strips CI pipes running at ceiling Channels and sections grouted on side walls Pipe risers Slotted angle fixed to the wall at every 1000 mm by means of bolts embedded in the wall. The pipes shall be clamped to the structural supports by means of U clamps fabricated out of 40 x 3 mm GI strip or GI U bolts.

### 13.9 PROTECTIVE COATING & PAINTING

Structural steel work and the pipes shall be provided with anti corrosive treatment and two coats of synthetic enamelled paints. All mild steel work shall be given two coats of paint.

# INTERNAL ELECTRIFICATION WORKS

## INTERNAL ELECTRIFICATION WORKS

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SL NO DESCRIPTION

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#### 1.0 GUIDE LINES

##### 1.1 SCOPE

The scope of this section covers guidelines for the contractor on the specification and schedule of material and the general requirements.

##### 1.2 SCOPE OF CONTRACT

The scope of work under this contract covers equipment, material, accessories and labour required for the specified works and to carry out the erection as specified and shown on the drawing and schedule of material. Safety, good workmanship and quality are the prime requisites of the work covered under this contract. All the equipments, material and the work carried out shall meet the relevant codes, specification and the intents of specifications and the proper functioning of the systems and installation and shall be in correct lines, levels etc.

##### 1.3 MATERIAL

The equipments and material shall meet the specifications and requirements indicated in the technical specifications covered under specific section and the relevant equipment data. The makes of material shall be one of the recommended makes covered under Section 104 makes of material.

##### 1.4 SPECIFICATION

The technical specification attached herewith gives general guidelines and minimum standards for equipments material and workmanship. However it is the responsibility of the contractor to meet the statutory provision and local codes.

##### 1.5 SCHEDULE OF WORK

The schedule of work indicates the scope and quantity of the work estimated at the time of preparation of this tender. The quantity indicated are based on rough estimate on the basis of the drawings and subject to variation due to site condition. Also additional requirements may arise during the installation and deletion or replacement of items. Hence there shall be variation in quantities indicated and the unit rates quoted shall remain firm during the contract period.

##### 1.6 STANDARDS & REGULATIONS

Each section indicates the Indian Standard Specification to be followed. It is the responsibility of the contractor to meet the statutory regulation local codes and other relevant standards and specifications connected to the work being carried out.

### 1.7 INSPECTION & TESTING

The Consultants/Clients have the right to inspect the plants, equipments and material at manufacturer's work or at site at any stage and reject the material that is substandard or does not meet the requirements of the specification and codes. The contractor shall provide at his cost at site and elsewhere instruments and appliances for testing and equipments and installation at various stages of manufacturing /installation. These instruments shall be got tested and calibrated for their accuracy and performance from the approved institutions.

The inspection and testing carried out by the Consultants/Clients/Third party does not relieve the contractor of their responsibility of carrying out routine inspection during each stage of procurement, manufacture and installation and also meeting the intents and requirements of the specification and statutory requirements. All equipments and the installation to be tested in the presence of the Consultants/Clients after carrying out necessary rectification, adjustments and balancing. Four sets of test readings should conform to the specification, equipment data, standards and codes.

### 1.8 TRAINING

The operating staff of the clients shall be trained free of cost for the operation, maintenance overhauling etc. of the equipments and installation.

### 1.9 STATUTORY INSPECTION

The contractor shall be fully responsible for meeting all the statutory obligations and local inspectorates pertaining to the works carried out by them. The contractor should prepare all working drawings and obtain approval of competent authorities and also have the equipment and installation inspected and got approved. All official fees will be paid by the clients directly against demand in writing from the appropriate authorities and all other expenses for submission and approval of the various relevant statutory bodies shall be embodied in the tender prices. You shall also do the necessary liaison work with the power supply company on client's behalf.

### 1.10 DEVIATIONS

Should the tenderer wish to deviate from the provision of specification and drawings, the same shall be indicated separately along with supporting drawing and specifications to decide the merits of such deviation. In the absence of any deviation it is deemed that the tenderer is fully satisfied with the intents of specification and drawings and their compliance with the statutory provisions and codes. However, the offer shall be strictly on the basis of tender specification and schedule of material. The offer for the deviated items shall be furnished separately.

### 1.11 REFERENCE DRAWINGS

The drawings issued with the tender and shown in relevant section are basic diagrammatic drawings and is part of the tender documents. Contractor shall preserve one set of this drawing in good condition incorporating all modifications carried out from time to time during the erection period at the site and shall return them to the Consultants/Clients after completion of the work.

### 1.12 WORKING DRAWINGS

Contractor shall prepare and get approved shop drawings/fabrication drawings prior to execution of work for the following:

- a) Layout of substation indicating the details of poles, switches, accessories etc.
- b) GA, schematic and control drawings for switchgear panels, transformer etc.

On completion of work the contractor shall prepare 'AS BUILT' drawings and one set in CD in Autocad format and two sets hard copy shall be submitted.

### 1.13 MEASUREMENTS AND PAYMENTS

The mode of measurement and payment shall be strictly indicated under relevant Section measurements and payments. This indicates the mode of measurement, items to be included and items excluded etc. in a board basis. However, it is the responsibility of the contractor to meet the intents of the specification and total installation on the works contract/turnkey basis.



#### 1.14 HANDING OVER

The installation shall be handed over after a satisfactory testing along with the following documentation.

- a) Two sets of prints of the as installed drawings along with CD
- b) Two sets of test reading and certificate of local authorities.
- c) Two sets of detailed equipment data and operation and maintenance manuals.
- d) List of recommended spares.
- e) Performance guarantee in the prescribed form.

The final acceptance shall be effective only after the submission of the above documents.

Final payment will be released only after the handing over and submission of documentation.

#### 1.15 PERFORMANCE GUARANTEE

All equipment and the entire installation shall be guaranteed to yield the specified ratings and design conditions plus/minus 3% tolerance. Any equipment found short of the specified ratings by readings shall be rejected.

### 2.0 DIVISION OF WORK

#### 2.1 SCOPE

Scope under this section the division of work between the contractor and others on a broad basis, both supply of material and installation. The details of material to be included in the supply items as well as installation, testing and commissioning of the system are covered under respective section and measurements and payments. The scope of work of the contractor for installation of equipments and material supplied by the clients covers:

- a) Taking delivery of material, storage and safe custody till handing over.
- b) Transportation to the site of erection.
- c) Supply of all fixing material, supports and accessories.
- d) Supply of consumables for testing and commissioning.
- e) Maintaining register of material received and utilized.
- f) Hand over excess material.

Clients hold the option to supply some of the major material and debit it at the quoted supply rate.

### 3.0 MEASUREMENT & PAYMENT

#### 3.1 SCOPE

The scope under this section covers the mode of measurements and payments for all items.

#### 3.2 DIVISION OF WORK

The measurement and payments of items shall be based on the stage of completion of the work and shall be as indicated elsewhere in the tender.

#### 3.3 REQUIREMENTS

The general requirements for the above items shall be as shown below:

##### A) SUPPLY OF ITEMS

This shall include supply material and accessories required for the completion of the entire installation specified under various headings.

##### B) INSTALLATION, TESTING & COMMISSIONING

This shall include supply of all supporting material and accessories, equipments, tools and consumables for fixing, testing and commissioning and labour.

#### 3.4 MODE OF MEASUREMENT

The mode of measurement and the basis material to be included are as shown below. However, the item required for the proper installation other than that clearly indicated in the items excluded to achieve proper installation finish and functioning of the whole system shall be the responsibility of the contractor. Cutting and chasing of brick walls, rectifying, levelling etc., wherever required shall be included in the scope of work. No chasing or cutting shall be done on RCC work. The fixing of supports and hangers to RCC work shall be done using anchor bolts/fasteners of adequate capacities, which are included in the scope of work. Cutting of brick shall be done with wheel cutter. The final finish of chased area will be carried out by civil agencies.

SL

NO

ITEM ITEM INCLUDED ITEM

EXCLUDED

1 PANELS & DBS

Each MV panel shall be measured as one unit Supply of panel fixing accessories Trench

2 DISTRIBUTION BOARDS

2.1 Each DB shall be measured as one unit and shall be classified on the basis of no. of circuits Incoming and outgoing feeders busbars and interconnection, protecting and indicating meters and instruments fixing accessories : Nil

2.2 SWITCHGEAR

Each switchgear such as starter, switchfuse units etc. shall be measured as one unit-Feeders, enclosures fixing frames etc.: Nil

3 CABLING

3.1 CABLE

The cables shall be measured on the basis, unit length between the termination lugs Cable, clamps, cable markers, sand bricks etc. Cable tray, end termination of built up trench

3.2 END TERMINATION

Each cable end termination shall be measured as one unit and shall be classified based on the type and size of cable Cable gland, lugs nuts and bolts earthing of gland and armour : Nil

3.3 CABLE TRAYS

The cable trays shall be measured on the basis of unit length and shall be classified on the basis of type and size of tray : Trays, bends, tees, coupler etc. Supports

3.4 PIPES

Pipes shall be measured on unit length basis Pipe, fittings, excavation, back filling : Nil

4 EARTHING

4.1 EARTHING STATION

Each earthing station shall be measured as one unit and shall be classified on the basis of type and material of earth electrode Earth electrode, testing link, excavation soil treatment, watering pipe, chamber and cover: Nil

4.2 AIR TERMINATION

Each air termination shall be measured as one unit Air termination, fixing materials & accessories : Nil

4.3 EARTH CONDUCTOR

The earth conductor shall be measured as on the basis of unit length and shall be Earth conductor, excavation for external conductor, PVC sleeves for lightning conductor down : Nil

classified on the basis of material and size of conductor take, clamps, screws accessories

5 WIRING INSTALLATION

5.1 CONDUIT WIRING

Each circuit point shall be measured on the basis of unit length Conduit and accessories, wires, clamps termination etc. From DB to the first electrical outlet/fitting, including wiring to the switches, if any Control switches with boxes

5.2 Each secondary point looping from circuit point/outlet/ switch/fitting shall be measured as one unit Conduit and accessories wires, clamps, outlet box Control switches socket etc.

5.3 Each control switch outlet shall be measured as one unit. Multiple control switch outlet shall be considered as that many no. of switch outlets Control switch and box internal wiring for multiple outlets Conduit wiring

5.4 Each fan regulator shall be measured as one unit. Multiple regulator outlet shall be considered as that many no. Of regulator outlet Solid state regulator control switch, and box. Internal wiring for multiple outlet Conduit wiring

5.5 Each socket outlet including combined socket outlet shall be measured as one unit. Multiple socket outlet shall be measured as many no. Of socket outlets. Socket outlet, control switch and box. Internal wiring for multiple outlets and and plug tops for metal clad sockets Plug tops for 6/16A sockets

5.6 Each light fitting shall be measured as one unit and shall be classified based on the type of fittings. Fixtures with accessories, fixing material and accessories Fixture with lamps & control gear, if supplied by clients

5.7 Each ceiling fan shall be measured as one unit and shall be classified on the basis of size of the fan Ceiling fan, down rod hanging hook Regulator & switch

5.8 Each propellar fan shall be measured as one unit and shall be classified on the basis of the size and capacity. Propellar fan, fixing frame, gravity louvers bird screen : Nil

## 6.0 LOW VOLTAGE WIRING TELEPHONE

6.1 Each tag block shall be measured as one unit and shall be classified on the basis of no. of pair of terminals Tag block, enclosure, fixing accessories : Nil

6.2 The telephone cable shall be Cable, fixing accessories, Nil

### 6.2.1 PAYMENTS

The payment shall be made on the basis of quantities measured and the unit rates accepted. The payments shall be made according to the stages/terms indicated in 1201 tender details. Surplus material after completion of the installation shall be taken back by the contractor. In case the owner intends to take over these material, payments shall be made to the contractor at the supply rates/mutually agreed upon.

### 6.2.2 SUBSTATION ANCILLARIES

#### 6.2.3 SCOPE

The scope under this section shall cover the general specification and details for the substation ancillaries such as:

- a) Air break isolators
- b) Current and potential transformers
- c) Lightning arrestors
- d) Auxiliary power supply
- e) Central control console
- f) Pole structure

#### 6.2.4 STANDARD SPECIFICATION

The standard specification shall be applicable:

- a) IS : 1818/1972 Alternative current isolators (disconnectors and earthing switches)
- b) IS : 2099/1973 Bushings for alternating voltages above 1000 volts measured on the basis of unit length and shall be classified on type and no. of pairs marker excavation, back filling

6.3 Wiring of each telephone outlet from the tag block, to individual outlet shall be measured on the basis of unit length Conduit, wires Outlet & box

6.4 Each telephone outlet shall be measured as one unit Outlet with box : Nil

## 7 FIREALARM/CCTV/PUBLIC ADDRESS

7.1 Wiring to CCTV, speakers, detectors/hooters shall be measured on the basis of unit length Conduit, accessories wires, boxes etc. Devices

7.2 Fire alarm CCTV/Music systems units such as panel, hooter, break glass splitter, speaker etc. shall be measured individually Splitter, speaker, panel, detector, BG hooter, fixing accessories, JB etc. Wiring

- c) IS : 2165 (PT-3)/1973 Insulation co-ordination PT-3 for equipment having highest voltage for equipment of about 1 KV and less than 100 KV (1st Rev.)
- d) IS : 2486 (PT-1)/1971 Specification for insulator fittings overhead power lines with nominal voltage greater than 1000 volts PT general requirement and tests.
- e) IS : 2544/1973 Porcelain post insulators for systems with nominal voltages greater than 1000V (1st Rev.)
- f) IS : 2705 (PT-1)/1974 Current transformers Part-1 general requirements
- g) IS : 2705 (PT-2)/1964 Current transformer Part-2 measuring current transformers
- h) IS : 2705 (PT-3)/1964 Current transformer Part-3 protective current transformers
- i) IS : 2705 (PT-4)/1968 Current transformer part-4 protective current transformers
- j) IS : 3070 (PT-1)/1974 Lightning arrestors for alternating current system part-1 non linear resistor type lightning arrestor
- k) IS : 3070 (PT-2)/1966 Lightning arrestors for alternating current system part-2 expulsion type lightning arrestors
- l) IS : 3156 (PT-1,2,3) Voltage transformers Part-1 general requirements, measuring voltage transformer part-2 protective voltage transformer part-3
- m) IS : 5792 Drop out fuses
- n) IS : 1651 Stationary cells and batteries lead acid type with tubular positive plate
- o) IS : 1652 Stationary cells and batteries lead acid type with planted positive plate
- p) IS : 6304 Stationary cells and batteries lead acid type with pasted plates

## 4.3 AIR BREAKER ISOLATORS

The air break isolators/disconnecting switches shall have the following features:

- a) Single throw double break isolators with or without earthing blade
- b) The contacts should be electrical grade copper pressure relieving type. The female fixed contacts shall be high pressure self aligning. The male moving contacts shall be either flat or tubular the contact pressure should not be less than 0.25 kg per amp.
- c) Terminal pads shall be copper flat. Terminal connectors should be suitable for receiving ACSR conductor's busbars of adequate size.
- d) The current rating of switches shall be based on a temperature rise of 30 deg. C above ambient of 40 deg.C. The one second short circuit rating of the isolator shall be not less than the RMS current of maximum half cycle short circuit current.
- e) The isolator shall be provided with make before and break after type copper arching horns of the following requirements to break the magnetic current of transformer

Voltage Copper rod Horn gap

SWG mm

11 KV 2 200

22 KV 2 250

33 KV 1 330

66 KV 0 510

110 KV 2/0 750

- f) The operating control base for all the manual operator isolators are of robust construction. Locking arrangement shall be provided for both "On" and "Off" position. Safety stops are provided on the base to prevent over travel.

g) Auxiliary switches with pairs of contacts of both open and close position and for remote control indication, interlocks etc. should be provided and should be housed in weather proof box designed to operate on standard DC voltage. Mechanical interlocks should be housed in weather proof box.

4.3.1 Isolators should be mounted on the structure with necessary ground clearances as shown in the drawings. All metallic parts not carrying the current shall be connected to earth grid as shown in the drawings. All interlocking feature and isolator position indicator should be connected to relay control panel using suitable size and number of cores control cables.

#### 4.4 TESTING AND COMMISSIONING

- a) General inspection of isolators
- b) Insulation test of terminal points with respect to earth using 2500 volts meggar.
- c) Checking of position of isolator on relay control panel.
- d) Checking of interlock i.e. operation isolator should be possible only when circuit breaker in position is 'Off' or in case switch On/Off of isolator circuit breaker should be in 'Off' position or circuit breaker can be switch on only when isolator in 'On' position.

#### 4.5 CURRENT TRANSFORMERS

Current transformer should be wound type separately mounted HV current transformer should be of live tank design which is mounted on the bushing with fine design aluminium clamps with adequate mechanical strength avoiding any damages. Rated standard : IS : 2705, BS : 3938 CT assembly will include :

- a) HV line terminal
- b) Oil expansion chamber
- c) Oil level indicator
- d) Oil fitting plug
- e) Porcelain insulator
- f) Tank with cover
- g) Lifting lugs
- h) Secondary terminal box with HV neutral terminal I) Oil drain plug
- j) Rating and diagram plate
- k) Earthing terminal
- l) Abnormal pressure relief valve

CTS should be mounted separately with ground clearance as shown in drawing.

#### 4.6 TESTING AND COMMISSIONING

- a) General inspection of CTS
  - b) Marshalling box kiosks
  - c) Insulation test of the terminal points using 2500 KV meggar.
  - d) Continuity test of conductors used for remote indication of metering and protection sockets in relays control panel. Short time rating of CT should be 18 KA for one second.
- The epoxy cast CT should undergo PD test essential and other test as per IS specification.

#### 4.7 POTENTIAL TRANSFORMERS

The PT shall have the following salient features :

- a) Reference standard : IS : 3156, BS : 3941
- b) Rated voltage : System voltage
- c) Basic insulation level : 140 KV
- d) Primary voltage : system voltage
- e) Secondary voltage : 110/3

4.7.1 PT assembly should include:

- a) N2 filling valve with cap

- b) primary terminals
- c) Line tank
- d) Oil level indicator
- e) Porcelain insulator
- f) Access for secondary terminals
- g) Cable gland
- h) Lifting lug with 30mm hole
- l) Oil filling plug and drain plug
- j) Bottom housing
- k) Rating and diagram plate
- l) Earthing terminals

Other enclosure etc. should be as per manufactures standard design. PT should be mounted separately with ground clearance as shown in the drawing.

#### 4.8 TESTING AND COMMISSIONING

- a) General inspection of potential transformer and marshalling box kiosks.
- b) Insulation test of terminal points using 2500 KV meggar.
- c) Continuity test of conductor used for remote indication of metering and protection circuits in relay control panel.

#### 4.9 LIGHTNING ARRESTORS

Substation has to be shielded against direct lightning strokes by provision of earth wires as shown in the drawing on the same substation. Earth wires should be suitably placed so as to provide coverage to the entire substation equipment. Besides direct strokes, the substation equipment has to be protected against travelling waves due to lightning strokes entering the substation. Lightning arrestors should be discharge resistance and station class type heavy duty with insulating base. Lightning arrester should be mounted separately with ground clearances as shown in the drawings. Lightning arrester should be connecting to independent earth pit.

#### 5.0 TRANSFORMER

##### 5.1 SCOPE

Scope of these specifications covers the manufacturer, testing, supply, installation and commissioning of transformers.

##### 5.2 GENERAL REQUIREMENTS

System of supply shall be 11/22/33 KV, 3 phase, 50 cycles, solidly earthed system as indicated in equipment data.

##### 5.3 RATING

Transformers shall be rated as per the design consideration and as IS:2026.

##### 5.4 NO LOAD VOLTAGE

No load voltage shall be 11000/22000/33000 Volts on H.V. Side and 433 Volts on M.V. Side.

##### 5.5 CONNECTIONS

Connections shall be Delta on H.V. side and star on MV side with Neutral terminal brought out for solid earthing.

##### 5.6 VECTOR GROUPS

Vector groups shall correspond to the Vector Symbol Dyn-11

##### 5.7 IMPEDENCE

The transformers shall be so designed and manufactured to have matched impedance for a parallel operation. Impedance shall be 5% and variation in impedance of the ultimate finished product shall be within +/-5% of the nominal impedance value.

#### 5.8 TYPE

Transformer shall be suitable for indoor or outdoor and oil cooled or Resin cast installation as indicated in the equipment data.

#### 5.9 MATERIAL AND CONSTRUCTION

Similar parts, particularly removable one shall be interchangeable. Exposed parts shall not leave pockets where water can collect. Internal design of transformer shall ensure that air is not trapped in any location. Material on contract with oil shall be such as not to contribute to the formation of acid in oil. Surface in contact with oil shall be not be galvanized or cadmium plated.

#### 5.10 CORE

- a) Magnetic circuit shall be of 'Core Type' construction. The core shall be build out high grade, non ageing, low loss, high permeability, cold rolled grain oriented silicon laminations.
- b) Finally assembled core shall be free from distortion. It shall be rigidly clamped to ensure adequate mechanical strength and to prevent vibrations during operations.
- c) Core shall be provided with lugs suitable for lifting the complete core and coil assembly.
- d) Core and coil assembly shall be so fixed in the tank that shifting will not occur during transport or short circuits.

#### 5.11 INTERNAL EARTHING

All internal metal parts of transformer shall be earthed.

#### 5.12 WINDING

- a) Winding shall be subjected to shrinking and seasoning process, so that no further shrinkage occurs during service. Adjustable devices shall be provided for taking up possible shrinkage in service.
- b) Materials used in the insulation and assembly of the windings shall be insoluble, noncatalytic and chemically inactive in hot transformer oil and shall not so often or be otherwise affected under the operating conditions.
- c) For dry type transformer, both HV & LV winding shall be cast as one rigid tubular coil, avoiding any ingress of particles. The insulation shall be class F.
- d) In case of DYN 11 transformers, neutral shall be brought out in open for solid earthing on the secondary side, separately on the tank.
- e) Windings shall be copper wound
- f) Winding shall be so designed that it can withstand the specified thermal and dynamic short circuit current.

#### 5.13 TANK

- a) Tank shall be made from commercial grade low carbon steel and Shall be of welded construction.
- b) Tank shall be designed to permit lifting by crane or jacks of the complete transformer assembly filled with oil. Accordingly the base shall be suitable reinforced to prevent any distortion.
- c) Material used for gaskets shall be cork neoprene or approved equivalent.
- d) All fasteners and bolts etc. shall be galvanised zinc passivated.

#### 5.14 OIL (only for oil type)

- a) Transformer shall be supplied with first filling oil conforming to IS: 335
- b) Additional 5% quantity of oil shall be supplied in non-returnable tin for each transformer for tapping purposes etc.

#### 5.15 OFF LOAD TAP CHANGER SWITCH –("Off Circuit Tap changer Switch")

Off load tap changing arrangement shall be provided on H.V. side. The tapplings shall be provided for variation of HV voltage from +7.5% to -7.5% in steps of 2.5% each with arrangement to lock with pad locks including 2 sets of keys. ANI externally hand operated Off-Circuit tap changing switch with handle, having a position indicating plate and lock device shall be provided.

#### 5.16 ON LOAD TAP CHANGER

On load tap changing arrangement shall be provided on HV side. The range shall be +5% to -15% in 16 steps. Tap changer shall be controlled by a Remote Tap changer control panel.

#### 5.17 TEMPERATURE RISE

Continuously rated for full load, temperature rise shall not exceed 50 deg centigrade by thermometer in oil (55 deg. Centigrade by resistance).

#### 5.18 COOLING (only for oil type)

Natural oil cooling by means of pressed/round tubes/radiators around transformer tank, ONAN type shall be provided.

#### 5.19 ACCESSORIES & FITTINGS

##### 5.19.1 LIFTING LUGS

Arrangement of lifting the active part of the transformers along with the cover of the tank by means of lifting lugs without disturbing the connections shall be provided. Also complete transformer lifting lugs shall be provided. Lifting arrangement for core and coils shall also be provided.

##### 5.19.2 JACKING PADS

Jacking pads shall be provided on the transformer.

##### 5.19.3 EARTHING PADS

2 nos. earthing pads of copper or non-corrodible material on transformer tank and suitable earthing terminals on cable boxes shall be provided.

##### 5.19.4 DIAGRAM AND RATING PLATES

One diagram and rating plate indicating the details of transformer connecting diagram vector group, tap changing diagram etc. shall be provided.

##### 5.19.5 AIR RELEASE

An air release hole with plug shall be provided on the top of the tank cover to facilitate release for entrapped air while filling of oil.

##### 5.19.6 BREATHER

The transformers shall be provided with indicating dehydrating silicagel-breather of sufficient capacity.

##### 5.19.7 OIL VALVES (only for oil type)

Transformers shall be provided with the following oil valves with all free end of the valves blended.

- a) Filling valves
- b) Main tank drain valve with flanged or threaded connection. The drain shall be so designed that 90% of the oil can be drained off in 10 minutes.
- c) Top and bottom filter valves
- d) Pressure relief device or explosion vent
- e) Shut off valve between Buchholtz relay and main tank
- f) Shut off valve between Buchholtz relay and conservator

#### 5.20 OIL CONSERVATORS (only for oil type)

Transformers shall be provided with the conservator with welded end plates. It shall be bolted to the cover and enable dismantling for purposes of transport. It shall be provided with oil level guage with marking for minimum level and oil filling hole with a cap which can be used filtering oil. For draining purposes a plug shall be provided. A connection pipe between the conservator and main panel shall be provided which shall project inside the conservator.



#### 5.21 ROLLERS

4 nos. Bi-directional rollers shall be provided to the transformer on cross channels to facilitate easy movement and positioning of the transformer. Suitable arrangement of the rollers shall also be provided.

#### 5.22 THERMOMETER POCKET

A pocket along with 0-120 degree centigrade mercury-in-glass thermometer shall be provided for reading the oil temperature. The pocket shall have water proof, dust proof and weather proof design to avoid contamination of transformer oil under outdoor usage.

#### 5.23 BUCHHOLTZ RELAY

Buchholtz relays suitable for 30 Volts D.C. operation with alarm and Trip contacts with air/gas release cock shall be provided.

#### 5.24 DIAL TYPE THERMOMETER FOR OIL TEMP.

A dial type thermometer of 150 mm dia and with maximum set pointer at 75 degree centigrade shall be provided. The indicating instrument shall have 2 electrical independent contacts for electrical alarm and trip at high temperature and at 2 distinctly different temperature suitable for 30 Volt.D.C.auxiliary contacts.

#### 5.25 EXPLOSION VENT

The tank shall be provided with a pressure release device. The device shall be weatherproof and shall be provided with a diaphragm. Equaliser pipe shall be connected to the pressure release device (explosion vent) of the conservator. The vent shall be placed in such a manner so that incase of diaphragm rupture the discharge of oil shall not be on the transformer.

#### 5.26 CABLE AND BOXES

Cables and boxes shall be as follows.

- a) On H.V side Cable End Box suitable for 11/22/33 KV, 3 core x 185 sq.mm. XLPE cable
- b) On M.V. side Cable End Box shall be suitable to accept busduct/single/multicore PVC insulated cables as specified
- c) Cable terminal box shall be provided with suitable copper flats and flexibles of proper size. Extended copper flats shall be suitable to accept the above mentioned cables.

#### 5.27 MARSHALLING BOX

A marshalling box shall be provided on the transformer to have the following contact blocks.

- a) Alarm and trip contacts for Oil Temperature Indicator suitable for 30 Volt D.C. Supply.
- b) Alarm and trip contacts for Buchholts Relay suitable for 30 Volt D.C. Supply.
- c) 1 no. of filament a type bulb suitable for 230Volt Operation with On/Off switch is to be provided in the Marshalling Box.

#### 5.28 NOISE

Noise levels shall be as per NEMA standards

#### 5.29 TESTING

Transformers shall be subjected to the following tests all the factory before despatching the same and test certificates shall be furnished.

- a) Measurement of winding resistance
- b) Ratio polarity and phase relationship
- c) Impedance Voltage
- d) Load losses, copper losses
- e) No load loss and no load current
- f) Insulation resistance
- g) Induced over voltage withstand
- h) Separate source voltage withstand

### 5.30 INSTRUCTION MANUAL

Successful bidder shall submit 4 copies of manual complete instructions for the installation, operation, maintenance and circuit diagram. Foundation and trenching details shall be provide with the transformers.

### 5.31 REJECTION

The Owners/Architect/Consultants may reject the transformer if during tests or services any of the following conditions arises.

- a) No load loss exceeds the guaranteed value by 5% or more.
- b) Load loss and copper losses exceeds the guaranteed value by 5% or more
- c) Impedance value exceeds the guaranteed value by +/-5% or more
- d) The difference in impedance value of any two phases during single phase short circuit impedance test exceeds 2 percent of the average value of guaranteed by the vendor.
- e) Oil or winding temperature rise exceeds the specified value by 5 Degree Centigrade.

### 6.0 H.V. SWITCHGEAR

#### 6.1 SCOPE :

These specifications cover the general design, manufacture, testing, installation and commissioning of 11/22/33 KV Switchgear of Vacuum Circuit Breakers/SF6 as indicated in the equipment data

#### 6.2 STANDARDS :

The equipment shall be designed, manufactured and testes in accordance with the relevant International and Indian Standards. Indian Electricity Rules and Indian Standards Specifications conforming to the latest edition of the following standards in so far as they are applicable shall be followed: IEC Pub 56/298 - Circuit Breaker

IS 375 - Marking and arrangements for switchgear boards, main connections and auxiliary wiring.

IS 2705 - Current Transformer

IS 3156 - Voltage Transformer

IS 2516 - A.C. Circuit Breaker, above 1000 Volts A.C.

IS 3043 - Code of Practice for Earthing

IS 722 - (Part IV ) – Three Phase Watt- Hour meter with Maximum demand indicator.

IS 1818 - Isolator and Earthing Switches.

IS 1248 - Direct acting electrical indicating instruments

IS 3231 - Relays

IS 8675 - Control Switches and Push

IS 2147 - Degree of Protection provided for enclosures for Switchgears.

#### 6.3 SYSTEM OF SUPPLY

11/22/33KV, 3 Phase, 50 Cycles, earthed system.

#### 6.4 TYPE

Indoor, floor mounting type.

#### 6.5 MATERIAL AND CONSTRUCTION :

The switchboard shall be factory assembled, indoor type metal clad, totally enclosed dead back and fully interlocked design generally manufactured and tested as per IS 25165/1980. The switchboard shall form a continuous board with main supporting frame if fabricated CRCA sheet steel of 14 gauge thickness to form a rigid assembly providing self contained housing for fully draw out type circuit breaker units and associated equipment. Doors and partitions shall be fabricated using 16 gauge CRCA sheets. Design of the board shall permit future extensions at both the ends. The switchboard shall be completely assembled and tested at the manufacturer's works for proper operation and designed for a short circuit capacity of 350MVA/33 KV. The bus bars shall be continuously rated for the ratings specified as per the technical details with levels suitable for 33000Volts, 3 phase, 50 cycles and effectively earthed system. The switchboard structure shall be divided into two sections. The front section shall comprise of self contained housing for a draw out type circuit breaker units, the top

sections shall accommodate the busbars, instruments, relays etc. and the back sections shall accommodate instrument transformers and cable boxes. The panels shall be designed with adequate space for accommodating the specified cables and terminations of cables and in case of an emergency for easy disconnection of the cables. The cubicles shall be dust and vermin proof. Bottom plates of each cubicle shall be such that the cable openings could be sealed effectively to prevent entry of creeping vermin after installation. All ventilation and other openings provided in the equipment shall have suitable screen protection by fine brass wire mesh. Draw out portion of the circuit breakers shall be interchangeable. Circuit breakers shall be with manual spring charging mechanism.

Circuit breakers shall be provided with necessary auxiliary contacts for indication, control, interlocking or other purposes. Excluding the contacts already used for the circuits, a minimum of four spare sets of contacts with two 'NO' and two 'NC' shall be left free in each unit. Busbars and jumper connections shall be insulated with suitable sleeves. Voltage transformer shall be insulated for full voltage rating and shall be Cast Resin Type. Secondary winding shall be rated for 110 volts RMS. High voltage HRC fuses of full interrupting rating shall be provided. Fuses shall be mounted for easy accessibility for replacement with safety while the main busbars are live. The VA rating of PT shall be adequate to meet the VA burden of all meters, relays together with 10% spare capacity. Current transformer shall be mounted in such a way that they do not come in the way of jumper connection to break isolating contacts. Each CT shall be of proper accuracy as per relevant standards for metering and protection, with adequate burden. CT shall be cast resin type having bar/wound primary. Meters, relays etc. shall be flush mounted preferably on a hinged metering panel in front of the switchboard permitting ready access to small wiring, terminal board, instruments, fuses etc. Each unit shall be equipped with metering and indication as called for in the schedule of quantities. Instruments shall preferably have square size and shall be vibration proof with proper accuracy.

Circuit breaker unit shall be suitable for short circuit symmetrical breaking current rating of 20 KA at 22KV, RMS.

#### 6.6 CLOSING SYSTEM

Manually charged spring power closing mechanism shall be provided for the breakers. The operating mechanism shall be TRIP FREE design.

#### 6.7 TRIPPING SYSTEM

Shunt trip coil suitable for 30 Volts DC battery supply shall be provided. Breaker elements shall be withdrawable in three distinct positions as follows:

- a) Fully plugged in (Service)
- b) Fully withdrawn, and
- c) Test.

In test position, the breaker element shall safely be isolated from the fixed contacts of the breaker. In the test position, it should be possible to close or trip the breaker over the control switch for testing purpose provided on respective breaker panel. Necessary interlocks shall be provided for the relative positions of the breaker element to facilitate fool-proof operation and maintenance.

#### 6.8 MECHANICAL SHUTTERS

The circuit breaker shall be horizontal draw out type with provision of automatic shutters over primary isolating contacts and positive interlocking to prevent the operation of the circuit breaker unless it is fully plugged in or isolated and also locked in either position.

#### 6.9 INDICATING LAMPS

- a) All indicating lamps shall be of the filament type suitable for continuous operation of 110 Volts AC.
- b) All indicating lamps shall be of low Watt rating.
- c) The lamps shall have Red, Green, Amber and White covers and out of temperature resistant prismatic glass or plastic.
- d) Bulbs and lenses shall be easily replaceable from the front.
- e) ON lamps – Red colour, Off lamps – Green colour, white lamp – Trip circuit healthy and Amber for Auto trip

#### 6.10 METERS

All indicating meters shall be of 96 sq. mm size and suitable for flush mounting.

#### 6.11 RELAYS

- a) Relays shall be :
- b) Enclosed in dust proof flush mounting cases.
- c) Accessible for setting and resetting from the front.
- d) Providing with positive acting hand reset flag indicators visible from the front.
- e) Auxiliary relays shall be rated to operate satisfactorily between 70% and 110% rated voltage.

#### 6.12 SELECTOR SWITCHES

Selector switches shall be of the rotary type and adequately rated for the purpose intended. Minimum acceptable rating is 10 Amps, continuous at 240 Volts.

#### 6.13 EARTHING

Main copper earth bar shall be 25 mm x 6 mm for the full length of switchboard. Provision shall be made for connections from the earth bar to the substation earth on both sides of the switchboard.

#### 6.14 DRAWING AND LEAFLETS

Two sets of illustrative literature and dimensional drawings shall be submitted with the tender. The successful bidder shall provide 3 copies of manual of complete instructions for the installation, operation, maintenance and repairs. Circuit diagram, foundation and trenching details shall also be provided with the tender.

#### 6.15 TESTING

H.V. Switchboard shall be subjected to tests specified in relevant Indian Standards before despatching and test certificates shall be furnished in triplicate. Only routine testing shall be carried out at the manufacturer's works. The manufacturer should produce the certificate for type test.

### 7.0 CABLING

#### 7.1 SCOPE

The scope under this section covers the following:

- A) Power cables HV and LV
- B) Control cables

#### 7.2 STANDARDS

The following standards shall be applicable:

- A) IS : 1753 : Specification for aluminium conductors for insulated cables
- B) IS : 2982 : Specification for copper conductors in insulated cables
- C) IS : 5831 : Specification for PVC insulated and sheath of electric cables
- D) IS : 6474 : Polythelene insulation and sheath of electric cables
- E) IS : 3975 : Specification for mild steel wires, strips and tapes for armouring of cables
- F) IS : 692 : Paper insulated lead-sheathed cables for electricity supply
- G) IS : 694 : PVC insulated cables
- H) IS : 1554 : PVC insulated (heavy duty) electric cables
- I) IS : 4288 : PVC insulated & PVC sheathed solid aluminium conducted cables of voltage rating not exceeding 1100 V.
- J) IS : 5755 : Mineral insulated aluminium sheathed cable with aluminium conductors
- K) IS : 1255 : COP for installation and maintenance of paper insulated power cables (upto and including 33 KV)
- L) IS : 7098 : Specification for cross linked polyethylene insulated PVC sheathed cables
- M) IS : 5959 : Polythene insulated and PVC sheathed (heavy duty) electric cables
- N) BS : 2004 : PVC insulated unarmoured cables for electric power & lighting.
- O) IS : 6380 : Electrometric insulation and sheath of electrical cable
- P) IS : 3961 : Recommended current ratings of cables

Q) IS : 5819 : Recommended short circuit ratings for high voltage PVC cables

### 7.3 GENERAL REQUIREMENTS

The cables shall be either copper or aluminium as indicated. The HV cables shall be of paper insulated, PVC or XLPE and the M.V cables shall be of PVC or XLPE as indicated in the drawings and schedule of materials. 3.2 Power cables shall comply of the following

- HV cables to suit the system voltage
- MV cables -1100 V grade with standard copper conductors upto and including 6 mm sq. and standard aluminium conductors for 10 mm sq.
- Colour coded insulation
- PVC inner and outer sheathing applied for extrusion
- Steel armouring between inner and outer sheathing

Control cables shall be 600V grade multi-core copper conductor with PVC insulation, armouring and sheathing. The cable sizes shall be selected to carry the continuous full load current, with stand short circuit currents and bring the voltage drop within the specified limits.

### 7.4 CONDUCTORS

The copper conductors shall comply with the requirements specified in IS : 2982 and aluminium conductor IS : 1753.

### 7.5 INSULATION

The type of insulation shall be as indicated in the drawing and bill of materials. The thickness of insulation shall be on the basis of insulation material, voltage and the conductor size conforming to the relevant standard specification. The cores shall be colour coded to Indian Standard Specifications. The XLPE cables shall be with chemically cross-linked polythene of natural unfilled compound. The PVC insulation & sheathing shall be of high quality & conforming to the following :

- Volume resistivity @ 278 5.12 x 10
- Tensile strength 125 kg/cm
- Elongation 125%

### 7.6 SHEATHING

The sheathing shall be PVC and shall be before and after the armouring, the thickness of the sheathing shall be based on the conductor size and overall diameter below the sheathing.

### 7.7 ARMOURING

Single core cables shall be without armouring. But it insisted it shall be of magnetic material. Multi core cables shall be with armouring. The armouring for cables upto 16 mm sq. shall be galvanized wire armoured and above 25 sq.mm shall be steel strips.

### 7.8 INSTALLATION

Power cable laying shall strictly be as follows : In full length without joints or splices. - Mark the routing on drawings and at site and get it approved, if the routes are not available on drawings. - Cable trays to be used for cables laid indoors except for single cables. The cable trays shall be of ladder type fabricated out of structural steel, GI perforated or aluminium perforated as indicated. The cable trays shall be of adequate strength to carry the weight of cables without sagging. Structural brackets grouted in the build up trenches to support the cable such supports shall be at intervals of not less than 750 mm centres.

All the structural steel work shall be finished with two coats of paint over primer. - Spacing of cable support for self supported cables on wall, ceiling or trenches shall be as follows : Horizontal run Vertical run

Upto 10 mm 350 mm 450 mm  
16 to 95 mm 450 mm 500 mm  
120 to 400 mm 700 mm 900 mm

- For cables laid indoors, plastic identification marks at every 20 m straight run, at bends & both ends.
- Cables laid underground shall be at a depth not less than 600 mm with sand bedding & protective bricks or tiles extending at least 100 mm on both sides. Markers to be provided above ground at bends, loops & crossing.
- Provide humepipes, trenches or tunnels at built-up areas & road crossings.
- Provide loops of minimum 500 mm radius at each ends.
- Cable should not be bend to a radius of not less than 20 times the diameter of the cables.
- Individual cable shall be clamped with saddle, clamp, spacer etc.
- Cables on trays shall be tied using lockable nylon ties of appropriate length.

Control cables shall be laid away from the power cables & shall be on suitable trays. The power cable termination shall have necessary brass glands & shall be as follows :

- Pressure clamp insertion type upto 4 sq.mm
- Tinned copper termination shall be through pressure clamp insertion type lugs.

## 7.9 TESTING

HT & LT cables shall be tested after installation using 1000V & 500V insulation resistance tester respectively and the following readings recorded:

- Continuity on all conductors
- Insulation resistance
- A) Between conductors
- B) All conductors & ground

## 8.0 MV SWITCHGEAR

### 8.1 SCOPE

The scope under this section covers supply and or installation, testing and commissioning of Main MV panels & switchgears.

### 8.2 STANDARDS

The following standards shall be applicable:

- A) IS : 3072 COP for installation & maintenance of switchgears
- B) IS : 4237 General requirements for switchgear & control gear for voltage not exceeding 1000V.
- C) IS : 375 Marking and arrangement for switchgear busbars, main connection and auxiliary wiring.
- D) IS : 2147 Degree of protection provided by enclosure for low voltage switchgear & control gear.
- E) IS : 139497 Specification for low voltage switchgear & control gear
- F) IS : 5987 COP for selection of switches voltage not exceeding 1000V.
- G) IS : 1818 AC isolators & earthing switches.
- H) IS : 4047 Heavy duty air break switches and composite units for air break switches and & fuses for voltage not exceeding 1000V.
- I) IS : 4064 Normal duty air break switches and composite unit for AB switches & fuses for voltage not exceeding 1000V.
- J) IS : 2607 Air break isolators for voltage not exceeding 1000V.
- K) IS : 8623 Specification for factory built assemblies of switch gears and control gears for voltage including 1100V AC & 1200 V DC.
- L) IS : 13703 HRC fuse links upto 1000V AC.
- M) IS : 3106 COP for selection, installation and maintenance of fuses voltage not exceeding 650 V.
- N) IS : 2959 AC contactors for voltage not exceeding 100V.
- O) IS : 3914 COP for selection of AC induction motor starters
- P) IS : 5124 COP for installation and maintenance of AC induction motor for voltage not exceeding 1000V.
- Q) IS : 1822 AC motor starters for voltages not exceeding 1000 V.

### 8.3 GENERAL REQUIREMENTS

The MV switchgear shall meet the requirements shown on the drawings. They shall be 1000 V grade suitable for the system short circuit capacity and rated current carrying capacities and shall comply the following features.

- A) Incoming & outgoing feeders.
- B) Starters and contactors
- C) Busbars and feeder connections
- D) Meters, relays indicating instruments
- E) All interconnection & wiring
- F) Sheet steel enclosure.

8.4 The switchgear shall be cubicle or industrial type as indicated on the drawings and schedule of material and shall meet the specifications of components indicated.

#### 8.5 CUBICLE PANELS

The panel shall be fabricated out of CRCA sheet steel enclosure having combination of 14 & 16 SWG thickness, free standing, totally enclosed, extensible modular construction. The panels shall be provided with 7 tank anticorrosive treatment. The panel shall be finished with 2 coats of approved synthetic enamel paint/powder coated over two coats of red-oxide primer, oven dried. The panel shall be dead front, components accessible from front for maintenance, panels having depth of 800 mm and above can have accessibility. For busbars and cables from back, subject to space availability on the rear side of panels.

Independent vertical compartments for busbars, feeders and cables with sufficient clearance and accessibility for maintenance of all components and connections. The cable entries shall be suitable for both top and bottom entry, unless specifically indicated otherwise. Non-cubicle panels (open type) also could be used with the approval of Consultants and if indicated in the bill of material specifically. Each feeder shall be totally enclosed, self sufficient with ACB/MCCB/SF unit, contactors, starters, meters, relay indicators, interlocking doors, padlocking facility, labelled terminal block, engraved plastic labels indicating feeder details. Each panel shall be adequately ventilated with louvers & shall be protected with wire mesh from inside. The maximum height of the operating handle/push button shall not be more than 1990 mm in the case of main panel and 1750 mm for other panels and MCC's unless specially approved by Consultants.

Each chamber shall be provided with concealed hinged door of not less than 14/16 G thick, machine cut opening for mounting relays, meters, PB's and indicators. The doors shall be provided with neoprene gasket of good quality. Door shall be earthed to the body of the panel.

Earthing of non current carrying metal parts shall be connected to the earth busbars. Feeder components shall be mounted on 2.5 mm thick M.S. top & bottom plates of the cable chambers shall be removable sectionalized to mount cable glands. Base frame work of minimum ISMC 75 shall be provided for all floor mounted panels and angle iron brackets for wall mounted type.

#### 8.6 BUSBARS

The busbars shall be of air insulated electrolytic grade aluminium/ copper as indicated in the drawing or schedule of material and shall comply with the following.

- A) Uniform cross section with 35 C rise above ambient and with colour coded PVC heat shrinkable sleeves.
- B) Branch busbars rated for 75% of aggregated capacities of the feeders connected.
- C) Neutral busbar of size 50% of phase bars.
- D) Earthing busbar of size similar to neutral busbar subject to a maximum of 150 sq.mm copper or 250 sq.mm Aluminium
- E) Non hydroscopic moulded (SMC/DMC) supports to withstand thermal and dynamic short circuit loads, equivalent to 35 m VA at 415 V.

#### 8.7 AIR CIRCUIT BREAKER

The air circuit breakers shall be double break, quick make, quick break, trip free horizontal draw out type and shall comply the following features.

- A) Ultimate breaking capacity (ICU) of 50-65 KA.
- B) Rated breaking capacity (ICS) of 50 – 65 KA
- C) Making capacity of (ICM)100-150 KA.

- D) Anti welding, anti arc traveling silver alloy main and arcing contacts with arc chute.
- E) Triple pole direct acting and temperature compensated over current releases suitable for discrimination with up and down stream feeders.
- F) Serve, test isolation and maintenance position setting with locking facility in any position.
- G) Isolation plugs, safety shutters and interlocking facility.
- H) CT operated overload and short circuit relays for all breakers with microprocessor controlled
- I) Under voltage and earth fault relays for incoming breakers, preferably microprocessor based in built. Meters and indicators shall be provided as shown in the drawing along with BMS connectivity port, if required.

#### 8.8 MOULDED CASE CIRCUIT BREAKERS

The MCCB's shall be of double break, quick make, quick break trip free operation shall comply the following features.

- 1) Interrupting capacities for different rating in KA at 415V, 50 Hz, 0.2 PF. a) Upto 100 A. - 35 KA
- b) Above 100 & upto 800 A - 50 KA
- 2) Non welding silver alloy main contacts and arcing contacts with arc chutes.
- 3) Inverse time instantaneous O/C, temperature, compensated adjustable and integral tripping mechanism.
- 4) Moulded, heat resistance resin bonded fibre glass or phenoltic material housing.
- 5) Under voltage and current operated earth fault releases for incoming MCCB's and earth fault releases to operate on 1 to 2A for CCB's used at power outlets shall be provided wherever shown on the drawing.
- 6) Extended handles for MCCBs of 200A & above.
- 7) All MCCBs 250 Amps above shall have microprocessor based releases capable of sensing true RMS
- 8) All breaking capacity specified are ICS and ICS = ICU

#### 8.9 SWITCHES AND SWITCH FUSE UNITS

The switches and SF units shall be of AC 23 duty and shall comply the following features.

- A) Quick make, quick break, double break silver alloy contacts with arcing horns of chutes.
- B) Common operating handle.
- C) Switch fuse units of combination fuse switch type with fuses on phase circuit and copper solid links for neutral circuit for TPN and DP units.
- D) Fuses shall be of min. 30 KA short circuit rates.

#### 8.10 STARTERS

The starters for rotating machines shall be as follows unless indicated otherwise.

- A) Upto 10.0 HP Direct on line
- B) 12.5 to 40.0 HP Star Delta
- C) Above 50 HP As specified

8.11 The starters shall comply the following features.

- A) Main and auxiliary contacts of required capacity with 240 V coils and 2 numbers NC and NO spare contacts each.
- B) Automatic change over for star delta with adjustable static timer.
- C) Bi-metallic over load relays and single phase prevention relays with manual reset etc.
- D) Start stop push button/auto-off-manual switch as indicated in the schedule of material.
- E) Internal wiring and accessories including CT's wherever required
- F) Indicating lamps with 2A control fuses.

#### 8.12 AUXILLARY EQUIPMENTS

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The auxiliary equipments such as instrument transformers, meters, relays, indicating lamps etc. shall be as specified.

#### 8.13 BUSDUCTS



The busducts shall be 1000 V grade totally enclosed with sheet steel having thickness of minimum 16 SWG. It shall be ventilated adequately with louver and louvers shall be covered with wire mesh from inside. The busbars, busbar supports and sheet steel treatment shall be same as specified for the panels. The busducts shall be provided with right angle bends wherever necessary and flexible connections at both ends.

#### 8.14 INSTALLATION

The switchgears shall be mounted 100 mm above the floor with necessary steel frame or masonry footings. The panels shall be thoroughly cleaned before commissioning and shall be made dust and moisture free using hot air blowers. The panel shall be provided with two earth connection of sufficient capacity. The bus ducts shall be mounted at the location shown on drawings with adequate supports. The spacing between the supports shall not be more than 1.0 metre. The bus duct shall be provided with 2 nos. earth connection terminals of sufficient capacity.

#### 8.15 TESTING AND COMMISSIONING

The MV switchgear shall be subject to factory inspection before finishing and despatch, unless inspection is waived. The following test are to be carried out and necessary certificates submitted.

A) Routine test certificates for ACB's and MCB's.

B) Insulation resistance test with 1000V megger with all switchgear in closed position.

1) Phase to phase 2.5 MEG. OHMS

2) Phase to neutral 1.5 MEG. OHMS

C) Secondary wiring and apparatus should withstand 2000 V for one minute.

D) Meters and relay calibrated and tested through secondary injection tests. Test certificates shall be submitted.

E) Capacitors

- Insulation resistance of 50 M ohms. after 1 minute charge with 500 V DC.

- To withstand 2500 V AC for 1 minute

- Functional test for APFC relay.

#### 9.0 EARTHING & LIGHTNING PROTECTION

##### 9.1 SCOPE

The scope of this section shall cover the following:

A) Earthing station

B) Earthing conductors

C) Earthing of equipments and installation

##### 9.2 STANDARDS

The following standards shall be applicable :

A) IS : 3043 COP for earthing

B) IS : 5216 Safety procedures & practice in electrical work

C) IS : 2309 COP for the protection of buildings and allied structures against lightning

##### 9.3 MATERIAL

The material for earthing system shall be one of the following as indicated in the drawing and schedule of material.  
Copper-Aluminium-GI

##### 9.4 EARTHING STATION/TERMINATIONS

The earthing station shall be generally as indicated in IS : 3043 shall include :

- 600 x 600 x 3 mm copper or 600 x 600 x 12 mm GI plate for plate earthing

- 50/75 mm dia 2500 mm long perforated GI pipe for pipe earthing

- Soil treatment with alternate layers of salt and charcoal

- Masonry chamber with hinged cast iron cover, watering pipe and funnel.

- Test link

The resistance of each station should not exceed 5 ohms. The no. of earthing station shall be as shown on the drawing.

#### 9.5 EARTHING CONDUCTORS

Earthing conductors shall be of copper, aluminium or GI as shown in the drawing and schedule of material. Copper conductors shall be with a phosphorous content of less than 0.2% GI and aluminium conductors buried in ground shall be provided with protective coatings and wrappings. There shall be minimum of one earth connection to single phase loads and two numbers for three phase. The sizes of earth conductors for equipments, switchgears etc. shall be as shown on the drawings.

#### 9.6 CABLES

- A) Armoured Earthing of armouring at both ends
- B) Unarmoured Continuous bare conductor or insulated conductor along with cable.

#### 9.7 CONDUIT WIRING

- A) Metallic & Non metallic Insulated conductor run inside the conduit

#### NOTE

- 1) The earth conductors for cables and conduits shall be of 50% of the phase conductor subject to a maximum of 120 sq.mm and a minimum 2.5 sq.mm copper.
- 2) The equivalent size of aluminium and GI conductors shall be 1.4 and 3 times the copper size respectively.

#### 9.8 INSTALLATION

The earth station shall be made by excavating the ground to a depth of not less than 2.5 m and the excess earth after back filling shall be removed from site. Ground with rocky strata, the depth of excavation shall be less. However, additional earthing stations or earth matting to be provided to achieve the system earthing less than one ohm. The earth conductors shall be fixed to the wall/columns etc. at every 500 mm centres with 10 mm spacers. The total earthing system shall be mechanically and electrically connected to provide independent path to earth.

#### 9.9 TESTING

The following earth resistance values shall be measured with earth meggar and readings recorded.

- A) Each earthing station
- B) Earthing system as a whole
- C) Earth continuity conductors

#### 10.0 DISTRIBUTION BOARDS

##### 10.1 SCOPE

The scope under this section cover the sub-distribution boards and feeder pillars for lighting and power distribution.

##### 10.2 STANDARDS

The following standards shall be applicable :

- A) IS : 2607 Air break isolators for voltages not exceeding 1000 V.
- B) IS : 13032 Enclosed distribution fuse boards and cutouts for voltages not exceeding 1000 V.
- C) IS : 2086 Carrier and base used in rewirable type electric fuses upto 650V.
- D) IS : 3106 COP for selection, installation and maintenance of fuses- voltage not exceeding 650 V.
- E) IS : 5039 Distribution pillars for voltage not exceeding 1000 V.
- F) IS : 8828} Miniature circuit breaker. IEC : 898}

##### 10.3 GENERAL REQUIREMENTS

The distribution boards shall be complete with:

- Sheet steel enclosure of 16 SWG suitable for recessed semirecessed or surface mounting or of thermoplastic/ABS body.
- Electrolytic grade copper, busbars, incoming and outgoing feeders
- Earthing terminals
- Circuit diagram indicating load distribution on the inside cover
- Weather proof enclosure and canopy for outdoor DB's and feeder pillar.
- Double door vertical or horizontal.

#### 10.4 ENCLOSURE & FABRICATION

The fabrication of the enclosure shall comply the following.

- 16 SWG sheet enclosure with circular knock-outs
- Wire race for individual phases.
- Phase barriers of insulating material for three phase DB's
- 2 nos. earthing terminals with lug type connection

10.5 Wherever wiring is with 3C –flexible wires, minimum space of 150 mm shall be provided between MCB & enclosure all around as well as between MCBs of different phase.

#### 10.6 CORROSION TREATMENT

Sheet steel work shall be provided with 7 tank anticorrosive treatment. The panel shall be finished with 2 coats of approved synthetic enamel paint over two coats of red-oxide primer, oven dried.

#### 10.7 BUSBARS

The busbars shall be as follows :

- The electrolytic grade copper bar suitable for incoming feeder with current carrying capacity of min. 800A/sq. inch.
- Individual phase and neutral bars located in respective phase cubicle for three phase DB's.

#### 10.8 MINIATURE CIRCUIT BREAKERS

The MCB's shall comply the following feature :

- Short circuit capacity of minimum 9 KA
- Quick make, quick break, non welding silver alloy contacts suitable for manual and automatic operation
- Inverse time over load and instantaneous short circuit tripping mechanism with trip free operation.
- Common operating handle and integral tripping for multiple MCB
- Pressure clamp terminals for users upto 4 mm sq. and bolted lugs for higher rating.
- Phenol formaldehyde moulded enclosure.
- B curve for lighting d curve for UPS supply & c curve for motor duty (AC etc.).

#### 10.9 FUSES

The fuses shall comply the following features:

- HRC link type with carriers
- Short circuit rating of minimum 25 KA
- Pressure clamp terminals for wires upto 4 mm sq. and bolted lugs for higher rating.

#### 10.10 INSTALLATION & TESTING

The distribution boards shall be mounted on necessary angle crow frame work.

Insulation resistance shall be tested with 1000V meggar and the values should be as shown below:

- Between phases : 2.5 megohms
- Between phases & neutral : 1.5 megohms

#### 11.0 WIRING INSTALLATION

##### 11.1 SCOPE

The scope under this section covers wiring installation consisting of :

- A) Lighting circuit
- B) Power circuit
- C) Equipment & machinery
- D) Low voltage installation

#### 11.2 STANDARDS

- A) IS : 732 COP for electrical wiring installation (system voltage not exceeding 650V)
- B) IS : 1646 COP for fire safety for buildings (General) electrical installation
- C) IS : 5216 Guide for safety procedures & practice in electric work.
- D) IS : 4648 Guide for electrical layouts on residential buildings
- E) IS : 302 General & safety requirements for light electrical appliances
- F) IS : 9537 Specification of conduits for electrical installation
- G) IS : 1653 Rigid steel conduits for electrical wiring.
- H) IS : 2509 Rigid non metallic conduits for electrical installation
- I) IS : 3480 Flexible steel conduits for electrical wiring
- J) IS : 3667 Fittings for rigid steel conduits for electrical wiring
- K) IS : 3837 Accessories for rigid steel conduits for electrical (wiring)
- L) IS : 6946 Flexible (pliable) non-metallic conduits for electrical installation.
- M) IS : 3419 Fittings for rigid steel conduits for electrical wiring
- N) IS : 694 PVC insulated wires
- O) IS : 8130 Conductors for insulated electric cables & flexible cords
- P) IS : 5133 Boxes for enclosures of electrical accessories
- Q) IS : 2148 Flame proof enclosure for electrical apparatus
- R) IS : 1293 3 pin plugs and sockets
- S) IS : 4705 Switch socket outlet (non-inter locking type)
- T) IS : 5561 Electrical power connectors
- U) IS : 2004 PVC insulated wires

#### 11.3 CONDUIT WIRES

Conduit wiring shall be from LDB, PDB, panels, MCC or isolators as indicated and shall be complete with:

- Conduit & accessories
- Wires & interconnections
- Control switches & sockets
- Outlet boxes with terminal connectors & earthing

#### 11.4 NON-METALLIC CONDUITS

Non-metallic conduits shall be heavy/medium guage PVC as specified in schedule of work as per IS : 9537 with following dimensions subject to tolerances. All accessories shall also be of the same material.

NOM. DIA ID OD

- 1) 20 dia 15.8 20
- 2) 25 dia 20.6 25
- 3) 32 dia 26.6 32
- 4) 40 dia 34.4 40

#### 11.5 METALLIC CONDUITS

All conduits & accessories shall comply the following features:

- Solid welded pipes with black enamelling
- Wall thickness of
  - 16 SWG upto 40 mm dia
  - 14 SWG above 40 mm dia
- Conduit accessories of similar wall thickness & include bends, elbows, junction boxes, reducers, nipple, splitter coupling plugs, etc.
- Junction boxes shall be with the required number of outlets & cover 50/75 mm deep as per site conditions.

- Flexible conduits made out of continuous length of spirally wound, inter-linked strip steel with fired zinc coating on both sides.
- Flexible HDPE pipes short length of upto 500 mm may be used as adaptor for drop to the fixtures wherever false ceiling is there.

#### 11.6 WIRES

Wires shall comply the following features:

- PVC insulated bright annealed copper stranded conductors.
- 600 V grade wires for single phase circuits and 1000 V grade for 3 phase circuits.
- Colour coded as below :
- Phase - R - Red
- Phase - Y - Yellow
- Phase - B - Blue
- Neutral - Black
- Earth - Green or yellow/green

#### 11.7 CONTROL SWITCHES AND SOCKETS

The control switches and sockets shall be of rated capacity and shall comply the following features:

##### A) CONTROL SWITCHES

- Silver contacts with shrouded current carrying terminals
- Moulded urea formaldehyde casing and cover plates

##### B) SOCKET OUTLETS

- Brass or copper female outlets enclosed in urea formaldehyde or porcelain casing
- Control switches & fuses
- Urea formaldehyde cover plates

- Brass or copper female outlet enclosed urea formaldehyde or porcelain casing.
- Aluminium alloy enclosure with cover
- Scraping in earthing terminals
- DP/TP MCB

##### D) OUTLET BOXES

The outlet boxes shall be factory fabricated out of machine pressed sheet steel passivated as per the switch manufacturer.

#### 11.8 LAYING OF CONDUITS

The size of conduit shall be selected on the following basis:

---

Conduit size mm dia

---

Wire sq. mm 20 25 32 40 50 63

---

Maximum number of wires

---

1.0 4 8 10 x x x

1.5 4 8 10 x x x

2.5 4 6 8 x x x

4 2 4 6 x x x

6 x 2 4 x x x

10 x x 2 4 x x

16 x x x x 4 x

25 x x x x 4 x

35 x x x x x 4

---

50 x x x x x 4

Note : x indicates not applicable

The conduit laying shall be as follows :

- On the routes indicated on the drawing or to be marked on the drawing and at site and got approved before laying.
- Conduit junction boxes/pull through boxes to be installed at spaces not more than 12 m or two 90 deg. bends, the junction boxes shall be flush with ceiling.
- Conduits to be kept 100 mm minimum from pipes and non electrical services
- Separate and colour coded conduits/runways to be used for
  - 1) Lighting circuits
  - 2) Emergency lighting circuit
  - 3) Power circuit
  - 4) Low voltage circuit
- Fixing screws to be rust proof or cheese head screws
- Conduit buried in concrete to be fastened to the reinforcement and get approved before casting the slab.
- Conduits embedded in wall to be fixed by staples at 500 mm intervals.
- Conduits embedded in floor screen to be of PVC or galvanized and painted with emulsified bitumen
- Conduits to be free from sharp edges and burrs and necessary PVC bushing to be provided wherever necessary.
- Outlet boxes to have minimum size of 50 x 50 x 32 mm or as per switch manufacturer's specification.
- Flexible conduits are acceptable only at machine end and for short extension to outlets (not exceeding 500 mm in false ceiling)
- Chasing the brick wall shall be done by cutters/circular discs.
- All metallic conduits and accessories shall be threaded type and exposed threads and bends shall be given one coat of black enamel paint over a coat of redoxide paint.
- Non-metallic conduit shall be jointed using solvent specified by the conduit manufacturers.

#### 11.9 EARTHING

Insulated earth conductors of specified size shall be taken through the conduits.

The size of earth wire shall be of size 50% of phase conductor subject to a maximum and minimum shown below

:

Copper Aluminium GI

Minimum (sq.mm) 1.5 2.5 4

Maximum (sq.mm) 150 175 350

All outlet boxes, switch & socket boxes, and light fitting to be earthed properly. The switch/socket outlet shall be factory built suitable for the particular make of switch/outlet.

#### 11.10 WIRING

The wiring in conduit shall comply the following :

- Single core PVC insulated copper aluminium wires as specified below or as shown on drawings and schedule of material

- Wire sizes

Copper Aluminium

Light circuit point 1.5 sq.mm 2.5 sq.mm

Light secondary point 1.5 sq.mm 2.5 sq.mm

Power points 2.5/4.0 sq.mm 4.0 sq.mm

Machineries According to the load current

11.11 A maximum 3 circuits of same phase can be taken per conduit and each circuit shall have independent neutral and earth wire from DB. Jointing of wires are not permissible, however looping may be done from the circuit point/secondary points. Metallic/non-metallic trunking may be used if number of conduits are many. The metallic trunking shall be earthed securely at DB end and throughout the length. Single trunking with metallic partition may be used for different voltage services.

### 11.12 TESTING

The entire installation to be tested for :

- 1) Insulation resistance
  - 2) Earth continuity
  - 3) Polarity of single pole switches
- 3 copies of test certificates shall be submitted for the approval.

### 12.0 LIGHT FITTINGS AND FANS

#### 12.1 SCOPE

The scope of this section covers light fittings, lamps, ceiling fans and exhaust fans.

#### 12.2 STANDARDS

The following standards shall be applicable:

- A) IS : 3646 COP for interior illumination
- B) 16101 : 2012 General Lighting - LEDs and LED modules – Terms and Definitions
- C) 16102(Part 1) : 2012 Self- Ballasted LED Lamps for General Lighting Services Part 1 Safety Requirements
- D) 16102(Part 2) : 2012 Self-Ballasted LED Lamps for General Lighting Services Part 2 Perform Requirements
- E) 16103(Part 1) : 2012 Led Modules for General Lighting Part 1 Safety Requirements
- F) 16103(Part 2) : 2012 Led Modules for General Lighting Part 2 Performance Requiren
- G) 15885(Part2/Sec13): 2012 Safety of Lamp Control Gear Part 2 Particular Requirements Section 1: or a.c. Supplied Electronic Controlgear for Led Modules
- H) 16104 : 2012 d.c. or a.c. Supplied Electronic Control Gear for LED Modules - Performance Requiren
- I) 16105 : 2012 Method of Measurement of Lumen Maintenance of Solid State Light (LED) So
- J) 16106 : 2012 Method of Electrical and Photometric Measurements of Solid-State Lighting (LED) Pro
- K) 16107Part 1):2012 Luminaires Performance Part 1 General Requirements
- L) 16107-1:2012 Luminaires Performance Part 2 Particular Requirements Section 1 LED Luminaire
- M) 16108 : 2012Photobiological Safety of Lamps and Lamp Systems
- N) IS : 1913 General and safety requirements for electric lighting fittings.
- O) IS : 7027 Transistorised ballasts for fluorescent tubes
- P) IS : 1534 Ballasts for fluorescent lamps
- Q) IS : 6616 Ballasts for HPMV lamps
- R) IS : 2215 Starters for fluorescent lamps
- S) IS : 3324 Holders for starters for tubular fluorescent lamps
- T) IS : 3323 Bipin lamp holders for tubular fluorescent lamps
- U) IS : 1569 Capacitors for electrical discharge lamps
- V) IS : 2418 Tubular fluorescent lamp for general lighting services
- W) IS : 5081 Glass tubes for fluorescent lamps
- X) IS : 481 Tungsten filament miscellaneous electric lamps
- Y) IS : 6701 Tungsten filament miscellaneous electric lamps
- Z) IS : 2183 Schedule of or HPSV lamps
- AA) IS : 7023 Methods for tests for HPMV lamps
- AB) IS : 2147 Degree of protection provided by enclosure for low voltage switch gear and control gear
- AC) IS : 4327 General requirement for switchgear and control gear for voltages not exceeding 1000 V.
- AD) IS : 374 Electrical ceiling type fan & regulators
- AE) IS : 1169 Electrical pedestal type fans & regulators
- AF) IS : 2997 Air circulator type electrical fan and regulators
- AG) IS : 6272 Industrial cooling fans (man coolers)
- AH) IS : 1709 Fixed capacitors for fans.

#### 12.3 GENERAL REQUIREMENTS-FITTINGS

The general requirements for the light fittings shall be as follows:

- Sheet metal mounting frame and enclosure with fixing accessories

- Sheet metal white stove enamelled reflector.
- Control gear such as ballast, starter and capacitor
- Lamp holder
- Diffuser and other attachments to reduce glare

12.4 The enclosure for the light fittings and other accessories shall conform to the IS : 2147 and IS : 2148 depending on the location mounting of the fittings. The type of fittings and lamps shall be as indicated in the drawing and schedule of material.

The ballasts shall be of copper wound, open type vacuum impregnated with minimum loss, silent operation and without radio interference or electronic ballasts as indicated in the schedule of material. The light fittings and the lamps shall be suitable for long life and shall withstand voltage variation of minimum 10% .The aircraft obstruction lights shall be of neon cold cathode helix with longer life,or LED type housed inside thick glass dome. The fittings shall be prewired with PVC insulated copper wires of adequate capacity but not less than 1.5 sq.mm copper. The light fittings shall be provided with earthing terminals.

#### 12.5 FANS

The fans shall be driven by copper wound electrical motors housed inside cast aluminium enclosure. The fans shall be with double ball bearing to achieve smooth and silent operation. The fan assembly and blades in the case of fans other than centrifugal fans shall be of cast aluminium with properly balanced blades. The fan shall be provided with capacitors for starting up single phase fans and to achieve better power factors for 3 phase fans.

#### 12.6 INSTALLATION

Fans shall be mounted on pre-embedded hook. The drawing of the junction box which shall be got approved. Wherever, pre-embedded hooks are not available anchor fasteners shall be used. The light fixtures suspended shall include two nos. down rods with ball and socket joints. For the recessed fittings, the mounting supports shall be taken from the ceiling.

#### 12.7 TESTING AND COMMISSIONING

Fans and light fittings shall be checked for visible damages before installation and proper performance.

#### 13.0 LOW VOLTAGE INSTALLATION

##### 13.1 SCOPE

The scope under this section covers the low voltage installation consisting of:

- a) Voice/Data wiring
- b) Music wiring
- c) Television wiring
- d) Fire alarm wiring
- e) Access control system

The equipments such as EPABX, telephone instruments, Nurses call control unit etc. Are excluded from the scope of this work.

##### 13.2 STANDARDS

- A) IS : 732 COP for electrical wiring installation (upto 650V)
- B) IS : 9537 Specification of conduits for electrical installation
- C) IS : 1653 Rigid steel conduit for electrical installation
- D) IS : 3667 Fittings for rigid steel conduits for electrical wiring
- E) ----- National Electrical Code
- F) ----- Indian Electricity Rules and Regulations
- G) BS : 5839 Fire alarm panel
- H) IS : 14131 Coaxial cables for TV



### 13.2 WIRING

The conduiting work for low voltage wiring shall be similar to that for electrical wiring except that there shall be no earthing conductors.

The wires and cable for different LV services shall be as shown below

- a) Voice/Data - 4 pair CAT-5e/CAT-6 UTP cable
- b) Fire alarm - 1.0 sq.mm or 1.5 sq.mm PVC insulated copper wires of 650V grade with colour coding of brown for positive, white for negative and blue for remote indication or 2C – 40/36 shielded as per the manufacturer's instruction
- c) Music - 2C-23/36 or 2C –40/36 multicore cables, colour coded twin twisted PVC insulated copper wires
- d) TV - Co-axial PVC insulated copper conductors of wideband type with operation upto 860 MHZ capability, with PE dielectric
- e) Access Control - 10C –1.5 sq.mm between reader & controller The tag block shall be Krone type, modular construction using non soldering / screening connectivity. The tag block shall housed in MS painted enclosure with lockable door.

The cables shall meet or exceed the following specifications RG R Foam Series RG 11 Foam Series IS Standard IS :  
14131 5 CA4 7 CA4

- a) Centre Conductor Dia 1.02 mm 1.63 mm
- b) Dielectric Dia 4.57 mm 7.11 mm
- c) Dielectric material Cellular PE Cellular PE
- d) Outer Dia. 7.0 mm 10.03 mm
- e) Bending Radius >75 mm >115 mm
- f) Impedance 75 ohms 75 ohms
- g) Return loss >23 Db >23 dB
- h) Attenuation at 20 C Max.dB/100 Mtr. Mtr. 5 MHz 1.9 1.25  
45 MHz 5.25 3.5  
300 MHz 11.65 7.38  
450 MHz 14.45 9.02  
550 MHz 16.1 9.97  
860 MHz 20.1 12.52

### 13.3 FIRE ALARM

#### 13.3.1 FIRE ALARM PANEL

Fire alarm panels in general shall confirm to IS : 2189 and analogue addressable system of single / multiloop type or microprocessor based multi-zone conventional type. The equipment for the main board shall be compact modular type, neatly wired wall or floor mounting type as specified, totally enclosed, dust and vermin proof type made of 16 SWG dust inhibited MS sheet of suitable size to accommodate accessories as specified, with oven baked finish duly painted with one coat of anti corrosive paint and two coats of synthetic enamel paint of fire red shade. The panels shall be completely solid state design. The primary function of control panels shall be to respond automatically to the operation of one or more detectors to give alarm and to indicate device/area/where the devices are activated. The operation of one or more detectors shall result in simultaneous alarm by the following .

- a) The external alarm hooters at floor of actuation
- b) A visible indication on control panel of zone/device
- c) Audible alarm on control panel itself (common to all zones/loops) The secondary function on the control panel shall be to indicate the faults within the system. An immediate fault shall be given by an audible and visual signal on the control panel. A fault warning shall be given in case of any of the following occurring.
  - a) Failure or disconnection of normal power supply
  - b) Failure or disconnection of stand by power supply
  - c) Failure or disconnection of battery charging equipment.
- d) Short-circuit or disconnection of the leads to trigger devices unless the fault condition reproduce the effect of the operation of a triggered device.

- e) Removal of any triggered device of the plug in type or disconnection from its transmitter or power supply.
- f) Short circuit or disconnection of any of the leads to alarm sounders external to the control and indicating equipment but if the alarm sounders are connected by a ring circuit, disconnection need not be immediately indicated but should be capable of being detected by the routine test procedure.
- g) Rupture or disconnection of any fuse on the operation of any protective devices that would prevent a fire alarm being given.
- h) Failure of a scanning device to interrogate the detector or zones at the correct time intervals or failure of any monitoring or interrogation system within the control equipment, such as to prevent an alarm being given.

A facility may also be provided for sending fault signal to remote center. For conventional panel, there shall be one indicator for fire and one for fault in the control panel corresponding to each zone. Each zone shall have two bulbs of fire/fault indication. Each indicator shall be clearly labeled with zone no. and inscribed with "Fire" or "Fault" or "Silence". Separate indicator must be provided in green for system, standby on etc.

Analogue addressable panels shall have min. 80 character backlit LCD display, for fire, fault, service indications, history and other related data or menu driven basis. The control panel shall derive 230 volts power from normal supply and the entire fire alarm and detection system shall be suitable for operation on 24 V.D.C. A standby power supply shall be immediately available in the event of failure of normal supply and shall automatically be connected as to maintain the equipment in condition such that fire alarm originating from the operation of detector in separate zone/device can be subsequently given. The standby supply should be capable of maintaining the system in normal operation for a period of not less than 48 hours after the failure of normal mains supply after which sufficient capacity would remain to provide full load operation for at least 30 minutes. The full load would be defined as that devices/zones (with a minimum of two zones/devices) and the operation of the fault indicator. The operation of trigger devices in further zones should not result in cancellation of fire alarm existing at that times. The panels shall have provision of additional of 2 sets contacts duly wired, per zone to cut-off power to the AHU's during fire. The panels shall have a facility for voice communication as telephone/speaker with necessary microphone, speaker, hand/head set, amplifier etc

Control panel drawing shall be got approved by the Consultants before taking up the fabrication.

#### 13.4 PHOTO ELECTRIC SMOKE DETECTORS

Photo electric detector conventional/analogue addressable should respond to visible as well as invisible smoke generated by smouldering or open fire. It shall basically use photo electric (light scattering) principle to measure smoke density, an electronic circuit, connection contact to the base and easy to clean protective housing. A response indicator for quick identification of the fire location or convenient testing of the detector as well as protection against reversed polarity and voltage surges must be built-in to the base of the detector. The detector shall be plug in type with provision for connecting remote indicator. The detector shall also be compatible to work with heat and photo detectors and shall have interchangeable base. It shall be listed with UL/FM and/or approved by TOC/TAC or any other recognized national, international standard. It should preferably also conform to IS : 11360 .

#### 13.5 HEAT DETECTORS

##### 13.5.1 RATE OF RISE-CUM-FIXED TEMPERATURE TYPE

Heat detectors, conventional/analogue addressable shall be of electronic, thermister or electro pneumatic type, working on rate of rise and fixed temperature. The rate of rise element shall respond quickly when the temperature rise is 15 deg. F or more per minute. The fixed temperature feature should be entirely independent of the rate of rise element and the operating temperature of fixed temperature element should be set as per the requirement of IS : 2175 (latest) for Grade – I detectors.

##### 13.5.2 FIXED TEMPERATURE TYPE

The fixed temperature heat detectors conventional/analogue addressable shall preferably incorporate replaceable fusible element to provide quick and easy restoration service. The operating temperature of the element should be factory set as per the requirement of IS : 2175 (latest) for Grade – I Detectors. The heat

detectors shall incorporate response indicator facility and to be with two wire system on D.C low voltage. It shall be possible to loop the heat detector with manual push button in the same circuit. The area of coverage per detector shall depend upon structural/architectural configuration, but generally shall be as per IS : 2189-1988. The detectors shall be either or the approved list of Fire Officer's Committee, U.K/Underwriter's Laboratory, USA or approved by CPRI, Roorkee and ISI marked.

### 13.6 BREAK-GLASS UNITS (MANUAL CALL POINTS)

Each manual call point unit conventional/analogue addressable, shall comprise of a push button or fuse of reputed make enclosed in a M.S. Box/cast aluminium box with provision for cable or conduit coupling. The manual push button shall have the words prescribed in clear bold letter on facial window. " In case of the fire break glass".

The whole assembly to be enclosed in the box enclosure with all sides covered except the front side. The front side shall be sealed with breakable glass cover using neoprene or equivalent gasket. The glass surface should be minimum 30 sq. cm. in area and glass thickness should not exceed 2 mm. The box enclosure shall be completely dust, vermin damp and weather proof and provided with chain and hammer attached to it. It shall be made of atleast 16 SWG sheetsteel. The complete unit shall be suitable for wall/column mounting with necessary mounting accessories. The complete unit and push button shall be painted signal red (shade no, 537 as per IS : 5 . The internal surface of the enclosure of the box shall be painted white in colour. The external painting shall be synthetic enamel.

### 13.7 ELECTRONIC HOOTER

The dual tone electronic hooter provided shall be conventional/analogue addressable type and it gives discontinuous/intermittent audible alarm automatically whenever the automatic/manual detector operates and is distinct from the background noise in every part of the premises. All hooters shall produce a similar sound and shall maintain the same during their operation. Hooter shall be complete with electronic oscillations, magnetic coil (sound coil) and accessories, ready for mounting (fixing) and conforming to IS : 2189- 1988.

### 13.8 SPEAKERS

The speakers/sound columns shall be of specified rating. The speakers shall be recessed or surfaced mounted type with ABS grille of approved colour and shall have line matching transformer. The sound columns shall be surface mounted with metallic / wooden enclosure and black nylon cloth front. Volume controls shall be continuous type, of specified ratings with off Switch.

### 13.9 TV TAP – OFF

These shall be of ultra wide bandwidth and of hybrid type & bi-directional suitable for Interactive TV system. These shall have a flat frequency response over the entire operating range. These shall have a aluminium cast housing for high frequency radiation resistance.

The tap offs shall be available in one way, two way and four way & eight way configurations. The tap offs shall be available in different tap values ranging from 11 dB, 15 dB, 20 dB & 30 dB to enable uniform signal balancing. The tap offs shall meet or exceed the following specifications. One way Two way Four way

- a) Tap Loss 15-20 dB 15-20 dB 15-20 dB
- b) Through Loss 2.0-0.5 dB 2.5-1.0 dB 3-1.5 dB
- c) Isolation >22 dB > 22 dB >22 dB
- d) Screening Factor > 75 dB > 75 dB > 75 dB
- e) Impedance 75 Ohms 75 Ohms 75 Ohms

### 13.10 ACCESS CONTROL

The microprocessor based controller shall be operating on 12V DC controlling single or multiple readers with a card capacity not less than 2000. The controller shall have built-in power supply unit to receive 230V AC. The proximity type card reader shall have a range of min. 75 mm with red LED flashing and green on presentation and acceptance of the card. The electromagnetic locks shall operate on 12V DC and shall have a minimum

holding force of 275.0 KG. The door position sensor shall be mounted on the door frame and NO contacts closes when the door is closed. The cards shall be proximity type, programmable at site. Necessary logos/screen printing/photo identity shall be carried out along with lamination.

#### 13.11 TESTING

The entire system shall be tested for:

- a) Continuity
- b) Performance

# INTERIOR WORKS

## INTERIOR WORKS

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#### 1.0 GENERAL

This Specification is for work to be done, item to be supplied and materials to be used in the works as shown and defined on the drawings and described herein, all under supervision and to the satisfaction of the client. The specification given under is General Specifications and shall be applicable only to relevant items specified in the tender Schedule. In case of brought out items where the model number is mentioned the manufacturer's specifications shall be valid. The workmanship is to be the best available and of a high standard, use must be made of a special trades men in all aspect of the work and allowance must be made in the rates for so doing. The materials and items to be provided by the Contractor shall be approved by the client in accordance with any samples which will be submitted for approval by Contractor and generally in accordance with the Specifications. Also if products are specified in the Specification and/or bill of brand, trade name or catalogue reference, the Contractor will be required to obtain the approval of the client before using the materials. The Contractor shall produce all in voices, Vouchers or receipts for any material if called upon to do so by the client.

Samples of all materials are to be submitted to the client for approval before the Contractor orders or deliver the materials at site. Samples together with their packing are to be provided free of charge by the Contractor and should any materials be rejected, they will be removed from the site at the Contractor's expense. All samples will be retained by the client for comparison with materials which will be delivered at the site. Also, the Contractor will be required to submit specimen finishes of colours, fabrics etc. for the approval of the client before proceeding with the work.

The contractor shall be responsible for providing and maintaining and boxing or other temporary coverage's required for the protection of dresses or finished work if left unprotected. He is also to clean out all shelving, out ends and other waste from all pairs of the works before coverings or in-fillings are constructed. Templates, boxes and moulds shall be accurately set out and rigidly constructed so as to remain accurate during the time they are in use. All unexposed surface of timber e.g. false ceiling, backing fillets, backs of door frames, cupboard framing, grounds, etc. Are to be treated with two coats of approved timber preservative before fixing or converging. Only first class workmanship will be accepted. Contractor shall maintain uniform quality and consistency in workmanship throughout.

#### 2.0 JOINERY

2.1 Joinery is to be prepared immediately after the placing of the Contract framed up, bonded and waged up. Any portions that are warped or found with other defects are to be replaced before wedging up. The whole of the work is to be framed and finished in a workmen-like manner in accordance with the detailed drawings wrought and whenever required, fitted with all necessary metal ties. Straps, belts, screws, glue etc. Running beaded joints are to be cross tongued with teak tongues wherever 1(1/2) thk. Double cross tongued. Joiners work generally to be finished with fine sand/glass paper.

## 2.2 JOINTS

All joints shall be standard mortise and tenon, dowel, dovetail, and cross halved. Nailed or glued but joints will not be permitted, screws, nails etc. will be standard iron or wire of oxidized Nettle fold tenons should fit the mortises exactly. Nailed or glued butt joints will not be permitted, exceptional cases with approval of client. Where screws shown on a finished surface, those will be sunk and the whole plugged with a wood plug of the same wood and grain of the finished surfaces will be neatly punched and the hole filled with wood filler to match the colour.

Should joints in joiner's work open, or other defects arise within the period stated for defect liability in the contract and the clause thereof be deemed by the client to be due to such defective joinery shall be taken down, and refilled, redecorated and/or replaced if necessary and any work disturbed shall be made good at the Contractor's expense. Nails, spikes and bolts shall be of lengths and weights approved by the client. Nails shall comply with IS 1959-1960. Brass headed nails are to comply with B.S.1210. Wire staples shall comply with B.S.1494 or equivalent. The contact surface of dowels, tendons, wedges etc., shall be glued with an approved adhesive. Where glued, joinery and carpentry work is likely to come into contact with moisture; the glue shall be waterproof grade.

## 3.0 HARDWARE AND METALS

The hardware throughout shall be of approved manufacture or supplier well made and equal to in every respect to the samples to be deposited with the client. The Contractor may be required to produce and provide samples from many different sources before the client take decision and he should allow his rates for doing so. Fittings generally shall be brass polished & lacquered, unless otherwise specified and shall be suitable for their intended purpose. In any case, it will have to be approved by client before the Contractor procures it at site of work. Screws are to much the finish of the article to be fixed, and to be round or flat headed or counter sunk as required. The contractor should cover up and protect the brass and bronze surfaces with thick grease or other suitable productive material, renew as necessary and subsequently clean off away on completion.

Aluminium and stainless steel shall be of approved manufacture and suitable for its particular application. Generally the surface of aluminium shall have an anodized finish and both shall comply with the samples approved by the client. All stainless steel sheets shall be 304 SS Japan or equivalent with gauge as specified but not thinner than 16 G. All steel, brass, bronze, aluminium and stainless steel articles shall be subjected to a reasonable test for strength, if so, required by the client at the Contractor's expense . All brazing and welds are to be executed in a clean and smooth manner rubbed down and left in the flattest and tidiest way, particularly where exposed. Chromium plating shall be in accordance with I.S. Standard or as per approved specification for normal outdoor conditions and shall be on a base material of copper or brass.

## 4.0 GLAZIER

All glass to be of approved manufacturer complying with I.S. 3548-1966 as per approved quality and sample to be of the selective qualities specified and free from bubbles, smoke, air holes and other defects. Polished plate glass shall be "glazing glass" (G.G.) conforming to IS 3438-1965 or as per approved sample and quality. The compound for glazing to metal is to be a special non hardening compound manufactured for the purpose and of a brand and quality approved by the client. While cutting glass, proper allowance be made for expansion. Each square of glazing to be in one whole sheet. On completion of work clean all glass inside and out, replace all cracked scratched and broken panes and leave in good condition.

## 5.0 PAINTS & POLISHES

All material required for the works shall be of specified and approved manufacturer, delivered to the site in the manufacturer's containers with the seals etc., unbroken and clearly marked with the manufacturer's name or trade mark with a description of the contents and colour. All materials are to be stored on the site of the work. Spray painting with approved machines will be permitted only if written approval has been obtained from the client prior to painting. No spraying will be limited in the case of priming neither coats nor where the soiling of adjacent surfaces is likely to occur. The buzzle and pressure to be so operated as to give an even coating throughout to the satisfaction of the client. The paint used for spraying is to comply generally with the specification concerned and is to be specially prepared by the manufacturer for spraying. Thinning of paint made for brushing will not be allowed.

Wood preservative shall be Bison or other equal and approved impregnating wood preservative and all concealed wood work shall be treated with wood preservative. All brushes, tools, pots, kettles etc. used in carrying out the work shall be clean and free from foreign matter and are to be thoroughly cleaned out before being used with a different type of class of materials.

All iron or steel surfaces shall be thoroughly scraped and rubbed with wire brushes and shall be entirely free from rust, mill scale etc. before applying the priming coat. Surfaces of new wood work which to be painted are to be rubbed down, cleaned, down to the approval of the client.

Surfaces of previously painted woodwork which are to be cleaned down with soap and water, detergent solution or approved solvent to remove dirt, grease etc. While wet the surfaces shall be flatted down with a suitable abrasive and then rinsed down and allowed to dry. Minor areas of defective paint shall be removed by scraping back to a firm edge and the exposed surface touched in with primer as described and stopped with putty.

Where wood work has been previously painted or polished and is to be newly polished, scrapping, burning off or rubbing down. Surfaces of previously painted metal which shall be painted are to be cleaned down and flattened down as described in surfaces of any rust and loose scale shall be removed completely by chipping , scrapping and wire brushing back to the bare metal and touched in with primer as described .

## 6.0 POLISH

### 6.1 FRENCH POLISH

The basic material shall be shellac dissolved in methylated spirit. Preparation:-The timber must be sanded and cleaned and the grain filled with a grain filler .Any staining must be done before applying the polish.

Equipment :-The polishing rubber the most important implement in French polish shall consist of a pad of cotton wool , which acts as a reservoir for the polish , and a cover of soft white linen or cotton fabric , similar to a well-worn handkerchief which acts as a fitter , the rubber must never be dipped into the polish .; it should be changed by pouring the pouring the polish on to the pad with the cover removed.

Application:- Work evenly over the surface with a slow figure-of-eight motion until the timber is coated with a thin layer of polish. The objective is to apply a series of thin coats, allowing only a few minutes for drying between the coats. When a level and even-boiled surface is obtained the work is ready for the second stage i.e. spiriting off. Allow the work to stand for at least eight hours then take a fresh rubber with a double thickness of cover material and charge it with methylated spirit. The object of spiriting off into and remove the rubber marks and to give the brilliance of finish. Finally, work in the direction of the grain and continue until the surface is free from smears and rubber marks then leave to harden off.

### 6.2 WAX POLISH

Wax polish shall contain silicones and driers. A good silicon wax is to be used not a creamy or spray. The timber shall be sealed first with another finish such as Ronseal, before applying the wax. Application:- Apply a light coat of the sealer by brush or cloth direct to the unfilled timber, working it well in and finishing evenly with the grain. Allow to dry thoroughly then sand lightly with fine abrasive paper. Apply a heavy coat of wax by cloth or on flat surfaces, with a stiff brush. Work it well into timber and finish off by stroking with the grain before leaving to harden. Leave for several hours before rubbing up with a soft brush .Finally; buff the grain with a soft cloth. Transparent Colored Polyurethane (Melamine) this shall be applied where natural grain of the wood is required to show. Polyurethane gives tough surface which resist chipping, Scratching and boiling water.

Application:- Clean off all grease and wax with an abrasive and white spirit, this should not be applied in humid conditions. Apply the first coat, preferably of clear hard glaze with a cloth pad. Leave this to dry for at least six hours, and then apply further coats with a paint brush. If you wait for longer than 24 hours between coats , rub down the previous coat with fine glass paper or a medium grade of steel wool .Obtain a Matt finish , if required by giving a final coat of clear Renseal Matt coat .

#### 7.0 TIMBER

Only seasoned New Burma Teak Wood or Sal Wood to be used. All the wood shall be properly seasoned, natural growth and shall be free from worm holes, loose or dead knots or other defects, saw die square and shall not suffer warping, ting or other defects.

The moisture content shall not exceed 12%

All internal frame work shall be treated with approved wood preservative.

All wood brought to site should be clean shall not have any preservative.

All rejected decayed, bad quality wood shall be immediately removed from site.

All wood brought to site must be stacked-stored properly as per instructions.

#### 8.0 PLYWOOD

Plywood/medium density fiber board/teak particle board/ Veneered board etc., as specified in the approved list of manufacturers shall only be used. Only Fire retardant type exterior grade Phenol formaldehyde bonded, hot pressed ply generally conforming to I.S.I. 5509 of approved make only to be used.

Marine plywood shall generally conform to I.S.710-1980 and also to Defense/ Navy specification bonded, with phenol formaldehyde, treated with wood preservative.

#### 9.0 CARPENTRY WORK

Providing and fixing in position Exterior Grade MDF frame work for partitions upto true ceiling height, panelling, boxing, soffit with vertical members at not more than 450 mm centres and horizontal members not more than 450 mm centres complete including necessary additional supports, bracing runner etc. complete as per drawing and directions. Items are to be completed in all respects as per drawings & instructions from client. Rate to include applying of approved wood preservative approved make on the finished frame work.

#### 10.0 PANELLING / BOXING

Providing and fixing in position 12mm thick Exterior Grade MDF board. Item are to be completed in all respects as per drawings & instructions from HPCL/MMCI. Rate to include make on the inner side of the board. Actual executed area will be measured. Providing and fixing 8mm thick Glass in partition of approved make ( MODI GUARD / SAINT GOBAIN etc ), of appropriate size as per drawings and design with necessary wooden mouldings / biddings to hold the glass in position . All exposed wooden surfaces has to be finished with 2/3 coats of melamine polish. Finishes for Partitions / Panelling, Etc

**IMPORTANT NOTE:** Actual executed area will be measured on one side of partition. Rate of this item shall include cost of providing fixing wooden facia, if any, matching laminate in approved pattern, skirting, Cornice Moulding at both door level and false ceiling level, Top Cap moulding in case of Low Height Partition etc. as per details and finished in melamine polish of wooden and veneered surfaces for which no extra payment shall be made but shall measured alongwith the partition dimensions. The finishing material shall be fixed in required divisions/ panels/ pattern with proper grooves etc. as per drawings & directions. Item are to be completed in all respects as per drawings & instructions from client. Rate shall include supplying and installing electrical light modular switches as per the ceiling lighting plan and also providing 15nos 5/15 amps modular plug points along with switches in the interior partitionings, rate to include for wiring.



# LANDSCAPING & HORTICULTURE

## LANDSCAPING & HORTICULTURE

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#### 1.0 SCOPE

The landscape contractor shall from the date of commencement of contract, furnish all materials, labour, and related items necessary to complete the work indicated and specified herein. The scope of work for the above mentioned work shall include following and shall be carried out as per BOQ, Specification & Landscaping Layout drawings.

The landscape contractor will be generally responsible for the entire site but in particular to works listed below. Along with site management, the responsibilities will include landscaping works and arboriculture works and maintaining the same. After planting, all planted areas that have exposed soil will have to be mulched with straw or hay. Mulching will be evenly spread to cover any exposed soil. In addition, the contractor will also be responsible for filling gaps, thinning and transplanting, or replanting where plants may need to be replaced. Along with other planting, the contractor will also be responsible for improving soil conditions for planting. This may include import /export of sand/soil to/from site. The contractor will also clear vacant area from existing grasses, keep the site clean and maintain the already planted areas free of weeds, pests or insects that cause diseases. All weeds, unwanted grasses and plant material will be cleared up to 1000mm from the edge of planting of newly created and already existing horticultural works (such as boundary trees). The contractor will also be responsible for protection of the plants from salt spray that may occur during the monsoons.

#### 2.0 STORAGE SHED

No storage area will be provided at site by the Employer. As mentioned in General Conditions of Contract, security of materials at site will be the responsibility of the contractor. Any temporary sheds or structures may be built as working space at the area shown at site and on the approval of the Site Engineer.

#### 3.0 WATERING

Water will be made available at only one source at site. If the water on site is insufficient or saline or unacceptable, then the contractor shall be responsible for importing water in water tankers for the general upkeep of the plants. No plants shall be allowed to wither or die due to lack of proper watering.

#### 4.0 PLANT REQUIREMENTS

Plants and shrubs shall be sourced by the contractor from available nurseries, unless otherwise specified. Seeds shall be acquired from reputed organisations and hybrid seeds will be used where possible – particularly for flower varieties. No plant material shall be changed without the consent of the Consultant.

#### 5.0 RESPONSIBILITY

a) The contractor's work shall not hinder other work, either underground or over ground, such as electrical, phone lines, water or sewage lines, etc. In areas of overlap, the contractor shall work in coordination with other related

contractors. Any damage by the landscape contractor's team to such utilities will be penalized and contractor shall be responsible for cost for such damages.

b) The contractor shall abide by the Security rules / procedures of the Employer, and shall obtain gate pass, issue I.D. badges to all their employees on site, etc. As prescribed by the Employer.

## 6.0 MATERIALS & LABOUR

All the materials which are required for the progress of the Landscaping works shall be supplied by the contractor. The required numbers of Labour are to be provided by the contractor.

## 7.0 PLANTING

Whenever planting, the following specifications will be followed by the contractor. Wherever sand is to be removed, the following specifications shall be followed after refilling the area with good soil.

### 7.1 DIGGING OF PITS

Tree pits of 600mm x 600 mm x 600 mm (approx. 2'x2'x2') shall be dug a minimum of two weeks prior to back filling. The pits for shrubs shall be 600 mm in depth and 300mm diameter. For ground cover, the land will be prepared by digging up to 300 mm (1') and soil loosened. While digging the pits the top soil may be kept aside, and mixed with the rest of the soil as specified. If the soil quality is poor, it shall be replaced with soil mixture acceptable to the Consultant. If the soil quality is satisfactory, then it shall be mixed with manure and river sand. The soil condition will have to be approved by the Consultant. Pest/termite prevention chemicals or any other approved chemical to be applied into the soil before planting as per supplier's specification. When planting is in more than one row, then pits will be dug in a zig-zag fashion ensuring a diagonal planting in each row.

### 7.2 PLANTING MIXTURE:

The topsoil will be mixed with 15% farm yard manure or coco-peat, 40% red soil, 20% river sand and 20 % excavated earth (topsoil). This mixture will be filled in pits before and after planting.

### 7.3 BACK FILLING:

The soil is back filled, watered thoroughly and gently pressed down a day previous to planting, to make sure that it may not further settle down after planting.

### 7.4 PLANTING:

No tree pits shall be dug until a final tree position has been pegged out for approval. Care shall be taken that the plant sapling when planted is not buried beyond the level of the pot containing it. Planting should not be carried out in waterlogged soil.

### 7.5 STAKING:

If necessary, a single vertical stake 1 meter (approx. 3 ft) longer than the clear stem of the plant, driven 300 mm to 450 mm (approx. 1ft to 1'6") into the soil shall be used. Each plant should be secured to the stake so as to prevent excess movement

### 7.6 WATERING:

The landscape contractor shall allow for the adequate watering of all newly planted trees, shrubs and groundcover immediately after planting and during the following growing season, shall keep the plant material well watered.

### 7.7 MULCHING:

All planted areas including around trees which have open soil that is exposed will have to be mulched with straw or hay. Rates indicated in the Bill of Quantities shall include such mulching costs. No separate compensation will be paid for mulching

### 7.8 PROTECTION:

The contractor will be responsible and should take measures to protect the planted saplings from cattle, salt spray and high wind pressure. Rates indicated in the Bill of Quantities shall include such costs of protecting the plants including any physical construction such as walls, tree guards, etc. that may be required for the same.

## 8.0 LAWN

### 8.1 PREPARATION:

During period prior to planting the lawn, the area shall be maintained free from weeds, whatever the nature of soil, complete surface shall be trenched over to a depth of 300 –450 mm. Grading and final levelling of the lawn shall be completed at least 2 weeks prior to the actual sowing.

### 8.2 SOIL

The soil itself shall be ensured to the satisfaction of Consultant to be a good fibrous loam, rich in humus. Pest/termite prevention chemicals to be mixed if required. Top soil shall be mixed with farm yard manure or coco-peat and mixed with river sand in ratio of 15% manure, 25% river sand, 35% red soil and 25% excavated earth and levelled to maintain positive drainage or specified slopes.

### 8.3 EXECUTION

Nodes of specified grass shall be dibbled not more than 50mm apart on above mentioned soil conditions. Wherever specified, carpet lawn will be used. The carpets will be laid next to each other in an even pattern to ensure that all lawn area is covered. After laying of carpet, it should be lightly pressed into the ground to ensure that it does not shift, and to ascertain that the roots are in soil. Positive slopes will be maintained to ensure that there will be no low lying areas in center where water logging or pools are created.

### 8.4 MAINTENANCE

In the absence of rain, lawn shall be watered daily - heavily, soaking the soil thoroughly to a depth of at least 150 mm.

### 8.5 CUTTING

The scythe must continue to be used for several months until the grass is sufficiently secure in the ground to bear the mowing machine.

### 8.6 EDGINGS

These shall be kept neat and must be cut regularly with the edging shears.

### 8.7 FERTILIZING

The lawn shall be fed once a month with liquid fertilizer by dissolving 45 gms of Ammonium Sulphate in 5 litres of water.

### 8.8 WEEDING

Prior to regular mowing, the contractor shall carefully remove unsightly weeds.

## 9.0 MAINTAINANCE

Tenderer shall indicate the price schedule for annual maintenance contract for a period of 1 (one) year after the expiry of one year 'Defects Liability period' (guarantee period) in the following format. Charges shall be indicated for 1 (one) year after the expiry of guarantee period. However, payment shall be made on quarterly basis. Maintenance of all items as per BOQ for a period of 1 (One) year after the expiry of one year defects liability period.

## 10.0 FINAL INSPECTION AND FINAL CERTIFICATE

At the end of the Planting Establishment Period, an inspection will be made by the Superintendent to ensure that all works under the Contract have been finally and satisfactorily executed by the Contractor.

## 11.0 MEASUREMENT

The measurement for payment to the contractor will be in item wise mentioned in bills of quantities.

## APPROVED MAKE/MANUFACTURERS

### 1. CIVIL WORKS:

CEMENT (PPC/PSC) : ULTRATECH/DALMIA/ACC  
MS STEEL/REINFORCEMENT : TATA/SAIL/VIZAG/JINDAL  
VITRIFIED TILES : JHONSON/RAK/SOMANY/NITCO  
CERAMIC TILES : SOMANY/KAJARIA/JHONSON/NITCO  
CEMENT CONCRETE TILES : ULTRA/EUROCON/SOMANY  
WATER PROOFING COMPOUND : SIKA/PIDILITE/CICO/DR FIXIT  
PAINTS : ASIAN/BERGER/ICI DULUX/NEROLAC  
GLASS : MODIFLOAT/ASAHI/SAINTGOBAIN  
PUTTY : BIRLA/JK  
ALUMINIUM SECTIONS : JINDAL/INDAL/OEL/HINDALCO  
CEILING : ARMSTRONG/CALCIUMSILICATE/ANUTONE  
ADHESIVE : FEVICOL/PIDILITE  
FLUSH DOOR : ALISHAN/GREENPLY/MAYUR/CENTURY/MERINO  
BLOCK BOARD & PLYWOOD : ALISHAN/GREENPLY/MAYUR/CENTURY/ MERINO  
LAMINATES : GREENLAM/ MERINO /CENTURY  
LOCKS : GODREJ/DOORET/HAFELLE/DORMA  
HARDWARES : EARLBIHARI/DORMA/HAFELLE/DORMA/ GODREJ  
CEMENT CONCRETE PIPES : INDIAN HUME PIPE/MM METAL & CO  
DOOR CLOSER : DORMA/HAFELLE/HARDWYN/DOORSET/ GODREJ  
FRP DOOR : RAJASHREE/DARWAJA  
ALUMINIUM WINDOW : WINTECH/FENESTA/OKOTECH  
UPVC DOOR/WINDOW : FENESTA/WINTECH/OKOTECH  
STEEL SECTION : TATA/JINDAL/SAIL  
ACP CLADDING : ALSTONE/ALUDECOR/ALSTRONG  
PAVER BLOCK : TUFFSTONE/EQUIVALANT  
GALVANUM SHEET : G.E PLASTICS/TATA/BHUSAN

### 2. WATER SUPPLY & SANITATION WORKS:

VITREOUS SANITARY WARE : HINDWARE/PARRYWARE/JAQUAR/KOHLER/CERA  
VITREOUS URINAL PARTITION : HINDWARE/PARRYWARE/JAQUAR/KOHLER  
BIB COCK & CP FITTINGS : JAQUAR/HINDWARE/PARRYWARE/KOHLER/CERA  
CPVC PIPES & FITTINGS : AJAYA/ASTRAL/ASHRIBAD/SUPREME  
GI PIPES : TATA/JINDAL  
CI PIPES : KIRLOSKER/VENUS/SUSHILA  
SWR PIPES : HIND/ORISSA/ORIND/ASHRIBAD/ SUPREME/KISHAN  
OVER HEAD TANK : SYNTEX/EQUIVALENT  
MIRRORS : MODIGUARD/SAINTGOBIN/ASAHI

FERRULES : LEADER/HIMSON

GATE VALVE/CHECK VALVE : LEADER/KIRTI

GI PIPE FITTINGS : KS BRAND/JINDAL/KIRTI

NAHANI TRAP : SILK/SUSHILA

KITCHEN SINK : NIRALI/EQUIVALENT

PVC PIPE : ORIPLAST/ATS/NEELPLAST

### **3. ELECTRICAL WORKS:**

MS CONDUIT PIPE : BEC/SUPREME/KALINGA

MS CONDUIT ACCESSORIES : UNIVERSAL/LAXMI

SWITCH/SOCKET/HOLDER ETC : HAVELLS/ABB/L&T/SIEMENS

PVC INSULATED WIRES (FRLS) : FINOLEX/L&T/HAVELLS/POLYCAB/ANCHOR/V-GUARD

PVC INSULATED CABLES : NICCO/GLUSTER/INCAB

BAKELITE SHEETS : HYLAM/FORMICA

CABLE LUGS : DOWELLS/CLIPON

FAN : USHA/HAVELLS/BAJAJ/ORIENT

LIGHT : PHILLIPS/BAJAJ/HAVELLS/JAQUAR/WIPRO

SWITCH PROTECTION : L&T/ABB/SIEMENS/SNIDER/HAVELLS

SWITCH GEARS/CHANGEVER : SIEMENS/L&T/ABB/LEGRAND  
MCB/RCCB : MDS/L&T/INDO ASIAN/ LEGRAND/ABB  
VOLTMETER/AMMETER : AE/IMP/MECO/LEGRAND  
ENERGY METER : GEC/SECURE/CAPITAL  
LT DISTRIBUTION BOARD : ESS/VEEES/TECHNOCRAT/ LEGRAND  
KITKATS : ANCHOR  
HRC FUSE : ALSTHOM/SIEMENS/L&T  
CTS & PTS : AE/KAPPA/ EASTERN SWITCHGEAR  
METAL CLAD PLUG SOCKET : CROMPTON/HAVELLS/INDO ASIAN/ LEGRAND  
CFL/FLUORESCENT FIXTURES : PHILLIPS  
LAMPS : PHILLIPS  
CABIN/PEDESTAL FANS/ : CROMPTON/USHA/ORIENT/HAVELLS CEILING FANS  
EXHAUST FAN : ALMONARD/CROMPTON/KHAITAN  
CLIPINTYPE MODULAR SWITCH: MK INDIA/LEGRAND/LK FUGA  
ADHESIVE & INSULATION TAPE: STEELGRIP/ANCHOR  
GI PIPES : TATA/JINDAL

# TECHNICAL SPECIFICATION

FOR

Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning Of 2.3MWp Grid Connected Roof Mounted Solar PV Power Plant Including 10 Years Comprehensive Maintenance Contract (CMC) Post 1 Year Warranty. At Kidderpore Dock-II, Syama Prasad Mookerjee Port, Kolkata, West Bengal.

e-NIT Document No.- B AND R/HO/SMPK/61038/SOLAR-WORK/NIT/CW/01 DTD.  
11.03.2024

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## **1. Solar PV Modules/Photovoltaic Solar Modules / Panels:**

- i. Bidder has to recommend for Mono Passive Emitter and Rear Contact (PERC) Solar Panel of minimum 540Wp and above wattage for this project.
- ii. Bidder has considered 540 Wp Solar PV Module in the present design.
- iii. The module should be Potential Induced Degradation (PID) resistant.
- iv. The front glass used to make the crystalline silicon modules shall be toughened low iron glass with minimum thickness of 3.2 mm (2.5mm for glass-to-glass frameless & 2.0mm for glass to glass framed module).
- v. The glass used shall have transmittance of above 90% and with bending less than 0.3% to meet the specifications.
- vi. The module frame shall be made of anodized Aluminium, which shall be electrically & chemically compatible with the structural material used for mounting the modules.
- vii. It is required to have provision for earthing to connect it to the earthing grid.
- viii. The anodization thickness shall not be less than 15 microns.
- ix. PV Module shall have a RFID tag as per MNRE guidelines and must be able to withstand harsh environmental conditions.
- x. **Technical Requirements**
  - (a) Cell type : Mono-crystalline
  - (b) Module Efficiency :  $\geq 21$  % for Mono-crystalline
  - (c) Rated power at Standard Test Conditions (STC) : No negative tolerance
  - (d) Temperature co-efficient of power : Not less than  $-0.4\%/^{\circ}\text{C}$

## **2. Module Mounting Structure:**

- i. The module mounting structure for this project should be made of mild steel sheet (CRCA sheet) and galvanizing HDGI (Hot Dip Galvanized) with minimum 85 microns coating with self blast type.
- ii. The Mounting structure shall be so designed to withstand the basic wind speed of 180km/hour. Suitable fastening arrangement such as grouting and clamping should be provided to secure the installation against the specific wind speed.
- iii. The mounting structure steel shall be as per latest IS 2062: 1992 and galvanization of the mounting structure shall be in compliance of latest IS 4759.

- iv. The fasteners used should be made up of stainless steel. The structures shall be designed to allow easy replacement of any module. The array structure shall be so designed that it will occupy minimum space without sacrificing the output from the solar photovoltaic (SPV) panels.
- v. Installation of solar structure should not damage the roof in any way. The concrete foundation or blast shall be cast on site or pre-cast type. It will be ensure that the total load of the structure (when installed with PV modules) on the terrace shall be less than 60 kg/m<sup>2</sup>.
- vi. As per the design of the module mounting structure the total load of the structure on the roof (when installed with PV modules) on the shed shall be as follows:

Sl. No.	Building Name	Total Dead Load on Terrace (kg/Sq. Mtrs)	Remarks
1	Shed 22	64.23	Refer Drawing of MMS Layout with Marking Plan
2	Shed 23	63.56	
3	Shed 24	62.69	
4	Shed 25	63.32	
5	Shed 26	63.60	

### 3. Inverter:

We recommended String Inverter for this rooftop project.

As Solar PV array produce direct current electricity, it is necessary to convert this direct current into alternating current and adjust the voltage levels to match the grid voltage. Conversion shall be achieved using an electronic Smart Inverter and the associated control and protection devices.

Maximum power point tracker (MPPT) shall be integrated in the inverter to maximize energy drawn from the Solar PV array. The MPPT voltage window shall be sufficient enough to accommodate the output voltage of the PV array at extreme temperatures prevailing at site. Inverter shall consist of an electronic three phase inverter along with associated control, protection, filtering, measurement and data logging devices.

#### Technical Requirements:

- a) Type: String
- b) Rated AC power : As per Design (In the present design, 125 kW and 25 kW are considered)
- c) Switching devices : Microprocessor / DSP (Digital Signal Processor)
- d) Nominal AC output voltage and frequency : 415V, 3 Phase, 50 Hz
- e) Output frequency : 50 Hz
- f) Grid Frequency Synchronization range :As per Indian Electricity Regulation
- g) Ambient temperature considered : -20o C to 50o C
- h) Humidity : 95 % Non-condensing
- i) Protection of Enclosure: IP-65 (Minimum) for outdoor.

- j) Grid Frequency Tolerance range :As per Indian Electricity Regulation
- k) Grid Voltage tolerance : - 20% & + 15 %
- l) No-load losses :As per Indian Electricity Regulation
- m) Inverter efficiency(minimum) :>93%
- n) Total Harmonic Distortion : Less than 3%

#### **4. LT Panels (ACDB Panel):**

AC Distribution Panel Board (ACDB) shall control the AC power from string inverter, and should have necessary surge arrestors with suitable rating

All switches and the circuit breakers, connectors should conform to IEC 60947, Part I, II and III/ IS60947 Part I, II and III.

All cables shall be terminated onto a bus bar by means of suitable MCB/MCCB/ACB.

ACDB Panels shall be metal clad, totally enclosed, rigid, floor mounted, air - insulated, cubical type suitable for operation on three phase 415 volts, 50 Hz

Cable alley design needs to be compatible to allow easy access depending upon the number of AC Cables into the panel. Minimum width of cable alley shall be 300 mm. Location of bus bars should be such so as to avoid any overlapping/looping of cables in the panels.

Connections of cable with the bus bars should be properly tightened and check nuts must be provided to avoid any possibility of loosening of connections.

Bare/exposed portion of terminal/cables should be covered with appropriate sleeves instead of wrapping insulating tape.

#### **Technical Requirements:**

- a) Type : Outdoor
- b) Nominal AC output voltage and frequency : 415V  $\pm$  10%, 3 Phase, 4 wire, Neutral Solidly Earthed.
- c) Output frequency : 50 Hz
- d) Grid Frequency Synchronization range :As per Indian Electricity Regulation
- e) Ambient temperature (Minimum) : 45 degree Celsius
- f) Humidity : 90 % and dusty weather
- g) Protection of Enclosure : IP65 or better.
- h) Light : Tube Light (20W)

All the 415 Volt AC devices / equipment like bus support insulators, circuit breakers, CT, PT etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under the following supply conditions.

- a) Variation in supply voltage : +/- 10 %
- b) Variation in supply frequency : +/- 3 % Hz

## 5. Cables:

### 5.1 DC Cables

Solar cable is the interconnection cable used in photovoltaic power generation. A solar cable interconnects solar panels and other electrical components of a photovoltaic system. Solar cables are designed to be UVresistant and weather resistant. It can be used within alarge temperature range and are generally laid outside.

One common factor for most of the photovoltaic power systems is outdoor use, characterized by high temperatures and high UV radiation. Single-core cables with a maximum permissible DC voltage of 1.8 kV Umax.

The phase to ground DC voltage rating must be  $U_0 \geq 1.5kVDC$  and a temperature range from - 40 °C to +90 °C ambient, 120 °C on the conductor for 25 year service life against thermal ageing. Ambient temperature and conductor temperature is derived from the Arrheniuslawforageing of polymers-ageing of polymers doubles for every 10 °C rise. DC string cables must be As per Indian Electricity Regulation.

<b>DC CABLE (Modules to Inverter)</b>	
Size (cable from modules to T-connector)	Single core 4.0 sq.mm Cu. Multi strand flexible solar grade cable
Conductor Temperature Range	(-) 40 °C to +120° C
Nominal Voltage	1000 V DC
Voltage	1.8KV DC
Type	a. Annealed Tinned Copper b. Flexible type conductor c. Class-5
Properties	UV Resistive, Ozone &Flame Resistant Weather & Abrasion Resistant
Approval	TUV(2PFG1169/08.2007) RoHS Conformity
Colour Codes	a) Positive :Red b) Negative :Black
Applicable standard	IEC60228

### 5.2LT Cables

1.1kV Grade, Cu. / Al Conductor XLPE cable will be used between outgoing from solar string inverter to combiner ACDB panel and between other feeder panel. These cables will be laid on conduit / cable tray / trench. The cable will confirm to relevant IS standards.

<b>AC CABLE ( From Inverter to ACDB Panel)</b>	
Size	4C x 35 sq.mm & 4C x 70 sq. mm Cu XLPE cable, PVC Insulated
Temperature Range	90 Deg. C Maximum
Conductor	Copper as per Class 2 of IS:8130/84.LatestRevision
Insulation	XLPEasperIS7098(Pt-1)/88,LatestRevision
Armoring	GI Flat Armored
Outer Sheath	ExtrudedPVCTypeST2asperIS:5831/84
Inner sheath	Extruded PVCST-2, Thermosetting material asperIS:5831
Nominal Voltage	1.1KV (1.5KV DC)
Applicable Standard	IS8130/84,IS7098PartI/88,IS5831/84,IS

<b>AC CABLE (Field ACDB Panel to Main Solar ACDB Panel)</b>	
Size	4C x 50 sq.mm Cu XLPE cable, PVC Insulated
Temperature Range	90 Deg. C Maximum
Conductor	Aluminum as per Class 2 of IS:8130/84.LatestRevision
Insulation	XLPE as perIS7098(Pt-1)/88,LatestRevision
Armouring	Aluminum Flat Armoured
Inner Sheath	Extruded PVCST-2, Thermosetting material asperIS:5831
Outer Sheath	ExtrudedPVCTypeST2asperIS:5831/84
Nominal Voltage	0.6/1 (1.2)kv
AC Test Voltage	3.5kV/5Min.
Applicable Standard	IS8130/84,IS7098PartI/88,IS5831/84,IS 3975/88 Latest with up to date amendments

## 5.2HT Cables

6.6/11kV Grade, Cu. / Al Conductor XLPE cable will be used between duty transformer to HT panel and between HT Panel to Metering Unit. These cables will be laid on conduit / cable tray / trench. The cable will confirm to relevant IS standards.

<b>AC CABLE (From Inverter duty transformer to HT Panel)</b>	
Size	3Cx 240 sq.mm Al, Armoured, Multistranded XLPE Insulated (Earthed)
Temperature Range	90 Deg. C Maximum
Conductor	H4 Grade Stranded Aluminum
Conductor Screening	Extruded Semi-conducting compound
Nominal Voltage	6.6 KV/ 11 KV (E ) Cable
Insulation	XLPEasperIS:7098/II/85shielded with extruded layer of semiconducting cross-linked polyethylene with triple extrusion process
Insulation Screening	Extruded semi-conducting compound followed by layer of copper tapes
Inner Sheath	Extruded PVCST-2, Thermosetting material asperIS:5831
Outer Sheath	FRLSPVC Type ST-2 as per IS-5831
Conductor Shielding	Extruded layer of semi-conducting cross-linked

	polyethylene compound over the conductor
Armouring	Galvanized flat steel strips as per IS:3975
Applicable Standard	IEC60332-3,IS:7098/II/85

## 6. Connectors

PV Connectors must be as following technical specification

Description	Specification for MC4 Connectors
Connector System	4 sq mm Cu DC Cable
Rated Voltage	1000VDC(IEC)
Rated Current	30Amps
Test Voltage	6kV (50 Hz, 1 min)
Ambient Temperature Range	-40 Deg. C to +90Deg. C
Upper Limiting Temperature	105Deg. C
Overvoltage Category/Pollution Degree	CATIII /2
Contact resistance of Plug connectors	0.5m Ohms
Safety Class	II
Contact System	MC Multilam
Type of termination	Crimping
Contact Material	Copper, tin plated
Insulation Material	PC/PA
Locking System	Snap-in
Flame Class	UL94-V0
Cable Strain relief according to	EN50521:2008

## 7. Lightning Protection System

ESE type lightning arrestors will be installed to cover the entire PV area on the roof from lightning protection. Protection will meet the safety rules as per International Standards NFC –C 17 102.

ESE type lightning arrestors on each roof mumty to protect the entire PV field with following specification.

- a) Air Terminal Protector Height: 5 Mtrs. (Minimum)
- b) Level : III
- c) Quantity : 1 Nos On Each Roof
- d) Earthing For LA : Tripod Earthing Pit

For ESE type lightning arrester, the required radius of protection for the roof will be as follows.

Sl. No.	Building Name	ESE Type LA with Radius of Protection	Remarks
1	Shed 22	97 MTRS.	SYSTEM LAYOUT Refer Drawing of LIGHTNING ARRESTER
2	Shed 23	97 MTRS.	
3	Shed 24	97 MTRS.	
4	Shed 25	97 MTRS.	
5	Shed 26	75 MTRS.	

## **8. Earthing and Surge Protections**

Each array structure of the PV plant yard will be fixed properly. In addition, the lightning arrestor/masts will be provided inside the array field, if necessary. Provision will be kept for shorting and grounding of the PV array at the time of maintenance work. All metal casing/shielding of the plant will be thoroughly grounded in accordance with MNRE standards. Earth Resistance will be tested and earthing will be done by calibrated earth tester.

- a) Each array structure of the PV yard should be grounded/ earthed properly as per IS: 3043-1987.
- b) DC & AC Earthing should be separate.
- c) Grounding/Earthing should be as per IS: 3043-1987 & IEEE 90.
- d) Total resistance should be <1.50hm for Array Yard, <1 Ohm for Lightning Protection.

## **9. PV Module Cleaning System**

Water based Cleaning System shall be used for this project. Pipeline will be laid on the roof with suitable capacity of water pump.

Water used for PV module cleaning purpose shall be of potable quality and fit for cleaning the modules with Total dissolved solids (TDS) generally not more than 75 parts per million (PPM). In case of higher salt contents, the water shall be thoroughly squeezed off to prevent salt deposition over module surface. However, water with TDS more than 200 PPM shall not be used directly for module cleaning without suitable treatment to control the TDS within acceptable limits. The water must be free from any grit and any physical contaminants that could damage the panel surface.

If available water is not suitable to be used directly for cleaning PV modules, RO Plant of required capacity should be provided with storage facilities.

## **10. Monitoring System**

### **10.1 SCADA**

The PV power plant will be monitored through the SCADA system. This will enable monitoring the status of inverters to gather information on energy generation. Periodic reports of the plant's performance will be provided by the monitoring system. A suitable display system shall also be installed in the plant to access live data on the performance of the solar system. Remote data access will be provided through secured gateway connectivity.

Data Logging Provision for plant control and monitoring, time and date stamped system data logs for analysis with the high quality, suitable PC. Metering and Instrumentation for display of systems parameters and status indication to be provided.

The following parameters are accessible via the operating interface display in real time separately for solar power plant:

For Individual Inverter

- a) AC Voltage
- b) AC Output current
- c) Output Power
- d) Power factor
- e) Output frequency

For Total Generating System

- a) DC Input Voltage
- b) DC Input Current
- c) Time Active
- d) Time disabled
- e) Energy Measurement
- f) Time Idle
- g) Power produced
- h) Protective function limits

## **10.2 Solar Radiation and Environment Monitoring System**

Solar radiation and environment monitoring system shall be installed on one of the shed roof along with the solar PV power plant. The system shall consist of various sensors, signal conditioning, data acquisition, LCD display (Locally/Remotely)and remote monitoring.

Global and diffuse beam solar radiation in the plane of array (POA) shall be monitored on continuous basis. Global Horizontal Irradiation at the collector panel is required to be measured.

Solar Irradiance: An integrating Pyranometer (Class II or better) provided, with the sensor mounted in the plane of the array readout integrated with data logging system.

Temperature: Temperature probes for recording the Solar panel temperature and ambient temperature to be provided complete with readouts integrated with the data logging system.



Anemometer: A hemispherical cup anemometer should be provided to measure the wind speed.

## **11. Technology for 2X2.5 MVA 415/6KV Sub Station**

### **11.1 TECHNICAL SPECIFICATION FOR SUPPLY OF TRANSFORMER**

**Name of the Work:** Design, Manufacture, Supply, installation, testing and commissioning of 415V/6KV, YNd1, 2500KVA oil filled Transformer

Sl. No.	Description	Requirement
<b>1.</b>	<b>General Description</b>	
1.1	Capacity	2.5MVA
1.2	Nominal secondary Voltage Rating	6000V
1.3	Maximum System Voltage	6600V
1.4	Nominal primary Voltage	415V
1.5	Frequency	50Hz+/-3%
1.6	Vector Group	Dyn1
1.7	Method of Connection	
1.7.1	HV	Delta
1.7.2	LV	Star
1.8	No. of Phase	3
1.9	Painting	Epoxy
1.10	Colour	Shade 632 as per IS :5
1.11	Duty	continuous
1.12	Minimum guaranteed efficiency include of all tolerances	99.5% at 75% load at0.8pf
1.13	Type of cooling	ONAN
1.14	Outdoor/ Indoor Type	Outdoor
1.15	System Earthing	Neutral of LV side to be solidly earthed
1.16	Impedance Voltage (%), at Nominal Tap	5.75
1.17	Thermal Class Insulation	H
<b>2.</b>	<b>Codes And Standards</b>	
2.1	The equipment shall comply with the latest edition of the following and other relevant Indian Standards/Manual	
2.1.1	IS 335	Insulatingoil
2.1.2	IS 1271	Thermal evaluation and Classification of electrical insulation.
2.1.3	IS 2026	Powertransformers
2.1.4	IS 2099	Bushing for Alternative voltages above 1000V
2.1.5	IS 2705	Currenttransformers.
2.1.6	IS 3347	Dimensions for porcelain TransformerBushings
2.1.7	IS 3637	Gas operatedrelays
2.1.8	IS 3639	Fitting &accessories for powertransformers
2.1.9	IS 4201	Application guide forCTs
2.1.10	IS 6600	Guide for loading of oil immersedtransformers
<b>3</b>	<b>Operating Conditions</b>	
3.1	Ambient temperature	35 Deg C Average temperature , temperature variations (+50Deg C max. and 6Deg Cmin.)
3.2	ThetransformershallbeconnectedtoaSolar Inverter.	
3.3	At full load and maximum ambient temperature, the oil temperature should not exceed 90	

	DegC.
3.4	The transformer shall have a nameplate as specified in IS2026/IEC60076
<b>4</b>	<b>Connections</b>
4.1	The station transformer shall be wound in Star/Delta configuration according to IEC VectorreferenceDyn1, with an Off Load Tap Changer on the HVside.
<b>5</b>	<b>TransformerWinding</b>
5.1	<b>CoreMaterial</b> The magnetic circuit shall be of low loss, cold rolled, grain oriented high gradesteel.
5.2	<b>WindingInsulation</b> The insulation on the winding shall be class H as defined in IS2026/IEC60076.
<b>6</b>	<b>VoltageTappings</b>
6.1	TheHVwindingshallhaveanominalratingof6KVwhiletheLVwindingshallhavearatingof415V.
6.2	ThevoltagevariationsofthetapchangershallbeofConstantFluxVoltageVariationcategoryasdefinedin IEC 60076 -1. There shall be no current limitation due to tapvariations.
6.3	Thetappingshallbecarried outbyanoff-loadtap-changer.
6.4	Tappositionindicationshouldbeclearlyvisiblefromgroundlevel.
<b>7</b>	<b>LV and HVTerminations</b>
7.1	The transformer LV and HV windings shall be brought out separately through bushings inaccordancewithBS137.TheHVterminalsshallbelabeledas2U,2V,and2WwhiletheLVterminalsshallbelabeled as 1u, 1v, 1w& 1n.
7.3	Air clearance on the LV terminals shall be observed as specified in IS 2026/ IEC60076.
7.4	First filling of oil. Shall be included in scope of vendor.
7.5	CableboxshallbeweatherprooftoIP-65.Forfixedportionofcablebox,inspectioncoverwithliftinghandle shall beprovided.
7.6	MarshallingboxshallbemountedontransformerandshallbeweatherprooftoIP-65.AllprotectivedevicesandneutralCTsshallbewiredbymeansofPVCinsulatedcopperconductoror armoredcables up tothemarshallingbox.Terminalsshallbeclamptype.Removableglandplatewithdoublecompression type glands shall be provided.
7.7	Lamp with switch & socket shall be provided inthemarshalling box. Preferably, marshalling box shall be located on the front side oftransformer.
7.8	Aseparateneutralbushingshallbeprovidedforneutralearththingoftransformers.The neutral CTshall be mounted asbelow:- a) CT for 51G shall be located in the earth path after bifurcation ofneutral. b) CT for 64 R can be located before bifurcation ofneutral. Supporting arrangement for GI strip/cable as applicable shall be provided for connection ofneutral bushing toearth.
<b>8</b>	<b>ACCESSORIES</b>
8.1	The following accessories shall be provided as aminimum:
8.2	Ratingplate
8.3	Terminal markingplate
8.4	Two earthingterminals
8.5	De-hydratingbreather
8.6	<b>Conservator</b> :The Conservator tank shall have adequate capacity between highest and lowest visible levels to meet the requirement of expansion of the total cold oil volume in the transformer and cooling equipment.
8.7	Air release Device (for transformers withconservator)

8.8	Thermometerpocket
8.9	Dial type thermo meter with contacts for OTI &WTI
8.10	Explosion Vent shall be provided as per standard.
8.11	Pressure reliefvalve
8.12	Samplingvalve
8.13	Conservator drainvalve
8.14	Top oil filtervalve
8.15	Drain cum bottom filtervalve
8.16	Double float Buchholzrelay
8.17	Separate neutral bushing outside terminal box with connectorassembly
8.18	Inspectioncover
<b>9</b>	<b>Protection</b>
9.1	Overheating protection
9.2	Over current protection
9.3	Differential Protection of Transformer
9.4	Earth Fault Protection (Restricted)
9.5	Buchholz Relay
9.6	Over-fluxing protection
<b>10</b>	<b>Inspection &amp; Testing</b>
10.1	Inspection and Testing of Transformer will be carried out as per IS-2026

### **11.2 TECHNICAL SPECIFICATION FOR SUPPLY OF HV SWITCHGEAR**

**Name of the Work:** Design, Manufacture, Supply, installation, testing and commissioning of HV Switchgear.

This specification covers the minimum requirements for the design, material, manufacturing, inspection, testing, supply, shipment and delivery to site of High Voltage Switchboard for Solar Power Plant Sub Station at Syama Prasad Mookerjee Port, Kolkata

Vendor shall be fully responsible for the design, material, manufacturing, inspection, testing and delivery of High Voltage Switchboard at site, installation and commissioning.

<b>Sl. No.</b>	<b>Description</b>	<b>Requirement</b>
<b>1</b>	<b>Site Condition</b>	
1.1	Maximum Ambient Temperature	50Deg C
1.2	Minimum Ambient temperature	6Deg C
1.3	Maximum Temperature Limit	85 Deg C
1.4	Relative Humidity	Heavy humidity of up to93%.
<b>2</b>	<b>Operating Conditions</b>	
2.1	Voltage	6 KV±10%
2.2	Frequency	50Hz +/-3%
2.3	Rated Continuous Current	630A
2.4	No. of Phase	3
2.5	System Fault Level	As required
2.6	System Earthing	Direct earthed
2.7	Auxiliary supply	DC 110 V + 10%-15%
<b>3</b>	<b>Codes And Standards</b>	
3.1	The equipment shall comply with the latest edition of the following and other relevantIndian Standards/Manual	
3.1.1	IS 5	Colours for ready mixed paints and enamels

3.1.2	IS 694	Polyvinyl chloride insulated unsheathed and sheathed cables/cords with rigid and flexible conductor for rated voltages up to and including 450/750 V
3.1.3	IS 1248	Direct acting indicating analogue electrical measuring instruments and their accessories
3.1.4	IS 2071	High voltage test techniques.
3.1.5	IS 2544	Porcelain post-insulators for systems with nominal voltage greater than 1000 volts
3.1.6	IS 2705	Current transformers.
3.1.7	IS 3156	Voltage transformers
3.1.8	IS 3231	Electrical relays for power system protection
3.1.9	IS 3427	AC Metal enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV
3.1.10	IS 3618	Phosphate treatment of iron and steel for protection against corrosion
3.1.11	IS 5082	Wrought aluminium and aluminium alloy bars, rods, tubes and sections for electrical purposes
3.1.12	IS 5578	Guide for marking of insulated conductors
3.1.13	IS 6005	Code of practice of phosphating of iron and steel.
3.1.14	IS 9385	High voltage fuses
3.1.15	IS 9920	High voltage switches
3.1.16	IS 9921	Specification for alternating current disconnectors (isolators) and earthing switches for voltage above 1 000V
3.1.17	IS 10601	Dimensions of terminals of high voltage switchgear and controlgear.
3.1.18	IS 11353	Guide for uniform system of marking and identification of conductors & apparatus terminals
3.1.19	IS 12729	Common specification for high-voltage switchgear and control gear standards.
3.1.20	IS 13703	Low voltage fuses for voltages not exceeding 1 000V ac or 1500V dc
3.1.21	IS/IEC 60470	High voltage switchgear alternating current contactor and contactor based motor starters
3.1.22	IS/IEC 60529	Degree of protection provided by enclosures (IP code)
3.1.23	IS/IEC 60947	Low voltage switchgear and control gear
3.1.24	IS/IEC 62271-1	High voltage switchgear and controlgear Part 1: Common specifications
3.1.25	IS/IEC 62271-100	High-voltage switchgear and controlgear Part 100 Alternating current circuit breakers.
3.1.26	IS/IEC 62271-102	High voltage switchgear and controlgear Part 102: Alternating current disconnectors and earthing switches.
3.1.27	IS/IEC 62271-105	High voltage switchgear and control gear Part 105: Alternating current switch fuse combinations
3.1.28	IS/IEC 62271-200	High-voltage switchgear and control gear Part 200: AC metal enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV.
3.2	In case of imported equipment, standards of the country of origin shall be applicable, if these standards are equivalent or stringent than the applicable Indian standards.	
3.3	The equipment shall also conform to the provisions of Indian Electricity rules and other statutory regulations currently in force in the country.	
4	<b>DESIGN AND FABRICATION REQUIREMENTS</b>	
4.1	Vertical panels shall be assembled to form a continuous line-up of uniform height.	
4.2	The High Voltage Switchboard shall be totally enclosed and vermin-proof. If necessary, openings for natural ventilation shall be provided.	
4.3	All openings, covers and doors shall be provided with suitable neoprene gaskets	
4.4	The drawout carriage on the High Voltage Switchboard shall have three positions: "Service", "Test" and "Drawout"	

4.4.1	- <b>"Service" position</b> - In this position both power and control circuits shall be connected. This shall be the normal operating position of the circuit breaker.
4.4.2	- <b>"Test" position</b> - The power contacts shall be disconnected in this position but the control connections shall not be disturbed, it shall be possible to close and trip the circuit breakers in this position.
4.4.3	- <b>"Draw out" Position</b> - both power and control circuits shall be disconnected in this position.
5	<b>Auxiliary wiring and terminals</b>
5.1	Inside the cubicles, the wiring for control, signaling, protection and instrument circuits shall be done with BIS approved, PVC insulated, flame retardant type, copper conductor wire.
5.2	A minimum of 10% spare terminals shall be provided on each terminal block.
5.3	Each wire shall be identified at both ends by correctly sized PVC ferrules.
5.4	Shorting links shall be provided for all CT terminals.
5.5	All inter-panel control wiring within each shipping section shall be by switchgear vendor.
6	<b>Control and Indication</b>
6.1	Circuit breaker tripping, closing and spring charging devices shall be fed with 110V DC control power supply
6.2	Circuit breaker positions (CLOSE, OPEN, spring-charged, test position, service position) shall be indicated mechanically& electrically.
6.3	A common DC control supply fail indication shall be provided for each bus section with a blue coloured lamp
7	<b>Earthing</b>
7.1	All cubicles shall be connected to an earth bus bar running throughout the length of the switchboard. The minimum earth bus bar size shall be minimum 50 x 6 mm <sup>2</sup> copper, for a short-circuit withstand capacity above 31.5 kA
7.2	All doors and movable parts shall be connected to the earth bus with flexible copper connections
7.3	Provision shall be made to connect the earthing bus bar to the plant earthing grid at two ends.
7.4	All noncurrent-carrying metallic parts of the equipment and components shall be earthed
8	<b>Space heaters</b>
8.1	The panels shall be provided with space heaters to prevent moisture condensation, and maintain cubicle temperature 5°C above the ambient.
8.2	The space heaters shall be controlled through a MCB and a thermostat with an adjustable setting
9	<b>Nameplates</b>
9.1	A nameplate with the switchboard designation shall be fixed at the top of the central panel.
9.2	A separate nameplate giving details for each feeder compartment of all panels shall be provided.
9.3	Danger plate (Red) shall be provided at the front and rear for each panel.
10	<b>Painting</b>
10.1	All metal surfaces shall be thoroughly cleaned and degreased to remove mill scale, rust, grease and dirt. Fabricated structures shall be pickled and then rinsed to remove any trace of acid. The under surfaces shall be prepared by applying a coat of phosphate paint and coat of yellow zinc chromate primer
10.2	After preparation of the under surface, the switchboard shall be spray painted with two

	coats of epoxy based final paint or shall be powder coated
10.3	Colour shade of final paint shall be as specified in the data sheet
<b>11</b>	<b>SWITCHBOARD COMPONENTS</b>
<b>11.1</b>	<b>Circuit Breakers</b>
11.1.1	Vacuum circuit breakers shall be used in the switchboard
11.1.2	The circuit breakers shall have a motor-operated, spring-charged mechanism. It shall also be possible to charge the springs manually. Spring charging motors in HT switchboards shall be suitable for 110V DC control supply
11.1.3	The closing spring shall get re-charged (for subsequent closing) soon after a closing shot and prior to circuit breaker tripping
11.1.4	The control circuit shall be suitable for local as well as remote control.
11.1.5	All circuit breakers shall be provided with mechanically operated emergency trip device
<b>11.2</b>	<b>Instrument Transformers</b>
11.2.1	Current transformers shall conform to IS 2705.
11.2.2	The voltage transformers shall conform to IS 3156
<b>11.3</b>	<b>Measuring Instruments</b>
11.3.1	All measuring instruments shall be of square pattern, flush-mounted type.
11.3.2	The accuracy class for all instruments shall be 1.0 as per IS 1248
11.3.3	All AC ammeters and voltmeters type shall be as specified in the data sheet.
11.3.4	All frequency meters and power factor meters type shall be as specified in the data sheet
11.3.5	The kW/kWh meters type shall be as specified in the data sheet
11.3.6	The kW / kWh meters shall be suitable to measure unbalanced loads on a 3-phase, 3-wire system
<b>11.4</b>	<b>Relays</b>
11.4.1	All the relays shall be used Numerical type.
11.4.2	All protective relays shall have hand reset facility and clear operating indication.
11.4.3	The relay cases shall have a provision for insertion of a test plug at the front for testing and calibration using an external power supply without disconnecting the permanent wiring.
11.4.4	All tripping relays shall be of lockout type with hand-reset contacts
11.4.5	The vendor shall be solely responsible for coordinating the relay characteristics with suppliers for the proper selection of all CTs with special attention to CTs of class PS.
<b>11.5</b>	<b>Auxiliary equipments</b>
11.5.1	Auxiliary relays and contactors shall generally be used for inter-locking and multiplying contacts. Auxiliary contacts shall be capable of carrying the maximum anticipated current
11.5.2	All control switches shall be rotary type, having a cam-operated contact mechanism.
<b>11.6</b>	<b>INSPECTION AND TESTING</b>
11.6.1	During fabrication, high voltage switchboard shall be subject to inspection by B And R/ SMPK or by an agency authorized by the B And R/ SMPK.
11.6.2	Vendor shall furnish all necessary information concerning the supply to B And R/ SMPK
11.6.3	The Purchaser shall have free access to the Vendor's works for the purpose of inspecting the process of manufacture in all its stages and he will have the power to reject any material, which appears to him to be of unsuitable description or of unsatisfactory quality
11.6.4	High voltage switchboards shall be tested in accordance with applicable standards

11.6.5	All acceptance and routine tests as follows shall be carried out at Vendor's work under his care and expense
11.6.6	Vendor's internal test reports shall be provided for Purchaser's review prior to inspection and testing
11.6.7	All type tests shall be performed at Vendor's work or independent approved testing laboratory under his care and expense.
11.6.8	For equipment bought from other sub-suppliers, certified test reports of tests carried out at the sub-supplier's works shall be submitted

### **11.3 TECHNICAL SPECIFICATION FOR SUPPLY OF MV SWITCHGEAR**

**Name of the Work:** Design, Manufacture, Supply, installation, testing and commissioning of MV Switchgear.

This specification covers the minimum requirements for the design, material, manufacturing, inspection, testing, supply, shipment and delivery to site of Medium Voltage Switchboard for Solar Power Plant Sub Station at Syama Prasad Mookerjee Port, Kolkata

Vendor shall be fully responsible for the design, material, manufacturing, inspection, testing and delivery of Medium Voltage Switchboard at site, installation and commissioning.

Sl. No.	Description	Requirement
<b>1</b>	<b>Site Condition</b>	
1.1	Maximum Ambient Temperature	50 Deg C
1.2	Minimum Ambient temperature	6 Deg C
1.3	Maximum Temperature Limit	85Deg C
1.4	Relative Humidity	Heavy humidity of up to 93%.
<b>2</b>	<b>Operating Conditions</b>	
2.1	Voltage	0.415 KV±10%
2.2	Frequency	50Hz +/-3%
2.3	No. of Phase	3
2.4	Current Rating	4000 A/ 800A
2.5	System Fault Level	As required
2.6	Type	Electrically Operated Draw Out (EDO) type.
2.7	Tripping coil	110V DC communicable type
2.8	Closing coil	110V DC communicable type
2.9	Spring Charging Motor	110V DC
2.10	System Earthing	Isolation & Earthing as per IEC 62271
2.11	Auxiliary supply	DC 110 V + 10%-15%
<b>3</b>	<b>Codes And Standards</b>	
3.1	The equipment shall comply with the latest edition of the following and other relevant Indian Standards/Manual	
3.1.1	IS 5	Colours for ready mixed paints and enamels
3.1.2	IS 1248	Direct acting indicating analogue electrical measuring instruments and their accessories
3.1.3	IS 2705	Current transformers.
3.1.4	IS 2824	Method for determining of the proof and the comparative tracking indices of solid insulating materials
3.1.5	IS 3156	Voltage transformers
3.1.6	IS 3231	Electrical relays for power system protection
3.1.7	IS 3618	Phosphate treatment of iron and steel for protection against

		corrosion
3.1.8	IS 5082	Wrought aluminium and aluminium alloy bars, rods, tubes and sections for electrical purposes
3.1.9	IS 5553	Reactors
3.1.10	IS 5578	Guide for marking of insulated conductors
3.1.11	IS 6005	Code of practice of phosphating of iron and steel.
3.1.12	IS 8623	Low voltage switchgear and controlgear assemblies
3.1.13	IS 11353	Guide for uniform system of marking and identification of conductors & apparatus terminals
3.1.14	IS 12672	Internal fuses and internal overpressure disconnectors for shunt capacitors.
3.1.15	IS 3340	Power capacitors of self-healing type for AC power systems having rated voltage upto 650V.
3.1.16	IS 3341	Requirements for ageing test, self-healing test and destruction test on shunt capacitors of the self-healing type for ac power systems having a rated voltage upto and including 650V
3.1.17	IS/IEC 60529	Degree of protection provided by enclosures (IP code)
3.1.18	IS/IEC 60947	Low voltage switchgear and controlgear
3.1.19	IS 61641	Enclosed low-voltage switchgear and controlgear assemblies - Guide for testing under conditions of arcing due to internal fault
3.2	In case of imported equipment, standards of the country of origin shall be applicable, if these standards are equivalent or stringent than the applicable Indian standards.	
3.3	The equipment shall also conform to the provisions of Indian Electricity rules and other statutory regulations currently in force in the country.	
4	<b>DESIGN AND FABRICATION REQUIREMENTS</b>	
4.1	The switchboard shall be metal enclosed, free standing, floor mounting compartmentalized, modular type, fully draw out or fixed type.	
4.2	The switchboard enclosure shall be dust and vermin proof and shall provide a degree of protection.	
4.3	The switchboard shall be assembled out of vertical panels of uniform height in single line up .The switchboard height shall be restricted to 2300 mm	
4.4	The switchboard shall be designed to ensure maximum safety during operation, inspection, connection of cables, relocation of outgoing circuits and maintenance, with the bus bar system energised and without taking any special precautions.	
4.5	All openings, covers and doors shall be provided with neoprene Gaskets	
4.6	All hardware shall be corrosion resistant	
4.7	Removable, CRCA or non-magnetic gland plates having minimum 3mm thickness shall be provided	
5	<b>Bus Bar</b>	
5.1	Bus bars shall be of high conductivity electrolytic aluminum supported on insulators made of non-hygroscopic, non-inflammable material with tracking index equal to or more than that defined in Indian standards	
5.2	The main bus bars shall have uniform current ratings throughout their length.	
5.3	Both horizontal and vertical bus bars, bus joints and supports shall be capable of withstanding dynamic and thermal stresses of short circuit currents for 1 second	
5.4	The short circuit capacity of the neutral bus bars shall be in line with IS/IEC 60947	
5.5	All bus bars shall be insulated with heat shrunk PVC sleeves of 1100 V grade. Red, yellow and blue colour shall be used for phase bus bars and black colour shall be used for neutral bus bars. Removable type shrouds shall be provided for joints.	
6	<b>Auxiliary wiring and terminals</b>	



6.1	Inside the cubicles, the wiring for control, signaling, protection and instrument circuits shall be done with BIS approved, PVC insulated, flame retardant type, copper conductor wire.
6.2	A minimum of 10% spare terminals shall be provided on each terminal block.
6.3	Each wire shall be identified at both ends by correctly sized PVC ferrules.
6.4	Shorting links shall be provided for all CT terminals.
6.5	All inter-panel control wiring within each shipping section shall be by switchgear vendor.
7	<b>Control and Indication</b>
7.1	Circuit breaker tripping, closing and spring charging devices shall be fed with 110V DC control power supply
7.2	Circuit breaker positions (CLOSE, OPEN, spring-charged, test position, service position) shall be indicated mechanically& electrically.
7.3	A common DC control supply fail indication shall be provided for each bus section with a blue coloured lamp
8	<b>Earthing</b>
8.1	All panels shall be connected to a tinned copper earth bus bar running throughout the length of the switchboard
8.2	The minimum earth bus size shall be 30x6 mm <sup>2</sup> copper for fault level up to 31.5 kA and 50 x 6 mm <sup>2</sup> copper for fault level above 31.5kA. However vendor to ensure the size of conductor as per the fault level specified.
8.3	All doors and movable parts shall be connected to the earth bus with flexible copper connections
8.4	Provision shall be made to connect the earthing bus bar to the plant earthing grid at two ends.
8.5	All noncurrent-carrying metallic parts of the equipment and components shall be earthed
9	<b>Space heaters</b>
9.1	The switchboard panels shall be provided with space heaters to prevent moisture condensation. The space heater shall be supplied from 110 V DC auxiliary bus for space heater. And the space heater shall be controlled through a MCB and Thermostat with adjustable settings.
10	<b>Nameplates</b>
10.1	A nameplate with the switchboard designation shall be fixed at the top of the central panel.
10.2	A separate nameplate giving details for each feeder compartment of all panels shall be provided.
10.3	Danger plate (Red) shall be provided at the front and rear for each panel.
10.4	Blank nameplates shall be provided for all spare and vacant modules.
11	<b>Painting</b>
11.1	All metal surfaces shall be thoroughly cleaned and degreased to remove mill scale, rust, grease and dirt. Fabricated structures shall be pickled and then rinsed to remove any trace of acid. The under surface shall be prepared by applying a coat of phosphate paint and coat of yellow zinc chromate primer
11.2	After preparation of the under surface, the switchboard shall be spray painted with two coats of epoxy based final paint or shall be powder coated
11.3	Colour shade of final paint shall be as specified in the data sheet
12	<b>SWITCHBOARD COMPONENTS</b>
12.1	<b>Circuit Breakers</b>

12.1.1	Air circuit breakers shall be used in the switchboard
12.1.2	The circuit breakers shall have a motor-operated, spring-charged mechanism. . It shall also be possible to charge the springs manually. Spring charging motors in LT switchboards shall be suitable for 110V DC control supply.
12.1.3	The closing spring shall get re-charged (for subsequent closing) soon after a closing shot and prior to circuit breaker tripping
12.1.4	The control circuit shall be suitable for local as well as remote control.
12.1.5	All circuit breakers shall be provided with mechanically operated emergency trip device
13	<b>Operating Mechanism</b>
13.1	For air circuit breakers with electrical power operating mechanism, provision shall also be made for manual spring charging.
13.2	The air circuit breakers shall be provided with mechanically operated emergency tripping device
13.3	Air circuit breakers open and closed positions, service and test locations and spring charged condition shall also be indicated mechanically in addition to electrical indications.
13.4	Castle lock arrangement shall be provided for all the air circuit breakers so that air circuit breakers can be locked in the test position while carrying out the maintenance of down steam equipment.
13.5	Air circuit breakers shall be provided with operation counters
14	<b>INSPECTION &amp; TESTING</b>
11.6.5	All acceptance and routine tests as follows shall be carried out at Vendor's work under his care and expense
11.6.6	Vendor's internal test reports shall be provided for Purchaser's review prior to inspection and testing
11.6.7	All type tests shall be performed at Vendor's work or independent approved testing laboratory under his care and expense.
11.6.8	For equipment bought from other sub-suppliers, certified test reports of tests carried out at the sub-supplier's works shall be submitted

#### **11.4 TECHNICAL SPECIFICATION FOR SUPPLY OF DC UPS SYSTEM AND BATTERIES**

**Name of the Work:** Design, Manufacture, Supply, installation, testing and commissioning of 110V DC UPS System for Solar Power Plant Sub Station at Syama Prasad Mookerjee Port, Kolkata.  
Vendor shall be fully responsible for the design, material, manufacturing, inspection, testing and delivery of High Voltage Switchboard at site, installation and commissioning.

Sl. No.	Description	Requirement
<b>1</b>	<b>Site Condition</b>	
1.1	Maximum Ambient Temperature	50Deg C
1.2	Minimum Ambient temperature	6Deg C
1.3	Maximum Temperature limit	85Deg C
<b>2</b>	<b>Codes and Standards</b>	
2.1	IS 1248	Direct acting indicating analogue electrical measuring instruments and their accessories
2.2	IS 2705	Current transformers

2.3	IS 1651	Stationary cells and batteries, lead acid type
2.4	IS 1652	Stationary cells and batteries, lead acid type
2.5	IS 3700 Part 7	Essential ratings and characteristics of semiconductor devices - Part VI Reverse blocking triode thyristors
2.6	IS 3715 Part 4	Letter symbols for semiconductor devices: Part 4 thyristors
2.7	IS 4411	Code for designation of semi-conductor devices
2.8	IS 5001	Guide for preparation of drawings of semiconductor devices
2.9	IS 5469	Code of practice for the use of semi-conductor junction devices
2.10	IS 6304	Stationary batteries, lead acid type with pasted positive plates
2.11	IS 7204	Stabilized power supplies de output.
2.12	IS 8320	General requirement and method of test for lead acid storagebatteries
2.13	IS 12021	Control transformers for switchgear and controlgear for voltages notexceeding 1000 V ac
2.14	IS 13703	L V fuses for voltage not exceeding 1 000V ac or 1500V dc
2.15	IS 14901	Semiconductor Devices - Discrete Devices and Integrated Circuits
2.16	IS/IEC 60529	Degree of protection provided by enclosures (IP code)
2.17	IS/IEC 60947	Low voltage switchgear and controlgear
2.18	IEC 60146-1-1	Semiconductor converters -General commutated converters –Part 1-1 requirements
2.19	In case of imported equipment, standards of the country of origin shall be applicable, if these standards are equivalent or stringent than the applicable Indian standards.	
	The equipment shall also conform to the provisions of Indian Electricity rules and other statutory regulations currently in force in the country.	
3	<b>General Requirements</b>	
3.1	The DC UPS system shall be an integrated system comprising of static battery chargers, batteries, DC Distribution Board, isolating and protection devices and all other equipment, accessories required for completeness of the system whether specifically mentioned herein or not, but necessary for completeness and satisfactory performance of the system.	
4	<b>Site Conditions</b>	
4.1	The DC UPS system shall be suitable for installation and satisfactory operation in indoor installation.	
5	<b>Input Power Supply</b>	
5.1	Voltage	415V ± 10%
5.2	Frequency	50 Hz± 3%
6	<b>Output Power</b>	
6.1	Output voltage 24V & 110V DC	
7	<b>DC UPS System Configuration and Operational requirements</b>	
7.1	The DC UPS system shall comprise 2 Nos. Float cum Boost Battery Chargers (each value for100% capacity) with 1 set of battery. The DC UPS system shall have the following design philosophy	
7.2	Normal operation requires that the battery assembly shall be float charged simultaneously by both battery chargers-1 & 2 while feeding the DC load. The battery chargers are thus operating in parallel and equally sharing the total load.	
7.3	However in case of failure of either of the battery chargers, the other battery charger shall float charge the battery while feeding the complete DC load. Faulty battery charger shall automatically get disconnected from the healthy system.	
7.4	In case of AC mains failure, the battery shall continue to supply the load	

7.5	Upon resumption of supply, one of the battery chargers shall supply the entire DC load and the other shall start boost charging the battery.
7.6	The process of changeover from float to boost charging and reverting from boost to float charging shall be selectable in Automatic or Manual mode by means of an Auto / Manual selector switch
7.7	Interlock shall be provided to ensure that when either of the battery chargers is selected in boost charging mode, it will be disconnected from both the DC load and the other battery charger operating under float charging mode
7.8	The battery chargers shall have facility for manual mode of operation in the event of failure of controller under closed loop control. The selection shall be done through Auto / Manual selector switch
7.9	Facility for initial charging of the uncharged battery shall also be provided
8	<b>Battery</b>
8.1	Lead Acid batteries shall have been type tested to meet the performance requirements for each design and AH rating of cells as per Indian standard IS-1651
8.2	Sealed maintenance free batteries (SMF) or Valve Regulated Lead acid (VRLA) cell. / battery shall be suitable for float duty operation at constant voltage permanently applied to its terminals which is sufficient to maintain it in a state close to full charge and shall be designed to supply load in the event of normal power supply failure.
8.3	The standard rated ampere hour capacity of the cell/ battery shall be at reference temperature of constant current discharge at 10 hours rate
8.4	Number of cells and end cell voltage shall be decided by the vendor on the basis of maximum permissible voltage to the load when batteries are float charged while feeding the load and minimum DC system voltage
8.5	The battery shall be suitable for being boost charged to, fully charged condition from fully discharged Condition within 8 hours unless otherwise specified.
9	<b>Indication</b>
9.1	The Charger shall be provided with following LED of reputed make Indication: (i) Supply of power--Green (ii) Charger on –Green (iii) Battery reverse polarity (iv) Input power supply fail–Red (v) Output over/under voltage (vi) Earth fault
9.2	Audio/Visual alarm to indicate:- (i) AC input Power failure. (ii) Charger Output failure. (iii) Battery disconnection/failure. (iv) DC under/Overvoltage (v) Condenser Fuse failure. (vi) In case of failure of charger on fault, it should give buzzer as well as LED indication
10	<b>Inspection And Testing</b>
10.1	During fabrication, the equipment shall be subjected to inspection by Purchaser or by an agency authorized by the Purchaser. Vendor shall furnish all necessary information concerning the supply to Purchaser
10.2	The Purchaser shall have free access to the Vendor's works for the purpose of inspecting the process of manufacture in all its stages and he will have the power to reject any material, which appears to him to be of unsuitable description or of unsatisfactory quality

10.3	DC UPS system shall be tested in accordance with applicable standards. Following acceptance tests on each DC UPS system as a minimum shall be carried out at Vendor's works under his care and expense. <ul style="list-style-type: none"> <li>(i) Insulation Test</li> <li>(ii) Heat Run Test</li> <li>(iii) Functional Tests</li> <li>(iv) Charger efficiency test</li> <li>(v) Auxiliary Equipment and Control Circuit Tests</li> <li>(vi) Parallel Operation</li> <li>(vii) Audible Noise Test</li> </ul>
10.4	Batteries shall be tested in accordance with applicable standards. Following acceptance tests on each AH rating of cells/battery shall be carried out at Vendor's works under his care and expense. <ul style="list-style-type: none"> <li>(i) Physical examination</li> <li>(ii) Polarity and absence of short circuit</li> <li>(iii) Marking and packing</li> <li>(iv) Verification of dimensions</li> <li>(v) Air pressure test</li> <li>(vi) Test for voltages during discharge</li> <li>(vii) Test for AH capacity</li> <li>(viii) Insulation resistance</li> </ul>
10.5	Battery duty cycle test to meet the load cycle requirement shall also be performed at site after installation as part of commissioning.

## 12. Earthing:

This specification defines the requirements for the supply of earthing & lightning protection materials and installation of the earthing and lightning protection systems.

### Codes And Standards:

The shall be carried out in the best workman like manner in conformity with this specification. The codes of practice of Bureau of Indian Standards and OIDS Standards listed below.

- SP:30(BIS) Special Publication-National Electrical code.
- IS:2309 Protection of buildings and allied structures against lightning.
- IS:3043 Code of Practice for earthing
- IS:7689 Guide for control of undesirable static electricity.
- OISD 110 Recommended practices on static electricity.
- OIDS 147 Inspection and safe practice during electrical installation.

In addition to the above it shall be ensured that the installation confirms to the requirements of the following as applicable.

- a) Indian electricity Act and rules
- b) Regulations laid down by CEA
- c) Any other regulations laid down by central/state/local authorities and insurance agencies.

### **Material Specification:**

All materials and hardwires to be supplied by the contractor shall be new, unused and of best quality and shall conform to the specifications given here under and to latest specifications of Bureau of Indian Standards. Contractor shall bring material samples to the site and get it approved by the Engineer-in-charge before installation.

The main earth grid conductor shall be hot dip galvanized M.S Flat. Size of main conductors and earth electrode should be fixed after necessary testing, design & calculation.

- The earth conductor shall be laid along cable trays, cable trench.
- The earthing conductor shall be suitably cleated and Electrically bonded to all the other cable trays on the same cable route at a regular interval of 25 to 30 Mtr.
- The earthing for equipment shall be tapped from the main earth conductor.
- Earth conductor when laid underground shall be at a depth of 500mm below finished ground level.
- Joints and tapings in the main earth loop shall be made in such a way that reliable and good electrical connections are permanently ensured.
- All joints below grade shall be welded and shall be

## **13. Control Room Building**

The plinth area for the control room building shall be as below:

### **A. General:-**

- (a) Buildup Area:- Minimum 210 Sq. Mtr
- (b) Building Height:-Minimum 3 Mtr.
- (c) Plinth Protection: Minimum 1.2Mtr.
- (d) Floor Level: +1Mtr from Natural Ground Level (NGL)

All the work should be carried out as per General Technical Specification

### **B. Soil Investigation :**

The Contractor shall perform a detailed soil investigation to arrive at sufficiently accurate general as well as specific information about the soil profile/strata and the necessary soil parameters of the site in order that the foundations of the various structures can be designed and constructed safely and rationally. Foundation systems adopted by the contractor shall ensure that relative settlement shall be as per provision in IS 1904 and any latest IS and other Indian Standards.

## **14. Other Civil Work**

### **14.1 Area fencing**

The specification covers supply (including fabrication) Providing & fixing of Chain link fencing using MS pipe ,Ms angle & GI wire Mesh chain link for Power Transformer area as per instruction of Engineer-In-Charge of B And R/ KOPT.

#### **14.3 Cable trench**

All the indoor & outdoor cable trenches shall be RCC type and as per General Technical Specification.

#### **14.4 Buried Cables**

Cables are to be laid in neat lines and at suitable levels. Their depth below ground level will depend upon the voltage associated with the cables but in all cases the excavation must provide a clear trench. Sand filling below, around and above the cables will always be required and protection covers or tiles will be placed in position over the sand filling before final backfilling to the ground level. The line of the cable trenches shall be marked with suitable posts as required by relevant section of this Specification.

#### **14.5 Fire Protection Wall:**

- a) Fire protection walls shall be provided in accordance with Tariff Advisory Committee (TAC) recommendations.
- b) A fire wall shall be erected between the transformers and if the free distance between the various pieces of equipment is less than 10 m, to protect each one from the effects of fire on another.
- c) Fire walls shall also be erected between the transformers, and auxiliary services transformers if the free distance is less than ten meters.
- d) The fire wall shall have a minimum fire resistance of three hours. Partitions which are made to reduce the noise level of the transformers shall have the same fire resistance where they are also used as fire walls. The walls of buildings which are used as fire walls, shall also have a minimum fire resistance of three hours.
- e) Fire walls shall be designed in order to protect against the effect of radiant heat and flying debris from an adjacent fire. The column of the fire walls shall be type be RCC, M20 (1:1.5:3 mix).
- f) Fire walls shall have the mechanical resistance to withstand local atmospheric conditions. If the wall is intended to serve as a support for equipment such as insulators etc., its mechanical rigidity must be increased accordingly. Connecting the walls by steel or other structures, which may produce a reversing torque if overheated, shall be avoided.
- g) Fire walls shall extend at least two meters on each side of the power transformers or reactors and at least one meter above the conservator tank or safety vent. These dimensions might be reduced in special cases, and if TAC permits so, where there is lack of space. A minimum of two meters clearance shall be provided between the equipmentse.g. , transformers and fire walls. Building walls which act as fire walls shall extend at least one meter above the roof in order to protect it.
- h) Fire walls may be made of reinforced concrete (M20 grade), fire brick, concrete blocks or corrugated iron on a steel structure as per the system requirements. Materials used must conform to the standards of the National Fire Prevention Association and TAC norms.

**Note: The dimension and rating of all Solar/Electrical equipment considered in the technical specification are tentative. The final specification and rating with technical details will be considered as per design submitted by the bidder and after final approval from B And R/SMPK.**



**Details about Comprehensive Maintenance Contract**

**SOLAR PLANT PERFORMANCE EVALUATION**

Maximum System Generation Degradation will be permitted 0.8%per year and thereafter with respect to the initial generation capacity (i.e. 2.3MWp) should be maintained up to the entire AMC period (10 years duration). The bidder should send the Monthly plant generation details with authenticated record to SMPK.

Failure against the stated generation penalty clause will be levied on the annual maintenance contract, which is as follows,

**Penalty will be imposed on the agency at the rate of INR 6.78 /- per unit generation loss/ Year**

Submission of O&M Report (OMR)

The bidder shall submit the Monthly O&M Report mandatorily to SMPK every month. Non-submission of the report shall be considered as “Breach of Contract” and shall attract punitive actions as per the relevant provisions of the Contract including non-release of subsidy. However, the decision of Engineer-in -charge shall be final in this regard.

**A. SOLAR PANELS**

Although the cleaning frequency for the panels will vary from site to site depending on soiling, it is recommended that

1. The panels are cleaned at least once every five days.
2. Any bird droppings or spots should be cleaned immediately.
3. Use water and a soft sponge or cloth for cleaning.
4. Do not use detergent or any abrasive material for panel cleaning.
5. Isopropyl alcohol may be used to remove oil or grease stains.
6. Do not spray water on the panel if the panel glass is cracked or the back side is perforated.
7. Wipe water from module as soon as possible.
8. Use proper safety belts while cleaning modules at inclined roofs etc.
9. The modules should not be cleaned when they are excessively hot. Early morning is particularly good time for module cleaning.
10. Check if there are any shade problems due to vegetation or new building. If there are, make arrangements for removing the vegetation or moving the panels to a shade-free place.
11. Ensure that the module terminal connections are not exposed while cleaning; this poses a risk of electric shock.
12. Never use panels for any unintended use, e.g. drying clothes, chips etc.
13. Ensure that monkeys or other animals do not damage the panels.

**B. CABLES AND CONNECTION BOXES**

1. Check the connections for corrosion and tightness.
2. Check the connection box to make sure that the wires are tight, and the water seals are not damaged.
3. There should be no vermin inside the box.

4. Check the cable-insulating sheath for cracks, breaks or burns. If the insulation is damaged, replace the wire.
5. If the wire is outside the building, use wire with weather-resistant insulation.
6. Make sure that the wire is clamped properly and that it should not rub against any sharp edges or corners.
7. If some wire needs to be changed, make sure it is of proper rating and type.

C. INVERTER

1. The inverter should be installed in a clean, dry, and ventilated area which is separated from, and not directly above, the battery bank.
2. Remove any excess dust in heat sinks and ventilations. This should only be done with a dry cloth or brush.
3. Check that vermin have not infested the inverter. Typical signs of this include spider webs on ventilation grills or wasps' nests in heat sinks.
4. Check functionality, e.g. automatic disconnection upon loss of grid power supply, at least once a month.
5. Verify the state of DC/AC surge arrestors, cable connections, and circuit breakers.

D. SHUTTING DOWN THE SYSTEM

1. Disconnect system from all power sources in accordance with instructions for all other components used in the system.
2. Completely cover system modules with an opaque material to prevent electricity from being generated while disconnecting conductors.
3. To the extent possible, system shutdown will not be done during day time or peak generation.

E. MANPOWER DEPLOYMENT

1. Engineer : 2 Head
2. Electrician : 1 Head
3. USL : 3 Head

**Operation and Maintenance Schedule**

<b>Component</b>	<b>Activity</b>	<b>Description</b>	<b>Interval</b>
PV Module	Cleaning	Clean and bird droppings/dark spots on mobile	Immediately
	Cleaning	Clean PV modules with plain water or mild dish washing detergent. Do not use brushes, any type of solvents, abrasive, or harsh detergents.	Fortnightly or as per the site conditions.
	inspections for plants >100 KWp	Use infrared camera to inspect for hot spots; bypass diode failure	Annual
PV Array	Inspection	Check PV Module and rack for any damage note down location and serial no. of damaged modules	Monthly
	Inspection	Determine if any new object such as a vegetation growth are causing shading of the array and move them if possible.	Monthly
	Vermin removal	Remove bird nests or vermin from array and rack area	Monthly
Junction Boxes	Inspection	Inspect electrical boxes for corrosion or intrusion of water or insects. Seal boxes is required. Check position of switches and breakers. Check operation of all protection devices.	Monthly
Wiring	Inspection	Inspect cabling for signs of cracks, defects, loose connections, over heating, arching, short or open circuits, and ground faults	Monthly
Inverter	Inspection	Observe	Weekly

# **BRIDGE AND ROOF CO. (INDIA) LIMITED**

KANKARIA CENTRE (4<sup>TH</sup> & 5<sup>TH</sup> FLOOR)  
2/1, RUSSEL STREET,  
KOLKATA - 700071

**NOTICE INVITING e-TENDER (e-NIT) NO. BANDR/HO/SMPK/61038/SOLAR-  
WORK/NIT/CW/01**

## **BIDDING DOCUMENT**

**FOR**

**DESIGN, ENGINEERING, MANUFACTURING, PROCUREMENT & SUPPLY,  
INSTALLATION, TESTING & COMMISSIONING OF CUMULATIVE 2.30MWP  
ROOF MOUNTED GRID CONNECTED SOLAR PHOTO VOLTAIC POWER  
PLANT INCLUDING 10 YEARS COMPREHENSIVE MAINTENANCE  
CONTRACT (CMC) POST 1 YEAR WARRANTY AT KHIDIRPORE DOCK -II,  
KOLKATA, WEST BENGAL.**



**BRIDGE AND ROOF CO. (INDIA) LIMITED  
KANKARIA CENTRE (5<sup>TH</sup> FLOOR)  
2/1, RUSSEL STREET,  
KOLKATA - 700071**

**Document Fee: Rs. 20,000.00 + GST @18% (Non-Refundable)**

# MASTER INDEX

**Name of work:** Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock –II , Kolkata, West Bengal.

**e-NIT Document No:** B AND R/HO/SMPK/61038/SOLAR-WORK/NIT/CW/01 DTD. 11.03.2024

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**NAME OF WORK.:** Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.

**Notice Inviting e-Tender (e-NIT) No.:** B AND R/HO/SMPK/61038/SOLAR-WORK/NIT/CW/01 DTD. 11.03.2024

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**BRIDGE AND ROOF CO. (INDIA) LTD.**  
**“KANKARIA CENTRE” (4<sup>TH</sup> & 5<sup>TH</sup> FLOOR),**  
**2/1, RUSSEL STREET,**  
**KOLKATA-700071**

**INVITATION FOR NOTICE INVITING e-TENDER (e-NIT)**

**ANNEXURE - A**

**Notice Inviting e-Tender (e-NIT) No. B AND R/HO/SMPK/61038/SOLAR-WORK/NIT/CW/01 DTD. 11.03.2024**

Online **Single Percentage Rate Bid(s)** in Two Part Bid System are invited from Reputed, Resourceful and Experienced Parties meeting prescribed Qualifying Criteria for “**Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.**”

Interested Bidder(s) have to enroll & register with the Government e-Procurement System and download the tender document through logging on to <https://eprocure.gov.in/eprocure/app>.

**Last Date of submission of Bid: 01.04.2024 up to 17:30 Hours.**

All Corrigendum / Addendum, if any, shall be hosted in Company's website: <https://www.bridgeroof.co.in> as well as CPP Portal: <https://eprocure.gov.in/eprocure/app>.



**BRIDGE AND ROOF CO.(INDIA) LIMITED**  
**Kankaria Centre (4<sup>th</sup>&5<sup>th</sup> Floor),2/1, Russel Street, Kolkata – 700 071**  
**CIN No. : U27310WB1920GOI003601**

**Notice Inviting e-Tender (e-NIT) No.: B AND R/HO/SMPK/61038/SOLAR-WORK/NIT/CW/01 DTD. 11.03.2024**

Online **Single Percentage Rate bid(s)** are invited by B AND R from Reputed, Resourceful and Experienced Parties meeting prescribed Qualifying Criteria for “**Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.**”

The Bidder(s) shall submit the documents for any or all the following work:-

**TABLE-1**

Name of Work and Location	Assessed Value put to Tender (Rs. in Crore) (Approx.)	Cost of Tender Document (Non Refundable)	Earnest Money Deposit (EMD)	Time of Completion	Tender Inviting Authority (TIA)
(1)	(2)	(3)	(4)	(5)	(6)
Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.	Rs. 16.85 Cr.	Rs. 20,000.00 + GST @18% = Rs. <u>23,600.00 (Rupees Twenty Three Thousand and Six Hundred only)</u> in the form of Demand Draft (DD) / Pay order / Banker's Cheque from any Scheduled Bank in favour of "Bridge And Roof Co.(India) Ltd." payable at Kolkata. <b><u>(No A/c Payee Cheque shall be considered)</u></b>	Rs. 26.85 Lakhs (Rupees Twenty Six Lakhs and Eighty Five Thousand only) and shall be submitted by Bidder(s) along with their offer in the form of Demand Draft (D.D.) / Pay Order / Banker's Cheque valid for minimum 90 (Ninety) days / Bank Guarantee (BG) in prescribed format valid for minimum 06 (Six) months / Term Deposit Receipt valid for minimum 45 days beyond the validity of bid from any Scheduled Bank pledged in favour of "Bridge and Roof Co. (India) Ltd" alongwith Offer. <b><u>[No A/c Payee Cheque shall be Considered]</u></b> .	<b>10 (Ten) Months</b>	<b>General Manager (Commercial)</b> Bridge And Roof Co.(India) Ltd., Kankaria Centre (5th Floor), 2/1, Russel Street, Kolkata – 700071

Cost of Tender Document & EMD prescribed above shall be submitted alongwith Techno-Commercial Part of offer **in Original.**

### 3. CRITICAL DATE SHEET:

Dates & Time For:-	Dates and Time
Bid Document Publishing Date	: 11.03.2024
Bid Document Download Start Date	: 11.03.2024
Bid Document Submission Start Date	: 22.03.2024
Date and Time of Pre-bid Meeting	: 21.03.2024 at 15:30 Hrs.
Place of Pre Bid Meeting	: Bridge and Roof Co(l) Ltd Kankaria Centre (5th Floor), 2/1, Russel Street, Kolkata – 700 071 Bidder should send their queries at least one day in advance.
Bid Document Submission End Date	: 02.04.2024 at 17:30 Hrs.
Last date of submitting Tender Fee, EMD and physical documents as specified in Tender Document.	: 03.04.2024 at 11:00 Hrs. <b>Positively</b>
Date of Opening of Technical Bid Document	: 03.04.2024 at 17:30 Hrs. through CPP Portal (ON-LINE) System
Site Visit	: 18.03.2024 at 15:30 Hrs.
Date Original Document Verification	: shall be intimated after opening of Tender to Initial Short-Listed Bidder(s), if required
Date of Opening of Financial Bid Document	: Shall be intimated to Techno-Commercially Recommended Bidder(s) only through CPP Portal System.

#### GENERAL GUIDANCE:-

1. Tender documents consisting of Pre-Qualification Criteria and the set of Techno-Commercial Terms & Conditions of Contract, Technical Specification, Drawings and other necessary Documents may be downloaded from the website <https://eprocure.gov.in/eprocure/app>.
2. Bids must be accompanied by cost of Tender Document (Non-Refundable) as mentioned in Table-1, in the form of Demand Draft (D.D.) / Pay Order / Banker's Cheque in favour of Bridge And Roof Co. (India) Limited issued by a Scheduled Bank payable at Kolkata.  
  
Bank Guarantee (BG) in lieu of Earnest Money Deposit (EMD), Security Cum Performance Bank Guarantee (SPBG), Additional Performance Security (if any), Mobilization Advance (if any), Secured Advance (if any) shall be issued by a Scheduled Bank in favour of Bridge And Roof Co. (India) Limited.
3. Checklist is to be duly filled in.
4. Price Bid shall be opened for the Techno-Commercially Recommended / Qualified bidder(s) only through CPP Portal. Bidder(s) shall submit Percentage Price (**to be quoted as "above/ below/ at par" in percentage**) in the allotted space of the Price Bid format. Quoted price shall be inclusive of all but excluding GST.
5. If any of the intending bidders wishes to withdraw from participation in the bid, he / she can freely withdraw from the participation before scheduled date and time of closure of Bid Submission.
6. B AND R reserves right to cancel the bid without assigning any reason thereof.
7. Instructions / Guidelines for tenders for electronic submission of the tenders have been annexed for assigning the agencies to participate in e-Tendering.
8. Any agencies willing to take part in the process of e-Tendering will have to be enrolled & registered with the Government e-Procurement System; through logging on to <https://eprocure.gov.in/eprocure/app>. The agency has to click on the link for e- Tendering site as given on the web portal.
9. **Each Tenderer is required to obtain DSC (Enlisted Class- III ) for submission of online e-tendering from any Certifying Authorities (CAs) certified by the Controller of Certifying Authorities (CCA) on payment of requisite amount , details are available at the Website [www.cca.gov.in](http://www.cca.gov.in).**
10. Bids shall be submitted online only at CPPP website: <https://eprocure.gov.in/eprocure/app>. Manual bids shall not be accepted. Tenderer / Contractors are advised to follow the instructions provided in the 'Instructions to Tenderer' for the e-submission of the bids online through the Central Public Procurement Portal for e-Procurement at <https://eprocure.gov.in/eprocure/app> before proceeding with the tender.

**NOTE:** All corrigendum, addenda, amendments and clarifications to this Tender will be hosted in Company's Website & CPP Portal and not in the newspaper. Bidder shall keep themselves updated with all such amendments.

**QUALIFYING CRITERIA**

**Notice Inviting e-Tender (e-NIT) No. B AND R/HO/SMPK/61038/SOLAR-WORK/NIT/CW/01 DTD. 11.03.2024**

Bridge And Roof Co. (India) Ltd., Kolkata as Executing Agency of **M/s. Syama Prasad Mookerjee Port Kolkata (SMPK)** for this Project, invites offers from Capable and Competent Agencies to carry out the works mentioned below:

**“Design, Engineering, Manufacturing, Procurement & Supply, Installation, Testing & Commissioning of cumulative 2.30MWP Roof Mounted Grid connected Solar Photo Voltaic Power Plant including 10 years Comprehensive Maintenance Contract (CMC) post 1 year warranty at Khidirpore Dock-II, Kolkata, West Bengal.”**

Interested Reputed, Resourceful & Experienced Parties having adequate proven experience in similar type of work may download the Tender along with Qualifying Criteria from Company's website: <http://www.bridgeroof.co.in> & <https://eprocure.gov.in/eprocure/app>.

The Company (B AND R) reserves the right to reject any or all offer(s) or cancel the notice at their sole discretion without assigning any reason, whatsoever thereof, which shall be final & binding upon the Bidders.

**I. QUALIFICATION CRITERIA FOR PARTICIPATION IN TENDER :-**

Experience should be in the name of the bidding Company and not in Subsidiary / Associate Company / Group Company etc.

**A.** The bidder should have successfully completed **“Similar Works”** of the value during the last **07(Seven) years** ending on the last date of month previous to the one in which tender is invited, not less than the followings:

i. **01 (One) Similar** completed work costing not less than the amount equal to **Rs. 13.48 Cr.**

**OR,**

ii. **02 (Two) Similar** completed work each costing not less than the amount equal to **Rs. 10.11 Cr.**

**OR,**

iii. **03 (Three) Similar** completed work each costing not less than the amount equal to **Rs. 6.74 Cr.**

**Note: “Similar Work” shall mean a Project comprising “Supply, Installation & Commissioning of Solar Power Plant in any Central Govt. / State Govt. / UTs / PSUs / Autonomous bodies / Private Sector etc.” in all respect under one Agreement / Contract.**

**Manufacturers who have supplied Solar Power Plant of the values as mentioned above in any Central Govt. / State Govt. / UTs / PSUs / Autonomous bodies / Private Sector etc. may also participate, provided supplier have to make MOU/Letter of Undertaking with the installation agency who have adequate experience in installation & commissioning of Solar Power Plant subject to fulfillment of PQ Criteria mentioned above [A(i / ii / iii)] for supply only. Relevant Documents regarding installation & commissioning of Solar Power Plant of Installation agency to be submitted.**

Notarized copy of **Completion Certificate** mentioning executed value of work & date of completion along with corresponding LOI/WO duly certified by clients from an officer not below the rank of EE or equivalent, substantiating the above-mentioned criterion under Sl. No. A as well as value of work to be submitted.

In case the Bidder is executing a Project, then Client / Owner has issued Completion Certificate in respect of a part of work, **(more than 90% of the value of work has been completed)** which meets the eligibility criteria, the same shall be considered while evaluating the Technical Bid.

In case the work experience is of Private Sector, the completion certificate shall be supported with copies of letter of award and copies of corresponding TDS Certificates along with the copy of relevant certified invoice. Value of work will be considered equivalent to the amount of TDS Certificates duly Notarized.

The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum; calculated from the date of completion to last date of receipt of offers for Tenders.

- B. Average Annual Financial Turnover** during the last 03 (Three) years ending **31.03.2023** should not be less than **the amount equal to Rs. 5.06 Cr.**

The value of annual turnover shall be brought to current costing level by enhancing the actual turnover figures at simple rate of 7% per annum; calculated in the following manner.

Financial Year*	2022-23	2021-22	2020-21	2019-20	2018-19
VEF*	1.00	1.07	1.14	1.21	1.28

- Copy of Audited Balance Sheet(s) along with Turnover Certificate duly signed by Chartered Accountant with his / her Seal, Signature & Registration Number for last 03 (Three) financial years ending **31.03.2023** to be submitted. The year in which no Turnover is shown, would also be considered for working out the average. **Turnover should be of the Bidding Company and not for Subsidiary / Associate Company / Group Company etc.**
- C.** The Bidder should not have incurred any loss (**Profit after Tax should be Positive**) **in more than two years during the last five years ending 31st March, 2023. Net Worth of the Company / Firm as on 31st March 2023 should be positive.** Net Worth Certificate for F.Y.: 2022-23 should be submitted duly certified by Chartered Accountant with his / her Seal, Signature & Registration Number.
- D.** Bidder has to submit **Bank Solvency Certificate** not less than **the amount equal to Rs. 6.74 Cr. The Solvency certificate being not more than 3 months old from the last date of bid submission.**  
**OR,**  
Net-worth certificate of **Rs. 1.70 Cr.** issued by certified Chartered Accountant with UDIN
- E.** The bidder should have adequate Engineers in his Company's roll and the bidder should also have own / lease / hiring arrangement for plant and machineries for execution of the work.
- F.** The bidder should have PAN, GST Registration and Current Income Tax Deposition Document.
- G.** The bidder should be able to abide by and handle statutory requirements related to Labour License, PF & ESI Registration Certificate during tenure of construction activities.
- H.** Bidder(s) should not have been black-listed by any Central / State Govt. / Autonomous Body / PSU in last five years from the original last date of bid submission. Bidder shall submit duly Notarized Affidavit to this effect as per Format **(Form – F)**.
- I.** Constitutional Status i.e. to specify whether Proprietary or Partnership Firm etc. with Documentary Evidence.
- J.** Bidder(s) have to submit copy of valid Electrical License or Bidder must associate himself with Agencies for Electrical Work having valid Electrical License. Therefore Bidder has to submit Willingness Certificate as per specified format from Associating Electrical Agency alongwith valid Electrical License.
- K.** **Bidder(s) should have submitted copy of Latest Filed Monthly / Quarterly GSTR-3B Return as GST Clearance Certificate.**
- L.** **Direct or Indirect Joint Venture(s) / Consortium / Special Purpose Vehicle (SPV) / Special Purpose Entity (SPE) are not permitted to participate.**
- M. BID CAPACITY :**  
Bidders who meet the minimum Qualification Criteria will be qualified only if their available bid capacity of work is **equal to more than the total bid value put to tender.**

The Bidder who fulfills the following requirements and having bidding capacity as per the following formula, shall be eligible to apply. **Consortium / Joint ventures are not accepted.**

$$\text{Bidding Capacity} = [ \{ A \times N \times 1.5 \} - B ]$$

Where,

**A** = Maximum turnover in construction works executed in any one year during **the last 05 (Five) years** taking into account the completed as well as works in progress. The value of completed works shall be brought to current costing level by enhancing at a simple rate of 7% per annum. Provisional / Un-Audited Balance Sheet shall not be considered.

**N** = Number of years prescribed for completion of work for which bids has been invited. **[N=1]**

**B** = Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited.

**N. Bidder(s) (Private Limited / Limited Company) should submit the Copy of Screenshot of MCA Portal showing 'Active' Status. Bidder(s) (other than Private Limited / Limited Company) should not submit the Copy of Screenshot of MCA Portal showing 'Active' Status.**

• **Note for clause I.A. above :**

- i. If the qualifying work is completed in the seven (7) year period specified above, even if it has been started earlier, the same will also be considered as meeting the qualifying requirements.
  - ii. The one (1) year period means any continuous 12 months period. However, for concurrent works the same 12 months period shall be considered.
  - iii. The word "executed" means the bidder should have achieved the criteria specified in the above QR even if the total contract is not closed i.e. under execution and provided the works is not terminated by the client.
- ❖ **The bidder is liable to be disqualified, even though they meet the Qualifying Criteria, if they.**
- a. **Made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or**
  - b. **Record of poor performance such as abandoning the works, not properly completing the Contract, inordinate delays in completion attributable to the Contractor, litigation history with B AND R / Client, or financial failures etc.; and/or**
  - c. **Participated in the previous bidding for the same work and had quoted unreasonable prices and could not furnish rational justification to the Engineer-in-Charge.**
  - d. **Indulged in unlawful & corrupt means in obtaining bids.**
  - e. **Been black listed / cancelled their registrations by the Competent Authority (i.e. Any Govt. Dept. / PSU / Semi Govt. / Local Govt. bodies etc.).**
  - f. **If Bidder or any of Constituent Partner had been debarred to participate in Tender by Client i.e. SMPK / B AND R during the last 05 (Five) years prior to the date of this NIT, such debarment will be considered as disqualification towards eligibility. A Declaration in this respect has to be furnished by the Bidder as per prescribed format (Form – F) without which the Technical bid shall be treated as Non-Responsive. Technical Bid shall be treated as Non-Responsive if anything adverse has come to the Notice of the Tender Inviting Authority against Firm / Agency / Bidder so far as his performance within the jurisdiction of this company.**
  - g. **If the tenderer deliberately gives wrong information / submit fake, false, fabricated, forged documents in his tender, B AND R reserves the right to reject such tender at any stage or to cancel the Contract if awarded and forfeit the Earnest Money / Retention Money / any other money due and to keep under black list / holiday list for 02 years.**

This being a composite tender, the Bidder must associate with himself agencies otherwise eligible to tender for other components individually including specialized services for which an Affidavit/Undertaking as per format enclosed should be submitted along with the Technical Bid.

The Contractor/Firm will indemnify B AND R and SMPK, as the case may be, against all penal action that may be levied/effectuated by any concerned authority for default in any Labour Regulation/PF/ESI and other statutory requirements of the relevant Acts/Laws related to the work of the contractor and will bear the legal charges, if any, and will pay the legal charges/dues directly to the Concerned Authority. An undertaking in this regard is required to be submitted by applicants along with prequalification.

CMC is important and shall be integral part of the Solar Power plant Tender, The Comprehensive Maintenance Contract (CMC) shall be part of the tender and it will be specifically mentioned that after defect liability period the solar contractor shall carry out the CMC job as per the rates quoted by them after acceptance of M/s SMPK and subsequently order given to them. However the payment shall be made by M/s SMPK directly to the solar contractor. There shall be tripartite agreement between the Solar contractor, M/s SMPK and B and R. In this regard by mentioning that after defect liability period, the solar contractor shall be directly liable to execute the CMC work under M/s SMPK's Guidance/ Instruction and the payment of CMC shall be made by M/S SMPK directly to the Solar Contractor as per the rates given in the Agreement. Band R shall not be responsible in any manner for CMC work post one year defect liability period after completion of total solar work. The CMC period shall be for 10 Years. Order shall be given by M/s B And R for execution part only and the CMC part shall be governed by tripartite agreement.

## **II. DETAILS TO BE FURNISHED WITH TENDER APPLICATION / OFFER :**

The bidders are requested to furnish the following details seriatim as under.

1. Details of Information to be furnished by the Bidder : Annexure – E
2. Letter of submission : Annexure : F
3. Power of Attorney in favour of the person signing the TENDER
4. Letter of Transmittal : Annexure : H
5. Process Compliance Form : Annexure – J
6. Financial Information (Form-A)
7. Solvency Certificate from a Scheduled Bank (Form-B)
8. Details of Similar nature of works (Form-C1) and Project under Execution or Awarded (Form-C2)
9. Performance Report of Works (Form-D)
10. Structure & Organization (Form-E)
11. Affidavit by the Bidder (Form-F) on non-judicial stamp paper of appropriate value duly notarized
12. Affidavit by the Bidder (Form-G) on Bidder's Letter Head
13. Willingness Certificate of Electrical Agency (Form-H)
14. List of Technical Manpower in Company's roll (Form-I)
15. List of Tools & Plants owned by the Company. (Form-J)
16. Information on Litigation History, Liquidated Damages, Disqualification etc (Form-K)
17. Declaration confirming Knowledge about Site Conditions (Form-L)
18. Laboratory Equipments (Form-M)
19. Compliance to Bid Requirement (Form-N)
20. Integrity Pact (Annexure -K)
21. Exhibits – EA to EK
22. Documentary evidence of Permanent Account No. (PAN) with Income Tax Department.

23. Documentary evidence of GST Registration with the concerned department and copy of Latest Filed Monthly / Quarterly GSTR-3B Return.
24. Documentary Evidence of P.F., ESI and Labour License with the Concerned Department.(if not registered with **Concerned Department** Documentary Evidence (s), **Successful Bidder must take Registration within one month from the date of Award and in this regard bidder has to submit an undertaking in their Letter Head alongwith their offer or the same).**
25. Documentary Evidence of **Screenshot of MCA Portal showing 'Active' Status of Bidder (for Private Limited / Limited Company).**
26. Format for Input Tax Credit as per **Annexure - N**
27. Bidder(s) have to submit copy of valid Electrical License or, Bidder must associate himself with Agencies for Electrical Work having valid Electrical License. Therefore Bidder has to submit Willingness Certificate as per specified format from Associating Electrical Agency alongwith valid Electrical License.
28. Constitution and legal status along with attested copies of Deeds / Articles and Memorandum of Association etc. as applicable.
29. Documents pertaining to Qualifying Criteria furnished in **Annexure-B** of the Tender and Detail of information to be furnished by the bidder as per prescribed format.

By submitting the offer, the bidder authorizes B AND R to seek verification on the information supplied and related matters.

1. Bidders shall, on request, provide any necessary authority and assistance to enable relevant enquiries to be carried out.
2. After submission of their offer, bidder must notify B AND R promptly, if there is any:
  - Substantial change in their financial or technical capacity.
  - Change in their business (such as Company name, address)
  - Change of ownership or holding, including any transfer of key personnel.
  - Any other significant change in information provided in the application.
3. **The bidder must provide any further details required for the review upon request from B AND R. Failure to comply with any request by B AND R for such information will result in rejection of their offer.**
4. B AND R may, in its absolute discretion suspend or disqualify an agency/agencies who, at any time, is considered to have breached any of the qualification conditions or has performed in an unsatisfactory manner without assigning any reason whatsoever.
5. B AND R will not be liable for any loss or damages incurred by the agency/agencies in the above exercise.
6. B AND R reserves the right to disqualify such bidders who had a record of not meeting the contractual obligations against earlier contracts entered into with the B AND R.

**SRI D. MUKHOPADHYAY**  
**GM(COMMERCIAL)**  
**COMMERCIAL DEPARTMENT**  
**BRIDGE AND ROOF CO (I) LTD.**





## **Instructions for Online Bid Submission**

The bidders are required to submit soft copies of their bids electronically on the CPP Portal, using valid Digital Signature Certificates. The instructions given below are meant to assist the bidders in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bids online on the CPP Portal.

More information useful for submitting online bids on the CPP Portal may be obtained at: <https://eprocure.gov.in/eprocure/app>.

### **REGISTRATION**

- 1) Bidders are required to enroll on the e-Procurement module of the Central Public Procurement Portal (URL: <https://eprocure.gov.in/eprocure/app>) by clicking on the link “**Online bidder Enrollment**” on the CPP Portal which is free of charge.
- 2) As part of the enrolment process, the bidders will be required to choose a unique username and assign a password for their accounts.
- 3) Bidders are advised to register their valid email address and mobile numbers as part of the registration process. These would be used for any communication from the CPP Portal.
- 4) Upon enrolment, the bidders will be required to register their valid Digital Signature Certificate (Class III Certificates with signing key usage) issued by any Certifying Authority recognized by CCA India (e.g. Sify / nCode / eMudhra etc.), with their profile.
- 5) Only one valid DSC should be registered by a bidder. Please note that the bidders are responsible to ensure that they do not lend their DSC's to others which may lead to misuse.
- 6) Bidder then logs in to the site through the secured log-in by entering their user ID / password and the password of the DSC / e-Token.

### **SEARCHING FOR TENDER DOCUMENTS**

- 1) There are various search options built in the CPP Portal, to facilitate bidders to search active tenders by several parameters. These parameters could include Tender ID, Organization Name, Location, Date, Value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as Organization Name, Form of Contract, Location, Date, Other keywords etc. to search for a tender published on the CPP Portal.
- 2) Once the bidders have selected the tenders they are interested in, they may download the required documents / tender schedules. These tenders can be moved to the respective ‘My Tenders’ folder. This would enable the CPP Portal to intimate the bidders through SMS / e-mail in case there is any corrigendum issued to the tender document.
- 3) The bidder should make a note of the unique Tender ID assigned to each tender, in case they want to obtain any clarification / help from the Helpdesk.

## PREPARATION OF BIDS

- 1) Bidder should take into account any corrigendum published on the tender document before submitting their bids.
- 2) Please go through the tender advertisement and the tender document carefully to understand the documents required to be submitted as part of the bid. Please note the number of covers in which the bid documents have to be submitted, the number of documents - including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.
- 3) Bidder, in advance, should get ready the bid documents to be submitted as indicated in the tender document / schedule and generally, they can be in PDF / XLS / RAR / DWF/JPG formats. Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document.
- 4) To avoid the time and effort required in uploading the same set of standard documents which are required to be submitted as a part of every bid, a provision of uploading such standard documents (e.g. PAN card copy, annual reports, auditor certificates etc.) has been provided to the bidders. Bidders can use "My Space" or "Other Important Documents" area available to them to upload such documents. These documents may be directly submitted from the "My Space" area while submitting a bid, and need not be uploaded again and again. This will lead to a reduction in the time required for bid submission process.

**Note:** *My Documents space is only a repository given to the Bidders to ease the uploading process. If Bidder has uploaded his Documents in My Documents space, this does not automatically ensure these Documents being part of Technical Bid.*

## SUBMISSION OF BIDS

- 1) Bidder should log into the site well in advance for bid submission so that they can upload the bid in time i.e. on or before the bid submission time. Bidder will be responsible for any delay due to other issues.
- 2) The bidder has to digitally sign and upload the required bid documents one by one as indicated in the tender document.
- 3) Bidder has to select the payment option as "offline" to pay the tender fee / EMD as applicable and enter details of the instrument.
- 4) Bidder should prepare the EMD as per the instructions specified in the tender document. The original should be posted/couriered/given in person to the concerned official, latest by the last date of bid submission or as specified in the tender documents. The details of the DD/any other accepted instrument, physically sent, should tally with the details available in the scanned copy and the data entered during bid submission time. Otherwise the uploaded bid will be rejected.
- 5) Bidders are requested to note that they should necessarily submit their financial bids in the format provided and no other format is acceptable. If the price bid has been given as a standard BoQ format with the tender document, then the same is to be downloaded and to be filled by all the bidders. Bidders are required to download the BoQ file, open it and complete the white coloured (unprotected) cells with their respective financial quotes and other details (such as name of the bidder). No other cells should be changed. Once the details have been completed, the bidder should save it and submit it online, without changing the filename. If the BoQ file is found to be modified by the bidder, the bid will be rejected.

- 6) The server time (which is displayed on the bidders' dashboard) will be considered as the standard time for referencing the deadlines for submission of the bids by the bidders, opening of bids etc. The bidders should follow this time during bid submission.
- 7) All the documents being submitted by the bidders would be encrypted using PKI encryption techniques to ensure the secrecy of the data. The data entered cannot be viewed by unauthorized persons until the time of bid opening. The confidentiality of the bids is maintained using the secured Socket Layer 128 bit encryption technology. Data storage encryption of sensitive fields is done. Any bid document that is uploaded to the server is subjected to symmetric encryption using a system generated symmetric key. Further this key is subjected to asymmetric encryption using buyers/bid opener's public keys. Overall, the uploaded tender documents become readable only after the tender opening by the authorized bid openers.
- 7) The uploaded tender documents become readable only after the tender opening by the authorized bid openers.
- 8) Upon the successful and timely submission of bids (i.e. after Clicking "Freeze Bid Submission" in the portal), the portal will give a successful bid submission message & a bid summary will be displayed with the bid no. and the date & time of submission of the bid with all other relevant details.
- 9) The bid summary has to be printed and kept as an acknowledgement of the submission of the bid. This acknowledgement may be used as an entry pass for any bid opening meetings.

#### **ASSISTANCE TO BIDDERS**

- 1) Any queries relating to the tender document and the terms and conditions contained therein should be addressed to the Tender Inviting Authority for a tender or the relevant contact person indicated in the tender.
- 2) Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed to the 24x7 CPP Portal Helpdesk.

#### **ASSISTANCE TO BIDDERS**

- 1) Any queries relating to the tender document and the terms and conditions contained therein should be addressed to the Tender Inviting Authority for a tender or the relevant contact person indicated below.

**Please send mail to:**

**a) (Mr.M .Tewari) : [commercial@bridgeroof.co.in](mailto:commercial@bridgeroof.co.in) | Extn : 269 / 298**

**ph: (033) 2217-4469 to 4473, 2217-4053/4054/4056**

Any queries relating to the process of online bid submission or queries relating to CPP Portal in general like **page not loading, java error, unable to upload document, DSC etc....** may be directed as

**Please send mail to:**

**a.) ( Mr.kalyan karar ) [eprocurement@bridgeroof.co.in](mailto:eprocurement@bridgeroof.co.in)  
ph: (033) 2217-4469 to 4473, 2217-4053/4054/4056| Extn- 295**

**b.) (shri. Barun Kanti das ) [barunkanti.das@bridgeroof.co.in](mailto:barunkanti.das@bridgeroof.co.in)  
ph: (033) 2217-4469 to 4473, 2217-4053/4054/4056| Extn- 268**

**NOTE :- Requesting bidder to send first an e-mail wait for an hour or so. Before making phone Company holidays on( 2nd & 4th Sat )**

## **HELP FOR THE TENDERER / BIDDER WITH DSC**

Instructions / Guidelines for tenders for electronic submission of the tenders have been annexed for assigning the agencies to participate in e-Tendering.

Any agencies willing to take part in the process of e-Tendering will have to be enrolled & registered with the Government e-Procurement System; through logging on to <https://eprocure.gov.in/eprocure/app> the agency is to click on the link for e- Tendering site as given on the web portal.

Each Tenderer is required to obtain DSC (Enlisted Class- III ) for submission of online e-tendering from any Certifying Authorities (CAs) certified by the Controller of Certifying Authorities (CCA) on payment of requisite amount , details are available at the Web Site [www.cca.gov.in](http://www.cca.gov.in)

**THE TENDERERS / BIDDERS CAN APPROACH ANY ONE OF THE FIVE CAS FOR GETTING DIGITAL SIGNATURE CERTIFICATE. IF REQUIRE , THE WEBSITE ADDRESSES ARE GIVEN BELOW.**

[www.safescrypt.com](http://www.safescrypt.com)

[www.idrbtca.org.in](http://www.idrbtca.org.in)

[www.tcs-ca.tcs.co.in](http://www.tcs-ca.tcs.co.in)

[www.ncodesolutions.com](http://www.ncodesolutions.com)

[www.e-Mudhra.com](http://www.e-Mudhra.com)

<http://hrinfracon.com>

[ Is LRA and alliance partner of (n)Code Solutions (a div. of GNFC) ]

[www.crgcorporate.co/](http://www.crgcorporate.co/)

[authorized agent of eMudhra Consumer Services Ltd. ]

Bids shall be submitted online only at CPPP website: <https://eprocure.gov.in/eprocure/app> Manual bids shall not be accepted. Tenderer / Contractors are advised to follow the instructions provided in the 'Instructions to Tenderer' for the e-submission of the bids online through the Central Public Procurement Portal for e-Procurement at <https://eprocure.gov.in/eprocure/app> before proceeding with the tender.

**FOR FURTHER INFORMATION, REGARDING SUBMISSION OF TENDER PLEASE VISIT TO  
BIDDER MANUAL KIT**

<https://eprocure.gov.in/eprocure/app?page=BiddersManualKit&service=page>

Signature Not Verified

Digitally signed by Monoranjan Tewari  
Date: 2024.03.11 17:28:10 IST  
Location: eProcure-EPROC

